Nutrition and Exercise

From Science to Practice

Fred Collins

Nutrition and Exercise: From Science to Practice

Nutrition and Exercise: From Science to Practice

Editor: Fred Collins

Academic Pages,
5 Penn Plaza,
19th Floor,
New York, NY 10001, USA

ISBN: 978-1-9789-6076-3

Cataloging-in-Publication Data

Nutrition and exercise : from science to practice / edited by Fred Collins.
p. cm.
Includes bibliographical references and index.
ISBN 978-1-9789-6076-3
1. Nutrition. 2. Exercise. 3. Health. 4. Physical education and training. 5. Physiology. I. Collins, Fred.
TX353 .N88 2021
613.2--dc23

Contents

Chapter 1 Omega-3 Fatty Acid Effect in Cardiovascular Disease Risk Factors 1

Chapter 2 Is Zumba® Fitness Effective to Manage Overweight without Dietary Intervention? 10

Chapter 3 Caffeine Consumption among Zayed University Students in Dubai, United Arab Emirates 19

Chapter 4 The relationship between Dieting and Levels of Perceived Psychological Stress in United Arab Emirates Residents 30

Chapter 5 High Intensity Interval Training or Moderate Intensity Continuous Exercise in Patients with Myocardial Infarction? 38

Chapter 6 Interdisciplinary Teaching in Physical Education 55

Chapter 7 Assessing the Healthiness of Physical Environment and Food Business at the Female Section of King Abdulaziz University 66

Chapter 8 Leaving School and Its Outcomes on Health-related Fitness Among Drop-out Algerian High School Students 82

Chapter 9 Postpartum Maternal Health at a Time of Rapid Societal Change in Abu Dhabi, United Arab Emirates 99

Chapter 10 The Impact of Skipping Breakfast on the Body Weight of Children and Young People in Saudi Arabia 112

Chapter 11 Vitamin D Supplementation does not Effect Adiposity in Healthy Adults 138

Chapter 12 Disordered Eating Attitudes and Exercise Behavior among Female Emirati College Students in the United Arab Emirates.....150

Chapter 13 Dietary and Activity Habits in Adolescents Living in the United Arab Emirates.....164

Chapter 14 Family Food Environment and Child Eating Behavior in a Private School of Abu Dhabi 180

Permissions

Omega-3 Fatty Acid Effect in Cardiovascular Disease Risk Factors

Alketbi Fatima Mohammed, Bolaji Lilian, and Zampelas Antonis

Department of Nutrition and Health, College of Food and Agriculture, United Arab Emirates University, Al Ain, UAE

Corresponding Author: Zampelas Antonis; email: anto-nios.zampelas@uaeu.ac.ae

Abstract

Background: One of the leading causes of death around the globe is cardiovascular disease (CVD). Nutrition plays a vital role in the prevention of CVD. However, the effects of margarines, rich in n-3 and n-6 fatty acids, compared to butter, are still controversial in plasma lipid levels.

Method: A single blind parallel study was carried out. Twelve (n = 12) healthy UAE University female students were recruited from age 19-24 years old and were randomly allocated in 2 groups. The participants were asked to consume either 25g of margarine or 25g of butter for 1 month and to retain their normal daily dietary habits. Fasting blood samples were collected before the beginning and at the end of the dietary periods for the assessment of lipid profile.

Result: Triglycerides decreased by 12% within the intervention group, total cholesterol, and glucose levels were decreased in both groups, but it was not statistically significant within and between the margarine and butter group.

Conclusion: The present study showed no statistical differences in the effects of butter and margarine, enriched with n-3 and n-6 fatty acid, on cholesterol, triglycerides, and glucose. Further research is necessary with bigger sample size and longer duration.

Keywords: Cardiovascular diseases, plasma lipids, butter, margarine, saturated fatty acids, polyunsaturated fatty acids

1. Introduction

One of the leading causes of death around the globe is cardiovascular disease (CVD), with low- and middle-income countries to be disproportionally affected: in particular, over 80% of CVD deaths take place in low- and middle-income countries and occur almost equally in men and women [7]. Cardiovascular diseases are predicted to remain the single leading cause of death and mortality from CVD - mainly from heart disease and stroke - has been projected to reach 23.3 million by 2030 [7, 12]. Factors such as unhealthy diet and physical inactivity contribute to CVD by indicating high blood lipids,

high blood glucose, high blood pressure, and overweight and obesity. These "intermediate risks factors" can be measured in primary care facilities and indicate an increased risk of developing a heart attack, stroke, heart failure and other complications [7].

Several studies have shown that n–3 fatty acids reduce the rates of death from cardiac causes and sudden death, the hypothesis that n–3 fatty acids work largely by preventing life-threatening cardiac arrhythmias gained increasing attention. In addition, n-6 is suggested to have a lowering effect on total cholesterol (TC), and LDL cholesterol (LDL). The distinct functions of these two families make the balance between dietary n-6 and n-3 fatty acids an important consideration for decrease cardiovascular disease risk factor [1, 3, 10, 13]. In particular, since 1978, Dyerberg and colleagues [4] hypothesized that marine n–3 fatty acids might provide protection against atherosclerosis and thrombosis, and they began research on the potential effects of n–3 fatty acids in the prevention and treatment of vascular disease. N–3 fatty acids may affect several intermediate determinants of cardiovascular risk. At doses of 3 g per day or more, these substances generally reduce hypertriglyceridemia in humans [15, 20] without changing cholesterol levels significantly [9]. The n–3 fatty acids are also associated with decreased levels of markers and mediators of inflammation such as the cytokines interleukin-1β and tumor necrosis factor α [2, 5]. Studies have shown that increased intake of n–3 fatty acids is associated with a small reduction in blood pressure (approximately 2 to 3 mmHg systolic and 1 to 2 mmHg diastolic) [6] and with a reduction in the resting heart rate (approximately 3 beats per minute) [14]. A short course of n–3 fatty acid supplementation has been reported to improve endothelial function [8] and to reduce features of inflammatory atherosclerotic plaque [19]; at present low-dose n-3 fatty acids (1 g/day) are recommended for patients with coronary disease in many countries [11, 16, 17].

However, although the effects of n-6 and n-3 fatty acids are for long considered to be anti-atherogenic, the effects of margarines compared to butter remain unclear. Therefore, the aim of the present preliminary study was to investigate the effect of margarine (with 2g of omega-3 fatty) acid intake in lipid profile.

2. Methodology

2.1. Participants

The present study is parallel single-blinded, of sample that include twelve (n = 12) healthy UAE University female students were recruited (age 19-24 years old). The exclusion criteria were any female who has any chronic disease such as CVD, hypertension, renal failure and liver diseases; or taking omega-3 fatty supplements. They should

not exercise vigorously and they should not be on any diet. Background dietary habits should resemble a typical "westernized" diet pattern. Ethics approval was granted by the Ethics Committee of the United Arab Emirates University.

2.2. 24-hr Dietary Recall

A 24-hr food recall collected from each study participants before they entered the study. The dates and times of these recalls were scheduled and participants have been asked to not change their normal eating pattern.

The participants asked if they used butter in there usually food, most of them confirmed that they don't, except two of them were eaten butter at breakfast with croissant in campus, and since the winter break started they stated that they don't eat it at home as breakfast. None of the participants have ever used Flora margarine at home before, so they introduced it to their daily life for one month. Participants were recommended to not change their dietary intake, and the habitual physical activity levels.

2.3. Dietary Intervention

The participants were asked to consume either 25 g of margarine or 25 g of butter for 1 month, without changing the rest of their dietary habits. They were divided into two groups, first group was given margarine (Flora, Unilever) to consume daily 25 g = 1 g n-3) of the margarine for one month. On the other hand, the control group consumed 25 g butter (Lurpak). The 25 g of margarine or butter could be consumed throw out the day, which is equal to (1 1/2 Tbsp.), and all of the participants were shown how to measure the 1 1/2 tablespoon to consume it. The participants were followed to ensure that they maintained there usual diet and adhered to the protocol, by creating group conference in the application "WhatsApp" that is available in all smartphone for free, every day a message is being send as group or private message as reminder.

2.4. Blood Test and Anthropometric Measurements

Blood samples were collected from the volunteers at fasting state, before the beginning and at the end of the study. Fasting blood samples were collected from each subject into 10 ml vacutainer tube. The tubes were centrifuged 3000 rpm, and kept there for 15 minutes, from each vacutainer tube plasma drawn to two eppendorfe 2ml tube each one has 1.5 ml of plasma and were stored in the freezer (−80°C) for further

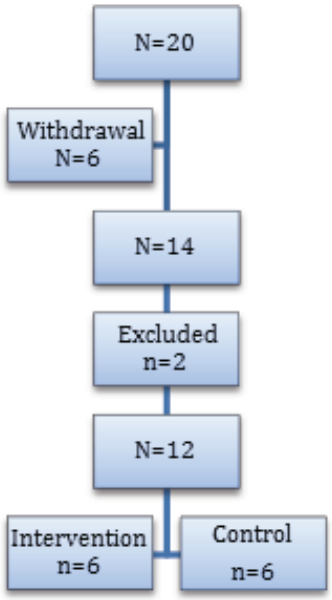

Figure 1: Flow chart of the recruitment.

analysis of TG, TC, and glucose (Glu) in the blood using the "Cobas c111" biochemical analyzer (Roche, Ltd).

The anthropometric measurement were taken twice as will, at the beginning and at the end of one month of the study, to see if there is any changes in the BMI, in the in both groups. Body height and body weight were measured using a stadiometer and standard scales in the Laboratory of Human Nutrition, of the Department of Nutrition and Health.

2.5. Statistical analysis

SPSS version 21 used to analyze the differences within and between the groups. T-test used to see the effects on TG, TC, and Glu by the product given. *P*-values of < 0.05 were considered significant. Office Open XML (Microsoft Excel) used to calculate the percentage and mean different between pre and post blood test for both intervention and control group.

3. Results

The flow of the participants across the study and their dietary habits are given in Figure 1 and Table 1 respectively. Body weight and Body Mass Index are given in Table 2.

24-hr recalls that were taken twice, before the first blood test and after 1 month before the second blood test. From the analysis of the 24-hr recalls it was observed

	Margarine			Butter			Both
Parameter	Pre mean value	Post mean value	P mean value	Pre mean value	Post mean value	P mean value	P mean value
Energy (kcal/day)	1771.5	1864.5	0.001	1419	1572.2	0.001	NS
Total fat (g\day)	57	50	NS	37	47	0.01	NS
SF (g\day)	8	9	NS	10	14	0.05	NS
Omega-3 (mg/day)	112	117	0.001	62	71	NS	0.001
Omega-6 (mg/day)	77	87	0.04	57	57	NS	0.8
CHO (g\day)	244.3	234.3	NS	188.6	158.6	NS	0.01
Protein (g\day)	87.6	86.6	NS	65.4	55.4	NS	0.01

Table 1: Dietary intakes of the subjects in the beginning and at the end of the intervention periods.

	Margarine			Butter			Both
Parameter	Pre mean value	Post mean value	P mean value	Pre mean value	Post mean value	P mean value	P mean value
Body weight (kg)	52	51	NS	54	53	0.5	0.03
BMI (kg/m^2)	20	20	0.06	21	21	0.5	0.01

Table 2: Body weight and Body mass index following the two interventions.

that in the Margarine and Butter groups that there was significant increase in the Energy intake due to the intake of 1 ½ tablespoon of margarine or butter, without a statistical significant difference between the groups. Saturated fat and total fat intakes were significantly increased in the butter group and there was a significant increase in n-3 and n-6 fatty acid intakes in the margarine group. It is noteworthy that although carbohydrate and protein intakes were different between the 2 study groups, intakes did not change during the interventions.

The weight in the margarine group participant's decreased, but it was not statistically significant (P = 0.1). On the other hand the butter group had a significant change in body weight compared to the margarine group (P = 0.03). For the BMI, there was a significant difference between the two interventions. However, from the values themselves, it is obvious that these differences have no clinical significance.

Blood lipid and glucose levels following the 2 interventions are given in Table 3. In TG levels for the Margarine and Butter groups, there was a decrease in total TG, but it was not significant (margarine P = 0.2, butter P = 0.28) and there was no significant difference between the two groups either (P = 0.4). Moreover, similar results were observed with the TC, where there was a decrease in both groups but it was not

	Margarine			Butter			Both
Parameter	**Pre mean value**	**Post mean value**	**P mean value**	**Pre mean value**	**Post mean value**	**P mean value**	**P mean value**
TG (mg/dl)	63.9	55.9	NS	66.7	53.3	NS	NS
TC (mg/dl)	161.8	145.7	NS	184.2	154.2	NS	NS
Glucose (mg/dl)	91.1	83.3	NS	91.1	85.5	NS	NS

Table 3: Blood lipid and glucose levels following the 2 interventions.

significant, (margarine P = 0.3, butter P = 0.1). For the glucose there was a decrease in both groups but not significant difference between the groups either.

4. Discussion

The main result in this small preliminary study is that a one-month intervention with either butter or margarine has no effect on plasma lipid levels.

In more detail, 24-hr recalls that were conducted twice, showed in the Margarine and Butter groups that there was a significant increase in the energy intake a significant increase in Saturated Fat and total fat on the butter group (SF P = 0.01, TF P = 0.08) was observed. On the other hand, there was also a significant increase in n-3 and n-6 fatty acids in the margarine group (N-3 P = 0.0, N-6 P = 0.04). No differences in the intake of carbohydrate and protein were observed.

Following one-month consumption of the margarine, a decrease in the total TG, from 63.9 to 55.9 mmg/dL was observed. However, this difference was not statistically significant (P = 0.2). Following the butter intervention, a decrease of total TG was observed from 66.7 to 53.3 mg/dL but this difference was not statistically significant either). When a comparison between the two interventions was carried out, a 12% decrease in fasting TG levels in the margarine group and a 22% decrease in fasting TG levels in the butter group were observed but no statistical difference was observed between the two interventions. Therefore, the margarine compared to butter didn't affect significantly total TG levels. It is of interest that although n-3 fatty acids rom fish have a profound htpotriglyceridemic effect, the present study does confirm other findings. However, it has been suggested that it needs at least 3 gr of n-3 fatty acids daily to produce a decrease in plasma TG in short term interventions [15, 20] .

For the cholesterol, one-month consumption of the margarine, had as a result a decrease in the total TC, from 161.8 to 145.7 mg/dL but this difference was not statistically significant. Following the butter intervention, a decrease of total TC was observed from 184.2 to 154.2 mg/dL but this difference was not statistically significant either.

When a comparison between the two interventions was carried out a 9% decrease in fasting serum TCs changed from baseline in margarine group and a 16% decrease in butter group were observed respectively but no statistical difference was observed between the two interventions. Therefore, the margarine compared to butter didn't affect significantly total cholesterol levels. These results were unexpected. It is widely known that saturated fatty acids, which are present in butter, increase plasma lipid levels and n-6 fatty acids, which are present in the margarine have a lowering effect. Therefore, a bigger study with more volunteers and possibly longer duration is needed.

The result for the Glucose level, for the margarine group showed a decrease in the total glucose, from 91.1 to 83.8 mg/dL. However, this difference was not statistically significant. Following the butter intervention, a decrease of total glucose was observed from 91.1 to 85.5 mg/dL, but this difference was not statistically significant either. When a comparison between the two interventions was carried out, a 7% decrease in fasting glucose changed from baseline in margarine group and a 6% decrease in butter group were observed respectively but no statistical difference was observed between the two interventions. Therefore, the margarine compared to butter didn't affect significantly total glucose levels.

5. Conclusion

The findings of the present study are that TC, TG, and glucose levels are affected similarly following a 1-month intervention of either margarine or butter in young female volunteers. However, the limited time of the intervention, but most importantly, the small sample size cannot generalize the results.

References

[1] G. E. Billman, J. X. Kang, and A. Leaf, "Prevention of ischemia-induced cardiac sudden death by n-3 polyunsaturated fatty acids in dogs," *Lipids*, vol. 32, no. 11, pp. 1161–1168, 1997.

[2] P. C. Calder, "Immunomodulation by omega-3 fatty acids," *Prostaglandins, Leukotrienes and Essential Fatty Acids*, vol. 77, no. 5-6, pp. 327–335, 2007.

[3] R. de Caterina, "n-3 fatty acids in cardiovascular disease," *The New England Journal of Medicine*, vol. 364, no. 25, pp. 2439–2450, 2011.

[4] J. Dyerberg, H. O. Bang, E. Stoffersen, S. Moncada, and J. R. Vane, "Eicosapentaenoic acid and prevention of thrombosis and atherosclerosis?" *The Lancet*, vol. 2, no. 8081, pp. 117–119, 1978.

[5] S. Endres, R. Ghorbani, V. E. Kelley et al., "The effect of dietary supplementation with n-3 polyunsaturated fatty acids on the synthesis of interleukin-1 and tumor necrosis factor by mononuclear cells," *The New England Journal of Medicine*, vol. 320, no. 5, pp. 265–271, 1989.

[6] J. M. Geleijnse, E. J. Giltay, D. E. Grobbee, A. R. T. Donders, and F. J. Kok, "Blood pressure response to fish oil supplementation: metaregression analysis of randomized trials," *Journal of Hypertension*, vol. 20, no. 8, pp. 1493–1499, 2002.

[7] Global status reports on noncommunicable diseases 2010, Geneva, World Health Organization, 2011.

[8] J. Goodfellow, M. F. Bellamy, M. W. Ramsey, C. J. H. Jones, and M. J. Lewis, "Dietary supplementation with marine omega-3 fatty acids improve systemic large artery endothelial function in subjects with hypercholesterolemia," *Journal of the American College of Cardiology*, vol. 35, no. 2, pp. 265–270, 2000.

[9] "Dietary supplementation with n-3 polyunsaturated fatty acids and vitamin E after myocardial infarction: results of the GISSI-Prevenzione trial. Gruppo Italiano per lo Studio della Sopravvivenza nell'Infarto miocardico," *The Lancet*, vol. 354, no. 9177, pp. 447–455, 1999.

[10] J. X. Kang and A. Leaf, "Effects of long-chain polyunsaturated fatty acids on the contraction of neonatal rat cardiac myocytes," *Proceedings of the National Acadamy of Sciences of the United States of America*, vol. 91, no. 21, pp. 9886–9890, 1994.

[11] P. E. Marik and J. Varon, "Omega-3 dietary supplements and the risk of cardiovascular events: a systematic review," *Clinical Cardiology*, vol. 32, no. 7, pp. 365–372, 2009.

[12] C. D. Mathers and D. Loncar, "Projections of global mortality and burden of disease from 2002 to 2030," *PLoS Medicine*, vol. 3, no. 11, article e442, 2006.

[13] P. L. McLennan, "Myocardial membrane fatty acids and the antiarrhythmic actions of dietary fish oil in animal models," *Lipids*, vol. 36, suppl. 1, pp. S111–S114, 2001.

[14] D. Mozaffarian, "Fish, n-3 fatty acids, and cardiovascular haemodynamics," *Journal of Cardiovascular Medicine*, vol. 8, suppl. 1, pp. S23–S26, 2007.

[15] R. Sadovsky and P. Kris-Etherton, "Prescription omega-3-acid ethyl esters for the treatment of very high triglycerides," *Postgraduate Medical Journal*, vol. 121, no. 4, pp. 145–153, 2009.

[16] C. von Schacky and W. S. Harris, "Cardiovascular benefits of omega-3 fatty acids," *Cardiovascular Research*, vol. 73, no. 2, pp. 310–315, 2007.

[17] A. C. Skulas-Ray, S. G. West, M. H. Davidson, and P. M. Kris-Etherton, "Omega-3 fatty acid concentrates in the treatment of moderate hypertriglyceridemia," *Expert Opinion on Pharmacotherapy*, vol. 9, no. 7, pp. 1237–1248, 2008.

[18] The global burden of disease: 2004 update, Geneva, World Health Organization, 2008.

[19] F. Thies, J. M. C. Garry, P. Yaqoob et al., "Association of n-3 polyunsaturated fatty acids with stability of atherosclerotic plaques: a randomised controlled trial," *The Lancet*, vol. 361, no. 9356, pp. 477–485, 2003.

[20] C. von Schacky, "A review of omega-3 ethyl esters for cardiovascular prevention and treatment of increased blood triglyceride levels," *Vascular Health and Risk Management*, vol. 2, no. 3, pp. 251–262, 2006.

Is Zumba® Fitness Effective to Manage Overweight without Dietary Intervention?

Emilia Vassilopoulou, Georgia Piperari, and Christoforos Christoforou

University of Nicosia, Cyprus

Corresponding Author: Emilia Vassilopoulou; email: vasilopoulou.e@unic.ac.cy

Abstract

Background: Zumba® Fitness is a popular aerobic exercise and sometimes due to its high-intensity is considered sufficient for weight management, from both trainers and trainees, regardless of the type of diet followed. Its effectiveness in weight and body fat loss, with or without dietary intervention has been slightly studied.

Subjects and Methods: In the current randomized controlled trial, thirty two healthy adult overweight women who attended exclusively Zumba® fitness for three times per week, were randomly divided into 3 subgroups and received parallel dietary advice for two months: Group A did not receive dietary intervention (control group), Group B received general healthy eating guidelines based on the Mediterranean pyramid and the food plate model and Group C individualized diet plan according anthropometric characteristics, lifestyle, and dietary habits. A Food Frequency Questionnaire used at baseline to assess dietary habits before the study, and three 24-hour recalls evaluated compliance upon dietary intervention.

Results: Significant reductions in body weight, fat, hip and waist circumference revealed in Group C, and in body fat of Group B.

Conclusions: Zumba® fitness is enjoyable and could be used to enhance weight loss with appropriate dietary individualized advice in overweight subjects. In parallel, it could be effective when combined with healthy eating guidance for improving fat loss and general well being.

Keywords: Zumba® Fitness,; body composition,; diet,; overweight,; diet education

1. Introduction

Obesity and overweight are among the most critical health problems nowadays. Lifestyle and dietary modifications are crucial tools on weight loss and fat reduction. Proper lifestyle and eating patterns changes should be based on individuals' needs and beliefs, as they require high rates of compliance in order to be followed.

Physical activity influences health and body composition in different ways according the type, duration, frequency and effort of muscles given when exercising (Westerterp and Kester, 2003) [1]. Aerobic exercise contributes into greater reductions of fat comparing to anaerobic training, but does not augment muscle mass (Redman et al., 2011) [2]. Weight loss is not enhanced with low intensity exercise, whereas exercise with resistance lowers body fat, while sustaining the Free Fat Mass (FFM) (Ross et al., 2000) [3]. High intensity exercise improves body weight, Body Mass Index (BMI), body fat, waist circumference [4](Irving et al., 2011), and cardiovascular and metabolic functions [5] (Redman et al., 2007) (Wisløff et al., 2005) [6]. The rate of reduction of the abdominal adipose tissue increases, when appropriate dietary changes are combined with exercise, even if these do not aim to weight loss (Giannopoulou et al., 2005) [7]. Generally, it is shown that diet or diet and exercise programs produce a three-to-five-fold greater change in body composition that the exercise programs alone. Weight loss through exercise is only 2-3kg whereas through diet or diet and exercise 10-12kg or 9kg respectively after 4months intervention programs (Miller et al., 1997). Combining diet with exercise results a 20% greater sustained weight loss after 1year intervention than diet alone (Curioni and Lourenço, 2005).

Zumba® fitness is a modern popular type of aerobic exercise, that combines mainly Latin moves with traditional aerobic exercise. Little data exist so far related to its effectiveness on weight loss management and the current investigation aims to determine the rate that Zumba® fitness enhances the rate of body weight and fat loss alone or with the combination of appropriate dietary advice.

2. Methodology

2.1. Participants

Thirty-two healthy women exercising exclusively with Zumba® fitness, three times weekly in local gyms, were recruited in the study and followed up for two consecutive months (8 weeks). Women suffering from chronic disease, on regular medication, pregnant or in menopause were excluded. Participants were randomly divided into three groups according to the dietary intervention they received: Group A (control group) did not receive dietary advice. Group B followed two consecutive- 1hour each-seminars providing behavioral changes regarding healthy eating, based on the food plate model and the Mediterranean pyramid, whereas Group C received a personalized diet plan based on individuals' energy requirements (Henry, 2005) [8] and dietary habits. Dietary guidance, to Groups B and C, was provided by a qualified dietitian. All

participants signed an informed consent before inclusion to the study and the study was approved by the Cypriot Bioethics Committee.

2.2. Anthropometric Measurements

Anthropometric Measurements were performed according to standard procedures (Bi et al., 2016) [9]. Height was measured using a Seca stadiometer at point 0. Weight, percentage (%) of body fat and free fat mass (FFM) were determined at baseline (point 0) and upon completion of the study (point 2) with BIA Tanita Body Composition Analyzer TBF-410MA (Tanita Corp., Tokyo, Japan). All participants were asked to avoid intensive exercise 24hours before the anthropometric measurements.

2.3. Dietary Intake

A validated self administered food frequency questionnaire (FFQ) was completed by all participants at point 0, to assess their dietary habits for the last six months (Garcia-Larsen et al., 2011) [10]. Three 24-recalls assessed compliance to dietary guidelines during the study (point 0, one month after initiation (point 1) and point 2). Exact meal-time, type, composition, cooking method, rate of satisfaction and place the meal was consumed, were recorded on 24-hour recalls and analyzed with Diet Plan 6.0 (Forest-field Software, 2011).

2.4. Physical Activity Assessment

Participants recorded their heart rates for one minute with the wrist method, before and after each Zumba® fitness session to evaluate the level of physical effort when exercising (Firstbeat Technologies, 2007).

2.5. Statistical Analysis

Statistical analysis was performed with SPSS, version 15.0 (IBM, Chicago, IL, USA). The 24-hour recalls and the FFQs were analyzed with Pearson Chi-square to check the independence between the row and the column, Likelihood Ratio for checking the asymptomatic chi-square distribution of the likelihood ratio of the null hypothesis and Linear-by- Linear association to test the linear trend of the data (Agresti, 1996). The anthropometric changes were first checked for normality with the Kolmogorov-Smirnov test with the use of normality plots and then the paired t-test was performed

to compare the two sets of data. The Wilcoxon test was performed for the nonparametric data. P values ≤ 0.05 were considered statistically significant.

3. Results

Forty-five females were initially informed about the study, whereas thirty-two completed an informed consent and randomly divided into the three groups and completed the intervention (Table 1).

The level of effort while exercising did not differ significantly among participants of the three groups, as shown by the heart rates (mean value before Zumba® sessions 65.8hr/minute and after 119.52hr/minute). Food choices of participants at point 0, as denoted by FFQ analysis, were used to decide proper dietary guidance for Groups B and C.

For Group A, no significant changes were found on macronutrient and micronutrient intake, when comparing the two 24-hour recalls, showing that their eating habits did not change upon intervention.

For Group B, energy and sodium intake appeared lower at both stages of re-evaluation (point 1 and 2) in comparison to baseline (point 0).

For Group C, remarkable changes of energy (increased), vitamin C (increased) and protein (decreased) intake from point 0 to points 1 and 2 were noticed, in order to meet their nutritional needs, as these were determined by the dietitian.

Concerning the anthropometric measurements, in women who performed only Zumba® fitness there was a tendency for weight and fat loss, and also reduction of waist and hip circumferences, but none appear significant. In both Groups B and C, body fat was significantly reduced in comparison to Group A. Additionally, in Group C body weight, hip and waist circumference were reduced significantly (Table 2).

4. Discussion

The current two month randomized control intervention study is one of the few studies carried out on the effectiveness of Zumba® fitness on weight and body fat loss, with or without appropriate dietary changes. Subjects who combined Zumba® fitness together with individualized dietary intervention benefit significantly in regards on body weight, fat and waist circumference reduction, in relation to others receiving no dietary advice or general healthy eating guidelines.

Generally aerobic exercise alone seems effective in maintaining a healthy body weight [11] (Donnelly et al., 2003), whereas in some cases is reported able to reduce

	Age (years)	Height (meters)	Weight (kg)	BMI	Body Fat (%)	Waist circum-ference (cm)	Hip circum-ference (cm)	Waist / hip ratio
Group A (n = 10)	21.00	1.61	65.00	25.08	26.00	73.00	99.00	0.74
	30.00	1.65	67.00	24.61	28.00	76.00	100.00	0.76
	22.00	1.67	68.00	24.38	26.00	76.00	103.00	0.74
	38.00	1.61	69.00	26.62	26.00	77.00	104.00	0.74
	23.00	1.62	68.00	25.91	27.00	79.00	105.00	0.75
	26.00	1.65	72.00	26.45	32.20	78.00	103.00	0.76
	27.00	1.64	69.00	25.65	28.90	77.00	104.00	0.74
	29.00	1.68	68.00	24.09	26.90	79.00	106.00	0.75
	32.00	1.60	67.00	26.17	28.30	78.00	100.00	0.78
	30.00	1.56	75.00	30.82	32.30	88.00	110.00	0.80
Mean (±SD)	27.80 (±4.89)	1.63 (±0.03)	68.80 (±2.68)	25.98 (±1.82)	28.16 (±2.26)	78.10 (±3.70)	103.40 (±3.10)	0.76 (±0.02)
Group B (n = 11)	37.00	1.67	69.80	25.03	31.00	84.00	112.00	0.75
	24.00	1.58	70.20	28.12	30.00	88.00	110.00	0.80
	22.00	1.64	62.00	23.05	25.00	71.00	98.00	0.72
	28.00	1.64	67.00	24.91	25.80	71.00	98.00	0.72
	32.00	1.67	70.00	25.10	26.40	79.00	99.00	0.80
	28.00	1.59	65.00	25.71	27.80	69.00	93.00	0.74
	22.00	1.66	72.00	26.13	29.00	82.00	99.00	0.83
	26.00	1.68	70.00	24.80	26.80	80.00	96.00	0.83
	27.00	1.65	68.00	24.98	27.50	78.00	105.00	0.74
	28.00	1.65	69.00	25.34	28.00	80.00	104.00	0.77
	37.00	1.68	69.20	24.52	27.40	82.00	101.00	0.81
MEAN (±SD)	28.27 (± 4.96)	1.65 (± 0.03)	68.38 (± 2.98)	25.24 (±1.17)	27.70 (±1.69)	78.55 (±5.66)	101.36 (±5.56)	0.77 (±0.04)
Group C (n = 11)	29.00	1.63	68.40	25.74	30.20	74.00	107.00	0.69
	34.00	1.54	62.00	26.14	29.80	72.00	105.00	0.69
	28.00	1.56	63.50	26.09	28.20	88.00	108.00	0.81
	23.00	1.67	72.00	25.82	28.60	87.00	108.00	0.81
	26.00	1.63	66.80	25.14	27.40	72.00	97.00	0.74
	21.00	1.67	70.70	25.35	27.00	85.00	100.00	0.85
	28.00	1.69	74.80	26.19	28.00	86.00	102.00	0.84
	23.00	1.72	75.50	25.52	26.50	88.00	100.00	0.88
	36.00	1.59	63.00	24.92	26.40	78.00	90.00	0.87
	22.00	1.60	76.00	29.69	30.00	75.00	100.00	0.75
	27.00	1.60	69.00	26.50	28.50	80.00	101.00	0.79
Mean (±SD)	27.00 (±5.06)	1.63 (±0.06)	69.25 (±5.34)	26.10 (±1.34)	28.24 (±1.42)	80.45 (±6.90)	101.64 (±5.35)	0.79 (±0.07)

Table 1: Baseline individuals' anthropometric measurements.

	Group A (p value)	Group B (p value)	Group C (p value)
Weight	-1.841 (0.066)	-1.483 (0.138)	-2.023 (0.043)
Body fat	-0.542 (0.588)	-2.023 (0.043)	-2.032 (0.042)
Waist circumference	-1.841 (0.066)	0.000 (1.000)	-2.121 (0.034)
Hip circumference	-0.921 (0.357)	-1.841 (0.066)	-1.841 (0.066)
Waist / hip ratio	-1.625 (0.104)	-0.535 (0.593)	-1.511 (0.131)

Table 2: Relative changes of participants' body composition measurements at end (point 2) and baseline point (point 0). P values lower than 0.05 are considered significant.

weight and fat (Heydari et al., 2012) [12]. It is known that healthy diet works synergistically with working out for achieving weight and fat loss (Leverse et al., 2013) [13], especially when diet is personalized (Centers for Disease Control and Prevention, 2011) [14], is high in protein and restricts calories [5] (Redman, 2007) (Layman et al., 2005) [15].

Zumba® fitness is a new very popular way of aerobic exercise, especially among young women. Zumba® fitness specifically provides magnitude enhancements in health related quality of life factors, cardiovascular and inflammatory functions and as shown elsewhere helps on body fat reduction in overweight, physically inactive women (Domene et al., 2016) [16], improves significantly aerobic fitness, neuromuscular functioning and well-being in female students (Donath et al., 2014) [17] and provokes slow (Vendramin et al., 2016) [18] weight loss, BMI, fat and circumference changes in overweight healthy women (Cugusi et al., 2016) [19] and overweight or obese diabetic [20] (Krishnan et al., 2015), even without dietary intervention when performed consistently for long periods (over 3months). All these findings are in line to ours, that show in women performing only Zumba® fitness there is a beneficial tendency for reduction of overweight, although not statistically significant.

Our study shows a positive estimation on the effectiveness of Zumba® fitness on weight and fat loss when combined with proper dietary advice. These results could have been enhanced if the study lasted longer, probably for a period of 6 months or even longer, and a follow up period of the participants after one year of the intervention could estimate the long period effect on maintaining the weight loss when Zumba® fitness is performed. Additionally, we have selected overweight young women, to avoid sub-complications of obesity, but the effect in obese individuals is interesting to investigate.

5. Conclusion

Dieting can be harsh opposite to dancing that is enjoyable. Proper dietary advice though and intervention, that takes into consideration one's eating habits, food preferences and lifestyle should be promoted in weight management, and used in combination with modes of exercise that promote the general well being, like Zumba® fitness. Since Zumba® fitness is very popular especially among women, children and adolescents, it could be also used as a prevention measure for obesity together with general dietary education, even in large scale interventional local or national programs, since as we show herein they both tend to lower, slower though, the weight. When overweight and obesity are diagnosed then appropriate personalized diet together with physical activity, like Zumba® fitness, should be applied, and the desirable weight and fat loss will be achieved in shorter periods of intervention.

6. Acknowledgments

We would like to thank all participants for their compliance and University of Nicosia for the permission to use Food and Nutrition Lab for the anthropometric measurements and the dietary interventions.

References

[1] A. Agresti, *An Introduction to Categorical Data Analysis*, John Wiley & Sons, New York, NY, USA, 2nd edition, 1996.

[2] X. Bi, S. L. Tey, C. Leong, R. Quek, Y. T. Loo, and C. J. Henry, "Correlation of adiposity indices with cardiovascular disease risk factors in healthy adults of Singapore: a cross-sectional study," *BMC Obesity*, vol. 3, no. 1, 2016.

[3] Centers for Disease Control and Prevention, Physical Activity for a Healthy Weight. Retrieved from: http://www.cdc.gov/healthyweight/physical_activity/index.html?s_cid=tw_ob387, 2011.

[4] L. Cugusi, B. Wilson, and R. Serpe, "Cardiovascular effects, body composition, quality of life and pain after a Zumba® fitness program in Italian overweight women," *J Sports Med Phys Fitness*, vol. 56, no. 3, pp. 328–335, 2016.

[5] C. C. Curioni and P. M. Lourenço, "Long-term weight loss after diet and exercise: a systematic review," *International Journal of Obesity*, vol. 29, no. 10, pp. 1168–1174, 2005.

[6] P. A. Domene, H. J. Moir, E. Pummell et al., "The health-enhancing efficacy of Zumba® fitness: An 8-week randomized controlled study," *J Sports Sci*, vol. 34, no.

15, pp. 1396–1404, 2016.

[7] L. Donath, R. Roth, Y. Hohn, L. Zahner, and O. Faude, "The effects of Zumba training on cardiovascular and neuromuscular function in female college students," *European Journal of Sport Science*, vol. 14, no. 6, pp. 569–577, 2014.

[8] J. E. Donnelly, J. O. Hill, D. J. Jacobsen et al., "Effects of a 16-month randomized controlled exercise trial on body weight and composition in young, overweight men and women: the midwest exercise trial," *JAMA Internal Medicine*, vol. 163, no. 11, pp. 1343–1350, 2003.

[9] Firstbeat Technologies, An Energy Expenditure Estimation Method Based on Heart Rate Measurement. (1st edn). Firstbeat Technologies Ltd, Finland, 2007.

[10] Forestfield Software, Diet Plan 6 (Version 6.70.51) [Software]. Available from: http://www.foresoft.co.uk/index.html, 2013.

[11] V. Garcia-Larsen, M. Luczynska, M. L. Kowalski et al., "Use of a common food frequency questionnaire (FFQ) to assess dietary patterns and their relation to allergy and asthma in Europe: Pilot study of the GA 2LEN FFQ," *European Journal of Clinical Nutrition*, vol. 65, no. 6, pp. 750–756, 2011.

[12] I. Giannopoulou, L. L. Ploutz-Snyder, R. Carhart et al., "Exercise is required for visceral fat loss in postmenopausal women with type 2 diabetes," *The Journal of Clinical Endocrinology & Metabolism*, vol. 90, no. 3, pp. 1511–1518, 2005.

[13] C. J. K. Henry, "Basal metabolic rate studies in humans: Measurement and development of new equations," *Public Health Nutrition*, vol. 8, no. 7 A, pp. 1133–1152, 2005.

[14] M. Heydari, J. Freund, and S. H. Boutcher, "The effect of high-intensity intermittent exercise on body composition of overweight young males," *Journal of Obesity*, vol. 2012, Article ID 480467, 8 pages, 2012.

[15] B. A. Irving, C. K. Davis, D. W. Brock et al., "Effect of exercise training intensity on abdominal visceral fat and body composition," *Medicine & Science in Sports & Exercise*, vol. 40, no. 11, pp. 1863–1872, 2008.

[16] S. Krishnan, T. N. Tokar, M. M. Boylan et al., "Zumba® dance improves health in overweight/obese or type 2 diabetic women," *American Journal of Health Behavior*, vol. 39, no. 1, pp. 109–120, 2015.

[17] D. K. Layman, E. Evans, J. I. Baum, J. Seyler, D. J. Erickson, and R. A. Boileau, "Dietary protein and exercise have additive effects on body composition during weight loss in adult women," *Journal of Nutrition*, vol. 135, no. 8, pp. 1903–1910, 2005.

[18] K. Levers, S. Simbo, B. Lockard et al., "Effects of exercise and diet-induced weight loss on markers of inflammation I: impact on body composition and markers of health and fitness," *Journal of the International Society of Sports Nutrition*, vol. 10, no. Suppl 1, p. P15, 2013.

[19] W. C. Miller, D. M. Koceja, and E. J. Hamilton, "A meta-analysis of the past 25 years of weight loss research using diet, exercise or diet plus exercise intervention," *International Journal of Obesity*, vol. 21, no. 10, pp. 941–947, 1997.

[20] L. M. Redman, L. K. Heilbronn, C. K. Martin, A. Alfonso, S. R. Smith, and E. Ravussin, "Effect of calorie restriction with or without exercise on body composition and fat distribution," *The Journal of Clinical Endocrinology & Metabolism*, vol. 92, no. 3, pp. 865–872, 2007.

[21] L. M. Redman, K. M. Huffman, L. R. Landerman et al., "Effect of caloric restriction with and without exercise on metabolic intermediates in nonobese men and women," *The Journal of Clinical Endocrinology & Metabolism*, vol. 96, no. 2, pp. E312–E321, 2011.

[22] R. Ross, D. Dagnone, P. J. H. Jones et al., "Reduction in obesity and related comorbid conditions after diet-induced weight loss or exercise-induced weight loss in men. A randomized, controlled trial," *Annals of Internal Medicine*, vol. 133, no. 2, pp. 92–103, 2000.

[23] B. Vendramin, M. Bergamin, and S. Gobbo, "Health Benefits of Zumba Fitness Training: A Systematic Review," *PM&R*, vol. 16, pp. 30189–30197, 2016.

[24] K. R. Westerterp and A. D. M. Kester, "Physical activity in confined conditions as an indicator of free-living physical activity," *Obesity Research*, vol. 11, no. 7, pp. 865–868, 2003.

[25] U. Wisløff, S. M. Najjar, Ø. Ellingsen et al., "Cardiovascular risk factors emerge after artificial selection for low aerobic capacity," *Science*, vol. 307, no. 5708, pp. 418–420, 2005.

Caffeine Consumption among Zayed University Students in Dubai, United Arab Emirates

Rola M. Al Ghali, Hessa Al Shaibi, Huda Al Majed, and Dalia Haroun

Zayed University, Dubai, United Arab Emirates

Corresponding Author: Rola M. Al Ghali; email: rola.mechli@zu.ac.ae

Abstract

Background: Over the past decade, the global caffeine consumption rate has increased dramatically. Coffee and tea are among the common sources, but energy drinks are becoming an important contributor to total caffeine consumption. Recommendations for daily caffeine intake is not being followed due to the perceived benefits of caffeine which include mood improvement, concentration, social factors, and energy boosting. This study was important to add to the limited data about caffeine consumption in the Gulf region and mainly in the UAE.

Objectives: The objectives were to determine the prevalence of caffeinated beverage consumption among university students and perceived benefits in addition to the estimation of daily caffeine consumption (mg/day).

Design: Data was collected through a self-reported questionnaire from a total of 175 participants (129 females and 46 males) who were conveniently selected from different settings at Zayed University - Dubai. Usual Caffeine intake was calculated from all caffeine containing beverages.

Results: Eighty-six percent of the 175 participants, both males and females, at Zayed University-Dubai consumed caffeinated beverages with an average intake of 249.7 ± 235.9 mg. The intake among the 150 caffeine consumers varied from 4.2 mg/day to 932.2 mg/day. Average intake of caffeine was not significantly different between genders (P = 0.125). Thirty-five percent of the population consumed more than 400 mg/day of caffeine, with no statistical difference between males and females (P = 0.202). Coffee was the most commonly consumed drink among both genders, followed by tea. Most perceived benefits of caffeine consumption were not significantly different except for the relationship between caffeine and improved exercise performance (P = 0.018) and caffeine in relation to weight loss (P = 0.001) among males.

Conclusion: The prevalence of caffeine consumption at Zayed University was high among both males and females. Further research is necessary to estimate the total caffeine intake from all dietary sources, mainly the cultural foods and beverages, and to determine the relationship between accessibility to caffeine containing beverages and caffeine consumption among University student.

Keywords: Caffeine, University students, gender difference, Dubai, UAE

1. Introduction

Caffeine of the methyl xanthine –class is a central nervous stimulant and the world's most popular psychoactive drug [3]. The scientific name of caffeine is 1, 3, 7-trimethyxanthine ($C_8H_{10}N_4O_2$), consisting of specific A1 and A2 receptor subtypes on its adenosine component. Respectively, one receptor is responsible of providing the body with protective features allowing tissues to maintain stability, whereas the other subtype shows the major effect in developing the effects seen after caffeine consumption [15]. Caffeine is readily available in coffee, tea, fizzy drinks, energy drinks, chocolate, and cola nuts [22]. Caffeinated beverages have the highest contribution to the total caffeine intake per day amongst all sources of caffeine [7, 22].

Generally, caffeine is safe, but the benefits and health effects are dose related. Health Canada [8] indicated that up to 400 mg/day is an acceptable daily consumption of caffeine with no health risk factors. Several meta-analyses supported this conclusion [4, 13]. On the other hand, woman who are planning to become pregnant, pregnant, or lactating females, should limit their intake to 300 mg/day due to the adverse effect of high caffeine on the fetal health (Victor et al., 2015).

While individuals respond differently to stimulants, research has found that caffeine has both positive and negative effects on the body, such as anxiety, insomnia, tachycardia, irritability, Broncho-pulmonary dysplasia and muscle tremors [5, 8, 16, 18, 20].

Commonly reported reasons behind caffeinated drinks were to boost energy, to stay awake, to improve mood, to increase concentration, and to socialize [16, 19, 21]. However, many people ingest these drinks disregarding the recommendations due to various reasons including lack of knowledge and awareness regarding energy drinks ingredients [21]. This results in the side effects of caffeine outweighing the benefits that consumers seek [20]. While it is indeed true that caffeine boosts moods, alertness and long-term memory, it is advisable to consume recommended proportions of caffeine [20]. The consumption of more than 5 cups daily increase the likelihood of cardiovascular complications, especially stroke or coronary artery disease [5]. In addition, caffeine has several renal and genitourinary complications, increased urine flow rate, sodium and calcium excretion, creatinine clearance, and urinary incontinence are the most common [8]. In fact, many individuals reported that they have experienced some of the adverse effects of caffeine. [1, 10]. In a recent study, more than 31.6% of caffeine consumers reported that they experienced some of the adverse side effects of caffeine; heart rate was the most common and "jolt and crash episodes" was the least common [10]. Another study showed that caffeine is more effective in showing its effects on males than females [1].

Caffeine has some benefits when consumed in moderate amounts, but the question is, are people following recommendations? In 2014, more than fifteen million of sixty-gram coffee bag was consumed by individuals globally. Compared to data obtained in 2011, the global coffee consumption showed an average annual growth rate of 2.5% increase in coffee intake [11]. Multiple studies have shown high rates of caffeine consumption across different countries including the United States, Israel, and India [14, 17, 21, 23].

On the other hand, regional studies showed the same trend in the consumption of caffeinated drinks, mainly energy drinks, among university students in the Gulf and Middle East [2, 19]. In the UAE, the limited studies that were done in this concern showed the high tendency of university students towards the consumption of caffeinated drinks, mainly energy drinks [12]. Gender was a determinant for caffeine consumption in many studies, where males tended to consume more caffeinated drinks that females [2, 10, 19, 24].

Given the lack of studies in this area in the UAE, and due to the global increase in caffeine overconsumption prevalence, more research is required in this area. Results will be beneficial for future planning of awareness programs and will be considered as a baseline for future research. Early control over caffeine consumption may be a key in reducing the prevalence of caffeine overconsumption, if the results showed any.

So the objectives of this study were to determine the prevalence of caffeinated beverage consumption among university students and perceived benefits in addition to the estimation of daily caffeine consumption (mg/day).

2. Methodology

This is a cross-sectional study where convenience sampling technique was used to select the study population. A total of 175 participants (46 males and 129 females) were recruited from Zayed University – Dubai campus.

The study conformed to the ethical standards of the university and ethical approval was obtained from the Research Ethics Committee at Zayed University. Consent was taken from all the participants prior to their participation.

The research focused on studying gender difference in caffeine consumption among students who met the inclusion criteria (caffeine consuming students who were currently enrolled Zayed and were 17 years or older). Exclusion criteria included: those who participated in the pilot study, students below 17 years, pregnant students, students who did not completely fill in the self-reported questionnaire, and students were not currently enrolled at the university.

A self-administered food frequency questionnaire that included all caffeine containing beverages in the market was used to determine the frequency of caffeine consumption and to estimate the average daily consumption. Demographic data such as gender, age, and marital status, participant's lifestyle including eating habits, physical activity, sleeping patterns, smoking, reasons for caffeine consumption and perceived benefits and health effects of caffeine consumption was also collected.

Data was analyzed descriptively and inferentially using SPSS 15.11.2 software. Independent samples T test and Chi-square tests were used to assess significant differences at a P-value of less than 0.05. Descriptive and frequency analysis to determine the general characteristics of all 175 participants was done, and then descriptive, comparison analysis and conclusions were conducted on the sub-sample of caffeine consumers (n = 150).

3. Results

The study sample consisted of 129 female students (73.7%) and 46 male students (26.3%), a total of 175 participants. The mean age of the students was 20.7 ± 2.9 years. The majority of participants were females (73.7%) while males represented around one fourth of the study sample (26.3%). This is due to the unbalanced number of enrolled students from both genders where there is a significantly larger female population than male population at the university. Zayed University is a governmental university, therefore, the vast majority of students are Emirati. Thus, 95.4% of the study sample were Emirati and 4.6% were other Arab nationals mainly from Saudi Arabia, Kuwait, Afghanistan, Bahrain, and Yemen. Most of the participants were not married (86.9%) and non-smokers (83.4%). They were distributed over the different university colleges; mainly University College (26.3%), College of Sustainability Sciences and Humanities (20.6%), Technological Innovation (18.3%) and College of Business (10.3%), and about 52% of the participants were in their 3^{rd} or 4^{th} year of studies. The majority (72.6%) reported not taking any nutrition related course during their course of study. From the 175 participants, 85.7% (n = 150) reported to consume caffeinated beverages.

The focus sample of analysis for this study was the caffeine consumer subgroup (n = 150). From the 150 caffeine consumers, 26% were males (n = 39) and 74% (n = 111) were females. Table 1 describes the general characteristics of this group.

On average, caffeine consumption was reported to be 249.7 ±235.9 mg/day. The range of the amount of caffeine consumed in the study sample varied from a minimum of 4.2 mg/day to 932.2 mg/day. Males, separately, had an average consumption of

Character		Frequency (N)[1]	Percent (%)
Gender	Male	39	26
	Female	111	74
Nationality	Emirati	142	94.7
	Non Emirati	8	5.3
Marital status	Single	130	86.7
	Engaged, married or divorced	20	13.3
Year of study	English levels	22	14.7
	First year	33	22
	Second year	19	12.7
	Third year	38	25.3
	Fourth year	38	25.3
College	Academic Bridge Program	22	14.7
	University College	40	26.7
	College of Art and Creative Enterprises	3	2
	College of Business Sciences	16	10.7
	Communication and Media Sciences	9	6
	College of Education	5	3.3
	College of Sustainability Sciences and Humanities	30	20
	College of Technological Innovation	25	16.7
Nutrition related courses	Yes	41	27.3
	No	109	72.7
Smoker	Yes	24	16
	No	126	84
Caffeine consumption	Yes	150	85.7
	No	25	14.3

Table 1: Caffeine consumer sample characteristics (n = 150).

300.1 ±244 mg/day which was not significantly different (P = 0.125) than the female average consumption of 232.2 ± 231.0 mg/day.

Compared to referenced recommended intake, 23.3% of the study population consumed more than 400 mg caffeine/day with higher overconsumption prevalence in males (30.8%) compared to females (20.7%), but this difference did not show statistical significance (P = 0.202).

Contributing factors to caffeine consumption varied among the study population. Reported reasons for caffeine consumption are presented in **Table 2.** A large percent of male (51.3%) and female (47.7%) students, claimed that they consume caffeinated beverage because it acts as a source of energy for them and boosts their energy.

Analysis showed that a significantly greater percent of male students consumed caffeinated drinks and beverages to enhance performance during exercise compared to females (P = 0.018). Moreover, a significantly greater percentage of males consumed caffeine to help them in dieting and weight loss (P = 0.001). Other reasons for caffeine consumption are shown in table 2.

Coffee was the main source of caffeine from liquid based drinks among both males and females. Tea, soft drinks, and then Energy drinks contributed to total caffeine intake as per order. In general, males consumed more coffee, soft drinks and energy drinks, while females tended to consume more tea and cocoa based drinks.

Average intake of caffeine from coffee among males and females was 232.1 mg/day and 172.8 mg/day, respectively, however, this difference was not statistically significant (P=0.587). A significantly higher amount of decaffeinated espresso was consumed by males than females (P = 0.001). Espresso, Double Espresso, Instant, and Americano are types of coffee that are significantly consumed in larger amounts by males in the study (P < 0.001). Notably, Intake of caffeine from green tea was significantly higher in females than males (P = 0.004). The total caffeine intake from energy drinks did not achieve any statistical difference between genders (P = 0.063). **Figure 1** presents a summary of the average intake of caffeine form different caffeinated beverages by males and females.

4. Discussion

Over the past decade, caffeine consumption has grown in popularity, especially among adolescents and adults who attend school or university. This study provides an insight on the general behavior of Zayed University-Dubai students towards caffeine intake and the consumption of caffeinated drinks. Similar to the findings of many studies [12, 21, 23, 24], (Al-Islam and Faris 2014), the overall, caffeine consumption was highly prevalent among Zayed University students. This can be attributed to the general trend

Reason	Males (n = 39)		Females (n = 111)		P (gender)
	No.	%	No.	%	
It is cheap	2	5.1	6	5.4	0.983
It give me energy	20	51.2	53	47.7	0.739
My friends consume it	2	5.1	6	5.4	0.938
It increases my concentration while working on a project or studying for an exam	14	35.8	46	41.4	0.517
It enhances my performance during exercise	7	17.9	6	5.4	0.018
It wakes me up in the morning	14	35.8	42	37.8	0.8
It helps me stay awake	17	43.5	35	31.5	0.185
It relieves my stress	8	20.5	17	15.3	0.468
It relieves headache	12	30.7	23	20.7	0.212
I am curious about its taste and effect	3	7.6	13	11.7	0.475
It helps me with dieting and weight loss	5	10.9	1	0.8	0.001

Table 2: Reported reasons for caffeine consumption among males and females*. *This question was a multiple answer question, therefore; the given percentage reflects the percentage of the total responses on this question and not on the total study sample.

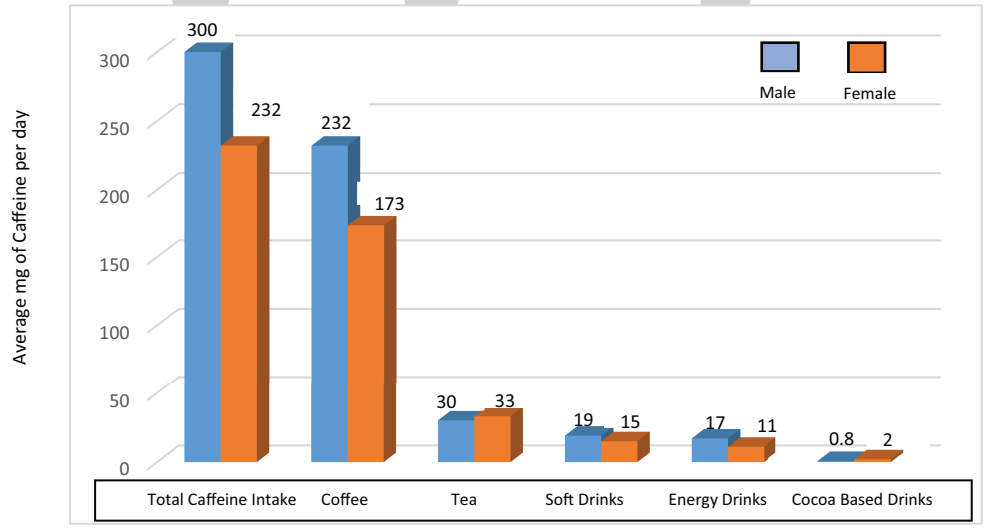

Figure 1: Daily average caffeine intake (mg) from caffeinated beverages (n = 150).

of high coffee consumption by the UAE citizens due to the culture and tradition of the country.

This study was the first study amongst the Arab region that determined the average intake of caffeine in mg by university students. Despite the difference between mean caffeine intake between male and females, yet this did not show any statistical difference (P = 0.125). On average, males consumed 300.1 ± 244 mg/day while females consumed 232.2 ± 231.0 mg/day. The big difference in standard deviation of the means can be explained by the huge variances between the consumption of caffeine among the study sample which ranged from 12.7 mg/day to 840.7 mg/day among females and ranged from 4.2 mg/day to 932 mg/day among males. Compared to safe average recommendations of 400 mg/day, the overall amount of caffeine consumed by Zayed University-Dubai students was not alarming. However, 23.3% of participants consumed 400 mg of caffeine or more per day.

Coffee was the main contributor to the total caffeine intake in this study population, followed by tea. The average amount of caffeine taken from coffee including instant coffee, espresso, latte, cappuccino, and decaffeinated coffee was 188 mg/day which was higher than the average reported in India (15 mg) [23]. As for tea, our study population consumed on average 32 mg/day of caffeine, while tea contributed to 6 mg/day in Suhasini and Sethu [23] study.

In regards to gender difference in caffeine intake, selective and limited studies were found in the literature yet none of them had the same focus as this study. Although there was no statistical difference between males and females in regards to caffeine consumption, yet, in alignment with other studies [2, 19], males tend to have higher caffeine consumption than females. In addition, coffee and energy drink consumption was more prevalent in males. Two different studies conducted in Israel and KSA supported this finding. Male university students in Israel scored higher prevalence in coffee consumption than female medical students [24]. Similarly, in this study, the prevalence of coffee consumption specifically was higher among males (90.7%) than females (78%). Another study conducted in Dammam City, Saudi Arabia, concluded that male adolescents tend to consume energy drinks twice as much as female adolescents do [19]. This concurred with the findings from this study population which showed that energy drink consumption was more prevalent in males (72.1%) than females (64.4%) but this difference was not significant.

Reasons for caffeine consumption that were pointed out in this study were coherent with other similar studies. The findings indicated that the main reason for caffeine consumption among Zayed University students is for energy boosting. Similarly, a large percent of adolescents and young adults in Jeddah [19] and the United States [21] consumed caffeinated beverages for the same reason. A minority of participants (5.4%) in this study indicated that they consume caffeinated drinks due to social influencers, such as friends.

5. Conclusion

Despite the fact that some students at Zayed University - Dubai are not caffeine consumers, a large percent of students consume caffeine at least once a month for reasons including boosting energy, improving concentration, staying awake, relieving headache, tasting, and dieting. The amount of caffeine consumed by students from beverages varied, with the majority consuming moderate amounts. This study focused on caffeine intake from beverages only. For this reason, we cannot say that Zayed University - Dubai students consume caffeine in moderate amounts as other dietary sources have influence on the total intake as well. Despite the fact that the average daily intake was within the recommended levels, yet several cases of caffeine overconsumption were reported. Further research is necessary to estimate the total caffeine intake from all dietary sources and to determine the relationship between caffeine consumption and accessibility to caffeine at the University. More on-campus awareness programs on caffeine adverse effects are necessary to control the high prevalence of caffeine consumption. Awareness on reading labels and the determination of caffeine content of beverages should also be raised as it may contribute to reducing the caffeine consumption to within acceptable levels.

References

[1] A. Adan, G. Prat, M. Fabbri, and M. Sànchez-Turet, "Early effects of caffeinated and decaffeinated coffee on subjective state and gender differences," *Progress in Neuro-Psychopharmacology & Biological Psychiatry*, vol. 32, no. 7, pp. 1698–1703, 2008.

[2] A. A. Alsunni and A. Badar, "Energy drinks consumption pattern, perceived benefits and associated adverse effects amongst students of University of Dammam, Saudi Arabia.," *Journal of Ayub Medical College*, vol. 23, no. 3, pp. 3–9, 2011.

[3] J. M. Chin, M. L. Merves, B. A. Goldberger, A. Sampson-Cone, and E. J. Cone, "Caffeine content of brewed teas," *Journal of Analytical Toxicology*, vol. 32, no. 8, pp. 702–704, 2008.

[4] A. Crippa, A. Discacciati, S. C. Larsson, A. Wolk, and N. Orsini, "Coffee consumption and mortality from all causes, cardiovascular disease, and cancer: A dose-response meta-analysis," *American Journal of Epidemiology*, vol. 180, no. 8, pp. 763–775, 2014.

[5] M. Ding, S. Bhupathiraju, A. Satija, R. Dam, and F. Hu, "Long-Term Coffee Consumption and Risk of Cardiovascular Disease: A Systematic Review and a Dose-Response Meta-Analysis of Prospective Cohort Studies," *Circulations*, vol. 129, no. 6, pp. 642–659, 2014.

[6] Food Standards (2011). Takeaway coffee cup measures program. Food standards, 2011. Retrieved from: http://www.foodstandards.gov.au/science/monitoringnutrients/ausnut/foodmeasures/Pages/Takeaway-beverage-measures-program—data-table.aspx.

[7] C. D. Frary, R. K. Johnson, and M. Q. Wang, "Food sources and intakes of caffeine in the diets of persons in the United States," *Journal of the Academy of Nutrition and Dietetics*, vol. 105, no. 1, pp. 110–113, 2005.

[8] G. E. Giles, C. R. Mahoney, T. T. Brunyé, A. L. Gardony, H. A. Taylor, and R. B. Kanarek, "Differential cognitive effects of energy drink ingredients: Caffeine, taurine, and glucose," *Pharmacology Biochemistry & Behavior*, vol. 102, no. 4, pp. 569–577, 2012.

[9] Health Canada. Caffeine in food [Internet] Ottawa (Canada); Health Canada, 2012. Retrieved from: http://www.hc-sc.gc.ca/fn- n/securit/addit/caf/food-caf-aliments-eng.php.

[10] N. Ibrahim, R. Iftikhar, M. Murad, H. Fida, B. Abalkaeil, and J. AlAhmadi, "Energy drinks consumption amongst medical students and interns from three colleges in Jeddah, Saudi Arabia," *Journal of Food and Nutrition Research*, pp. 174–179, 2014.

[11] International Coffee Organization, The Current State of the Global Coffee Trade, 2015. Retrieved from: http://www.ico.org/monthly_coffee_trade_stats.asp.

[12] S. Jacob, J. Tambawel, F. Trooshi, and Y. Alkhoury, "Consumption pattern of nutritional health drinks and energy drinks among university students in Ajman, UAE," *Gulf Medical Journal*, vol. 2, no. 1, pp. 16–22, 2013.

[13] Y. Je and E. Giovannucci, "Coffee consumption and total mortality: A meta-analysis of twenty prospective cohort studies," *British Journal of Nutrition*, vol. 111, no. 7, pp. 1162–1173, 2014.

[14] R. Lovett, Coffee: The Demon Drink? New Sceintist, 2015: (2518).

[15] S. Maia, H. Tracy, W. Nick, and L. Andrade, "Caffeine and chlorogenic acids in coffee and effects on selected neurodegenerative diseases," *Journal of Pharmaceutical and Scientific Innovation*, vol. 2, no. 4, pp. 9–17, 2013.

[16] B. Malinauskas, V. Aeby, R. Overton, T. Carpeter-Aeby, and K. Heidal, "A survey of energy drinks consumption patterns among college students," *Nutrition Journal*, vol. 6, no. 35, pp. 1–7, 2007.

[17] D. C. Mitchell, C. A. Knight, J. Hockenberry, R. Teplansky, and T. J. Hartman, "Beverage caffeine intakes in the U.S," *Food and Chemical Toxicology*, vol. 63, pp. 136–142, 2014.

[18] E. Mueni, N. Opiyo, and M. English, "Caffeine for the management of apnea in preterm infants," *Int Health*, vol. 1, no. 2, pp. 190–195, 2009.

[19] A. O. Musaiger and N. Zagzoog, "Knowledge, attitudes and practices toward energy drinks among adolescents in Saudi Arabia," *Global Journal of Health Science*, vol. 6, no. 2, pp. 42–46, 2014.

[20] A. Nehlig, "Is caffeine a cognitive enhancer?" *Journal of Alzheimer's Disease*, vol. 20, no. 1, pp. S85–S94, 2010.

[21] N. Olsen, "Caffeine Consumption Habits and Perceptions among University of New Hampshire Students," *Honors Thesese*, vol. 1, no. 1, p. 103, 2013.

[22] L. Somogyi, Caffeine Intake by the US Population. Oakridge National Laboratory. California: The Food and Drug Administration, 2012.

[23] S. Jennifer Suhasini and G. Sethu, "Intake of caffeine," *Journal of Pharmaceutical Sciences and Research*, vol. 7, no. 6, pp. 355–356, 2015.

[24] S. Tifferet, N. Shani, and H. Cohen, "Gender differences in the status consumption of coffee," in *Human Ethology Bulletin*, vol. 28, pp. 5–9, 2013.

[25] V. L. Fulgoni, D. R. Keast, and H. R. Lieberman, "Trends in intake and sources of caffeine in the diets of US adults," *Am J Clin Nutr*, vol. 101, no. 5, pp. 1081–1087, 2001.

The relationship between Dieting and Levels of Perceived Psychological Stress in United Arab Emirates Residents

Teresa Arora, Shamma Al Ketbi, Marwa Mubarak, Anood Al Othali, Sara Al Hajri, Adeeba Al Messabi, and Fatema Al Jneibi

Zayed University, Department of Psychology, College of Natural and Health Sciences, Abu Dhabi, United Arab Emirates

Corresponding Author: Teresa Arora; email: Teresa.Arora@zu.ac.ae

Abstract

Aim: The primary aim of this cross-sectional research study was to investigate the potential differences in perceived psychological stress level in those dieting compared to those not undertaking a diet. The secondary objective was to assess if stress levels in those dieting were correlated with the duration of the diet. **Methods:** We administered the previously validated Perceived Stress Scale (PSS) to 60 United Arab Emirates residents. Participants were also asked demographic questions concerning age and gender and were requested to indicate if they were currently undertaking a diet to achieve weight loss. Participants who were actively on a diet were also asked about the duration of the diet (days). **Results:** A total of 60 participants were recruited to the study, of which 71.7% were female. The majority (71.7%) of the sample were 18-25 years old and 58.3% indicated that they were undertaking a diet at the time of data acquisition. The median total score on the PSS was 19 (14 – 22). There was a significant difference in PSS total score between those on a diet and those not ($p = 0.021$). A positive correlation was found between number of days on a diet and perceived stress level ($r = 0.147$) but this was not statistically significant ($p = 0.406$). **Conclusions:** Dieting behaviour was associated with higher levels of perceived psychological stress compared to those not undertaking a diet. Engaging in dieting behaviour is commonly driven by body dissatisfaction and may be linked to heightened stress due to social pressures or other factors.

Keywords: diet, stress, body dissatisfaction, body image, perceived stress

1. Introduction

The mass media has been consistently implicated in influencing beliefs about ideal body size and shape with recent research reporting adverse effects in young people [4, 11] and women [4, 6]. Body dissatisfaction has become a public health concern

[4], although evidence to support this claim in the Middle East region is sparse. Dissatisfaction with body image can result in alterations to lifestyle behaviours which focus on reducing energy intake and increasing energy expenditure in order to reduce body weight and enhance body image satisfaction. Dieting, such as calorie restriction, is a commonly used approach for achieving weight loss and is well documented in young adults in academic settings [9, 16]. Dieting amongst female students appears to be widespread, with one study indicating that of 185 students aged 18-24 years, 83% recruited to the study reported dieting to achieve weight loss [9]. Despite the well documented chronic effects of dieting such as over-eating, weight regain, weight cycling as well as the long-term physiological and cardiovascular consequences [12], psychological distress has also been reported in children [2] and adolescent populations [15]. Conversely, a pilot study in athletes demonstrated that those adhering to a high-protein, low-fat type diet reported lower levels of stress [5]. The primary aim of the study was to examine the relationship between dieting and perceived stress level in United Arab Emirates residents. Secondary study objectives were to assess if the amount of time spent on a diet was related to perceived psychological stress level. We hypothesised that individuals on a diet would have higher levels of perceived stress compared to those who were not on a diet. We further hypothesised that the longer an individual had been on a diet, the higher the level of perceived stress.

2. Methods

Ethical approval for the study was provided by a Zayed University to support an undergraduate student-led research study in Health Psychology. Six undergraduate Psychology students collaborated and collected data from other university students as well as through networks of friends and family. Potential participants were approached for study participation and willing volunteers provided written informed consent. Participants were asked questions concerning socio-demographics including information about gender (male/female) and age (years). Participants were also asked if they were on a diet for purposes of weight loss (yes/no) at the time of data collection. Participants who indicated that they were on a diet were also asked about the duration of how long they have been undertaking a diet (days). The Perceived Stress Scale (PSS) is a 10-item instrument used to assess the extent to which ten situations in an individual's life are appraised as stressful during the last month [3]. Participants were asked to indicate one response for each of the ten items where the response options were "never", "almost never", "sometimes", "fairly often", or "very often". Higher total scores indicate higher levels of perceived stress and the range of possible scores is 0-40. The tool has been

extensively used in higher education students as well as those in various employment [2]. The internal consistency reliability, factorial validity and hypothesis validity of the PSS are well documented and the 10-item version has been found to be superior to the original 14-item version [2].

2.1. Statistical Analysis

All statistical analyses were performed using IBM SPSS Statistics Version 24 (Armonk, NY: IBM Corp.). Descriptive statistics of the total sample were conducted to determine the proportions of males and females, age group and dieters versus non-dieters that participated in the study. The PSS was scored according to the pre-defined scoring instructions by first reversing items 4, 5, 7 and 8. All ten items were then summed to provide a total PSS score. The distribution of the PSS total score was then assessed and the data were not normally distributed. The median and interquartile range (IQR) of the PSS total score was calculated and an independent samples Mann-Whitney U test was performed to assess the mean difference between those who were dieting and those who were not. For those on a diet, the distribution of the number of days on a diet was explored which was not normally distributed and indicated one outlier (1,095 days) which was subsequently removed. A Spearman's rho bivariate correlation was performed to investigate the relationship between number of days on a diet and total PSS score.

3. Results

A total of 60 participants were recruited to the study. Characteristics of the sample are presented in Table 1. Of the total sample, 28.3% (n = 17) were male and 71.7% (n = 43) were female. The majority (71.7%; n = 43) of the sample were aged 18-25 years, 18.3% (n = 11) were aged 26-35 years, 8.3% (n = 5) were aged 36-45 years and 1.7% (n = 1) was ≥46 years old. The median PSS total score was 19 (14 – 22). The majority of participants were undertaking a diet at the time of data acquisition (n = 35; 58.3%) and the median number of days on a diet was 21 (14 – 33) days.

Those who were on a diet at the time of data collection had a median PSS total score of 20 (17 - 23). Participants that indicated they were not on a diet had a median PSS total score of 14 (12 – 21). An independent samples Mann-Whitney U-test showed the difference in perceived stress level between dieters and non-dieters was statistically significant (p = 0.021).

Characteristic	Percentage or median (IQR)
Gender	
Male (n = 17)	28.3%
Female (n = 43)	71.7%
Age group	
18-25 years (n = 43)	71.7%
26-35 years (n = 11)	18.3%
36-45 years (n = 5)	8.3%
≥46 years	1.7%
Dieting	
Yes (n = 35)	58.3%
No (n = 24)	40.0%
Not indicated (n = 1)	1.7%
Perceived Stress Scale total score	19 (14 – 22)
Duration on diet (days)	21 (14 – 33)

Table 1: Sample characteristics of 60 United Arab Emirates residents. IQR = Interquartile Range.

Spearman's rho bivariate correlation showed a non-significant positive correlation between the number of days on a diet and the PSS total score, where r = 0.147, p = 0.406. A visual representation of the relationship between duration of diet (days) and perceived stress level is depicted in a scatterplot in Figure 1.

4. Discussion

Higher levels of perceived stress were observed in participants undertaking a diet to induce weight loss, compared to those not on a diet. For those on a diet, the duration (days) on a diet was not significantly associated with levels of perceived stress. To our knowledge, this is the first study to investigate the relationship between perceived psychological stress and diet in adults residing in the United Arab Emirates.

Body image dissatisfaction and weight concern is a widespread problem [1]. Discrepancies between current body weight and desirable weight has been linked to discrimination, internalized stigma and body image trepidations [7]. An extensive systematic review suggests that those with high levels of body dissatisfaction have a range of cognitive biases to appearance-related stimuli [4]. Furthermore, recent research has shown that higher body dissatisfaction is associated with poorer physical and mental

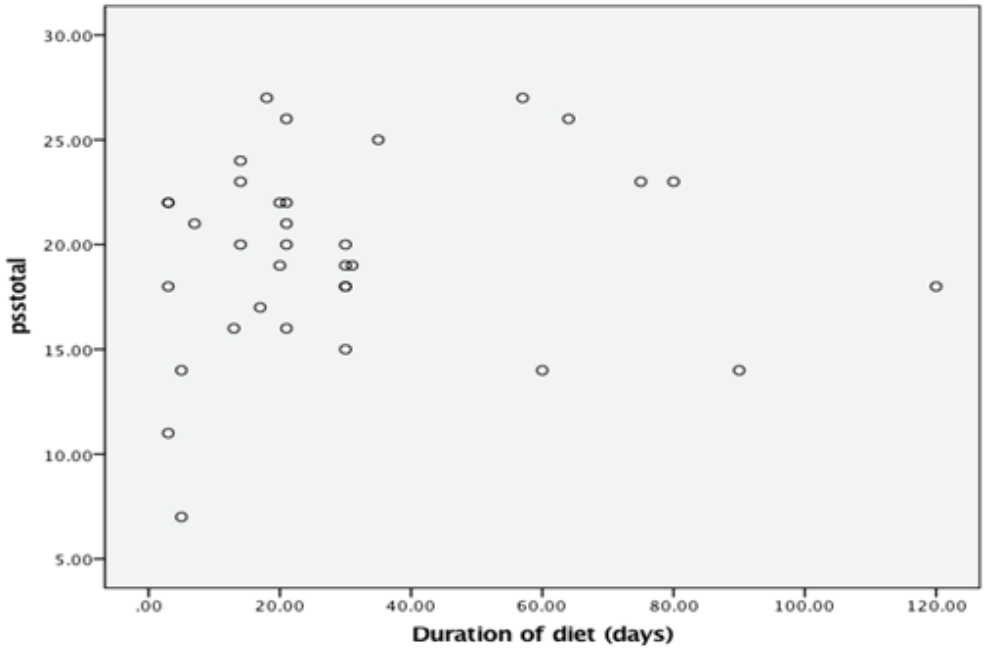

Figure 1: Scatterplot highlighting the relationship between duration of diet in days and perceived stress level in a sample of 35 Emirates.

health-related quality of life as well as greater psychological distress [4]. In our study, given that the median duration of those on a diet was just 19 days, body dissatisfaction may have been present in dieters as a potential explanation of the heightened stress levels observed. Whilst the body weight and body dissatisfaction of the sample were not ascertained, it remains possible that the non-dieters in our study were healthy weight individuals with no body dissatisfaction concerns, and could thus explain lower stress levels that were observed.

Addressing the issue of body weight concern is paramount, particularly in young people who have an increased risk of developing an eating disorder. Educating individuals about the risks and symptoms associated with dieting and feeding behaviour, may improve knowledge, subsequent behaviour and help people to better manage stress levels. Internet-based interventions targeted at those with eating disorders have demonstrated a range of favourable psychological and physiological outcomes [10]. Thus, educating those with body weight dissatisfaction, regardless of body weight status, may be an effective approach for reducing psychological and physiological consequences to address this public health concern.

Whilst this is the first study to examine the relationship between dieting and psychological stress in the United Arab Emirates, there are several study limitations that need to be acknowledged. First, the sample size was relatively small, thus our findings may not be generalizable to other populations. Furthermore, a small sample size restricts

the statistical power and limits more detailed statistical analyses. Future studies in this area may consider recruiting larger numbers to the sample to overcome such issues. Second, given that our study was cross-sectional, the cause-effect association remains to be determined. It is possible that dieting results in higher levels of stress due to cognitive restrictions the individual places upon themselves or due to social difficulties surrounding meal times. Conversely, higher stress levels may promote the onset of dieting due to body image dissatisfaction. Further studies are needed to disentangle the temporal associations between dieting and subjective psychological stress. Third, no anthropometric measures were performed in our study to assess body weight status. Given that obese individuals report negative obesity-related psychological consequences [7], our study could have been improved by obtaining body weight and body image dissatisfaction in an attempt to better understand the driving factors of dieting behaviour. Lastly, although demographic data were obtained and a validated scale was used to estimate stress level, the observed relationship may have been confounded by other factors including academic or employment related stress, education level, physical activity, mental and/or physical health.

5. Conclusion

In conclusion, this is the first study to examine the relationship between perceived levels of psychological stress and dieting behaviour in the United Arab Emirates. We observed higher stress levels in those undertaking a diet compared to those not on a diet. Duration of diet was not significantly associated with stress level. Individuals with body dissatisfaction concerns may require exposure to educational interventions to better management stress levels and ease physiological and psychological related symptoms; in turn, this may help to reduce the public health concern of body image dissatisfaction and its adverse consequences.

6. Conflict of Interest

None.

7. Acknowledgements

We thank all participants for taking the time to provide study-related information. This study was not financially supported by any commercial organization.

References

[1] Bibiloni MD, Coll JL, Pich J, Pons A, Tur JA. Body image satisfaction and weight concerns among a Mediterranean adult population. BMC Public Health. 2017;17(1):39.

[2] Cho JH, Han SN, Kim JH, Lee HM. Body image distortion in fifth and sixth grade students may lead to stress, depression, and undesirable dieting behavior. Nutr Res Pract. 2012;6(2):175-81.

[3] Cohen S, Kamarck T, Mermelstein R. A global measure of perceived stress. J Health Soc Behav. 1983;24(4):385-96.

[4] Griffiths S, Hay P, Mitchison D, Mond JM, McLean SA, Rodgers B, et al. Sex differences in the relationships between body dissatisfaction, quality of life and psychological distress. Aust N Z J Public Health. 2016;40(6):518-22.

[5] Helms ER, Zinn C, Rowlands DS, Naidoo R, Cronin J. High-protein, low-fat, short-term diet results in less stress and fatigue than moderate-protein moderate-fat diet during weight loss in male weightlifters: a pilot study. Int J Sport Nutr Exerc Metab. 2015;25(2):163-70.

[6] Jackson T, Jiang C, Chen H. Associations between Chinese/Asian versus Western mass media influences and body image disturbances of young Chinese women. Body Image. 2016;17:175-83.

[7] Jung F, Spahlholz J, Hilbert A, Riedel-Heller SG, Luck-Sikorski C. Impact of Weight-Related Discrimination, Body Dissatisfaction and Self-Stigma on the Desire to Weigh Less. Obes Facts. 2017;10(2):139-51.

[8] Lee EH. Review of the psychometric evidence of the perceived stress scale. Asian Nurs Res (Korean Soc Nurs Sci). 2012;6(4):121-7.

[9] Malinauskas BM, Raedeke TD, Aeby VG, Smith JL, Dallas MB. Dieting practices, weight perceptions, and body composition: a comparison of normal weight, overweight, and obese college females. Nutr J. 2006;5:11.

[10] Melioli T, Bauer S, Franko DL, Moessner M, Ozer F, Chabrol H, et al. Reducing eating disorder symptoms and risk factors using the internet: A meta-analytic review. Int J Eat Disord. 2016;49(1):19-31.

[11] Michels N, Amenyah SD. Body size ideals and dissatisfaction in Ghanaian adolescents: role of media, lifestyle and well-being. Public Health. 2017;146:65-74.

[12] Montani JP, Schutz Y, Dulloo AG. Dieting and weight cycling as risk factors for cardiometabolic diseases: who is really at risk? Obes Rev. 2015;16 Suppl 1:7-18.

[13] Rodgers RF, DuBois RH. Cognitive biases to appearance-related stimuli in body dissatisfaction: A systematic review. Clin Psychol Rev. 2016;46:1-11.

[14] Rodgers RF, McLean SA, Marques M, Dunstan CJ, Paxton SJ. Trajectories of Body Dissatisfaction and Dietary Restriction in Early Adolescent Girls: A Latent Class Growth Analysis. J Youth Adolesc. 2016;45(8):1664-77.

[15] Viner RM, Haines MM, Taylor SJ, Head J, Booy R, Stansfeld S. Body mass, weight control behaviours, weight perception and emotional well being in a multiethnic sample of early adolescents. Int J Obes (Lond). 2006;30(10):1514-21.

[16] Yahia N, El-Ghazale H, Achkar A, Rizk S. Dieting practices and body image perception among Lebanese university students. Asia Pac J Clin Nutr. 2011;20(1):21-8.

5

High Intensity Interval Training or Moderate Intensity Continuous Exercise in Patients with Myocardial Infarction?

Irene C. Themistocleous and Manos Stefanakis

Department of Life & Health Sciences, University of Nicosia, 46, Makedonitissas Avenue, Nicosia, 1700, Cyprus

Corresponding Author: Manos Stefanakis; email: manos.stefanakis.gr@ gmail.com

Abstract

Objectives: To determine the effects of high intensity interval training (HIIT) or moderate intensity continuous exercise (MICE) in patients with myocardial infarction (MI). **Background:** Cardiovascular diseases are the leading cause of mortality and morbidity globally causing a significant reduction in the quality of life of these patients. Participation of these patients in rehabilitation programs which involve a significant component of exercise seems to help by improving functional capacity and quality of life (QoL). Despite the beneficial effect of exercise, the type of exercise that yields the best results is yet to be determined. **Methods:** Three databases (MEDLINE, CINHAL and SportDirect) were searched in May-June 2017 for original articles regarding the effect of two types of exercise in patients with myocardial infarction. Randomized control trial studies which enrolled patients with myocardial infarction and studied the effects of HIIT and/or MICE, were included in this review. Data were extracted and summarised and all studies were assessed for bias. **Results:** Both forms of exercise seem to improve the relevant outcome measures such as functional capacity, QoL, walking distance, fatigue and function of the left heart. However HIIT seemed to be better in comparison with MICE in improving these outcomes. Several limitations and risk of bias have been identified and reported. **Conclusion:** Both HIIT and MICE are recommended for patients with MI. Further research is required to conclusively support the superiority of HIIT over other types of exercise.

1. Introduction

According to World Health Organisation [1] chronic diseases are among the primary causes of global mortality. The most common causes of mortality in 2012 were: cardiovascular diseases (46.2% of all deaths), cancer (21.7%), respiratory diseases (10.7%) and diabetes (4%) [1].

Several studies show that frequent physical exercise helps in the prevention of several chronic diseases and reduces the mortality rate from all causes, including cardiovascular diseases [2–7]. Aerobic exercise is extremely important for patients with CHD with or without MI [8]. Taylor and colleagues [9] report that rehabilitation programs based on aerobic exercise have reduced the total mortality rate by 20% and the cardiovascular disease mortality rate by 26% and they have helped in reducing risk factors such as hypertension, hypercholesterolemia, diabetes, and obesity in patients with MI, angina and CHD [9].

In addition exercise improves well-being and QoL [11]. Exercise is important especially for patients with coronary heart disease (CHD) [10] because it improves functional capacity, reduces coronary ischemia and angina and improves endothelial function [13]. However benefits from exercise rehabilitation programs depend heavily on the parameter of the program most notably the intensity and volume of exercise [12]. Studies show that perhaps interval exercise especially with high intensity might be superior in comparison with other forms of exercise in improving cardiac function, functional capacity and ultimately QoL in patients with CHD especially after myocardial infarction [14, 16], (Nillson Westheim & Risberg, 2008b; Moholdt Madssen Rognmo & Aamot 2014).

2. Methods

2.1. Search Strategy

The following electronic databases were searched from March until June 2014: Science Direct, MEDLINE and Cumulative Index to Nursing and Allied Health Literature [CINAHL]. The medical subject headings (MeSH) "myocardial infarction", "coronary heart disease", "high intensity interval training" AND "moderate intensity continuous exercise" were used alone or in combination. Each specific phrase was combined with the Boolean operator to limit the search and make it more specific. Additional searches were carried out by scanning the reference lists of related articles in order to maximize the amount of investigations involved in the current review.

3. Study Criteria and Selection

In order to define and frame the research questions the Population(s), Intervention(s), Comparator(s), Outcome(s) and Study Design (PICOS) were used [17]. The titles and abstracts of all records were screened initially against the basic initial eligibility criteria. A single failed eligibility criterion was sufficient for a study to be excluded from a

Inclusion Criteria	Exclusion Criteria	PICOS
Was the study a RCT?	Study designs other than RCT Quasi experimental studies, pilot studies	Study
Was the study published in English?	Duplicates Abstract and pilot-studies publications	
Did the study include males and females with CHD and MI?	Included subjects with disease risk factors	Population
Was the intervention HIIT or MICE and was it combined with another type of exercise?	Not HIIT or MICE Not specified	Intervention
Were the outcomes measures relevant?	Not relevant outcomes measures	Outcomes
Were the interventions compared with another type of exercise, or placebo or non therapy?		Comparison

Table 1: Full eligibility screening criteria.

review [17]. Moreover, the records that remained after initial eligibility screening, were therefore screened against the full eligibility criteria outlined in Table 1.

3.1. Outcome Measures

All relevant outcome measures were considered. Specifically measures such as QoL, VO2peak, functional capacity, fatigue or perceived rate of exertion, left ventricular function, and exercise time were considered relevant.

3.2. Data Extraction and Assessment of Risk of Bias

For each RCT included, data were extracted regarding: first author, year of publication, study outcomes, groups and exercise parameters, and assessed for bias using the Cochrane risk of bias tool. The quality assessment was performed to identify the quality of papers. Trials should provide full details of the randomisation process, allocation concealment or blinding of outcome assessment to be considered high quality. The quality of included studies was assessed using the Jadad scale [20], a three-point questionnaire form. Each question was to be answered with a *yes* and score a single point, or a *no* and scored zero points.

4. Results

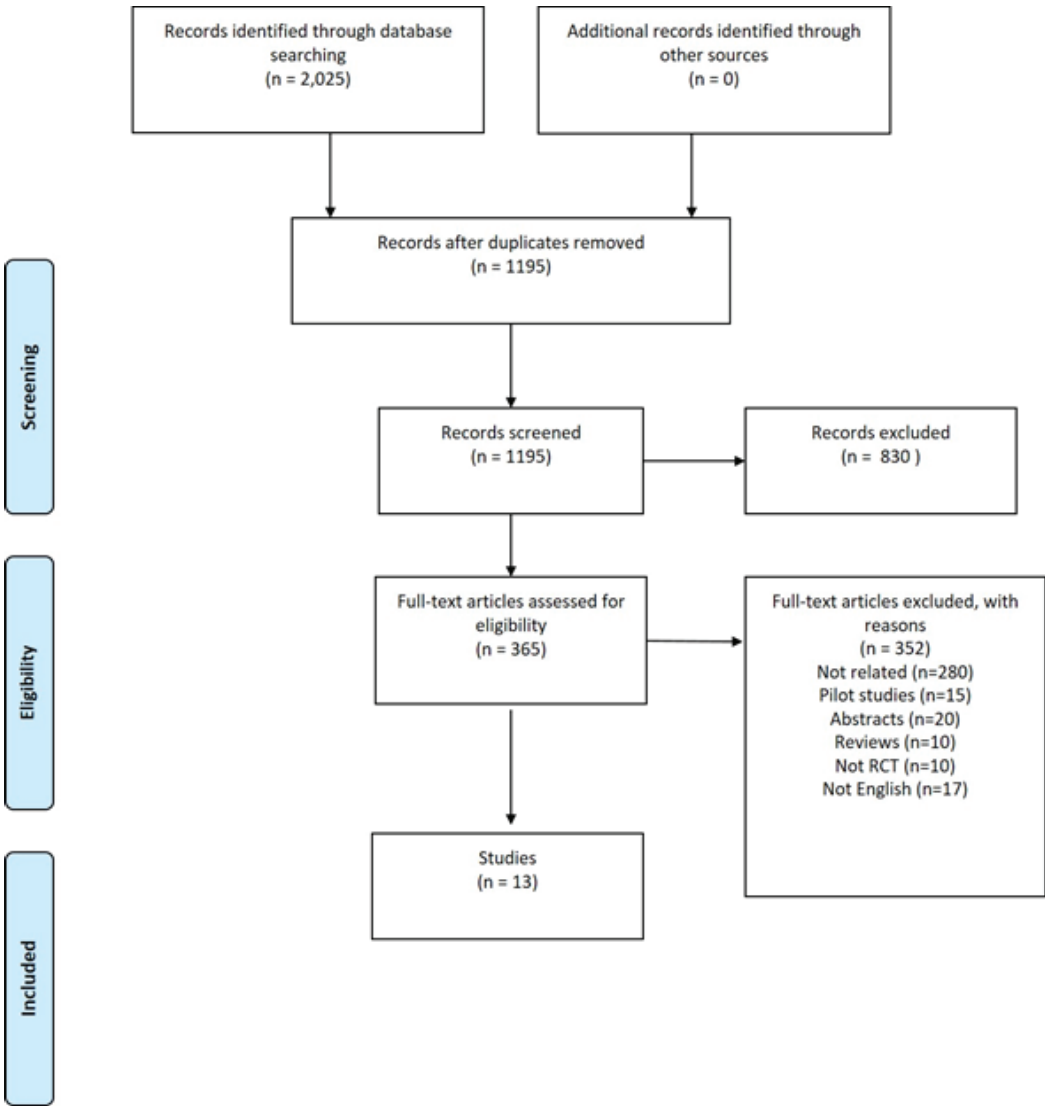

Figure 1: PRISMA diagram for included studies [19].

4.1. Identification of Records and Study Selection

The search strategy from the three databases identified a total of 1095 records. An initial screen of the article title resulted in exclusion of 830 papers. Three hundred and sixty five studies were assessed for eligibility using the inclusion and exclusion criteria of Table 1. Following this process of the eligibility criteria, 352 records were excluded, due to reason described in detail in Figure 1. The remaining 13 records met the eligibility criteria and were included in the final review.

4.2. Description of Included Studies

Thirteen studies were included in this review. A summary of the studies' characteristics is presented in Table 2. Eight of the studies [22–26, 29–31] compared HIIT with MICE alone or in combination with a control group, whereas the remaining studies [14, 15, 21, 27, 28] examined only HIIT or MICE in relation to another type of exercise.

Six of the studies [22, 23, 25, 29–31] had a small sample (below 30) and the rest had sample that varied from 59 to 200 participants. Most of the studies used an exercise program of 10-16 weeks with a frequency of 2-3 times per week, however one study used a program of four week with a higher frequency (5times/week) and one study used a 1-year program of 2 sessions per week.

Generally both forms of exercise seemed to improve QoL, maximum aerobic capacity, functional capacity and left ventricular function. HIIT and MICE were superior to control intervention in two of the studies that had a control group [24, 31] in terms of aerobic capacity, functional capacity and QoL. In addition HIIT was superior to a control group in another two studies [14, 15] in terms of functional capacity, QoL and exercise time. HIIT was also superior in improving VO2peak compared to aerobic exercise (no further information regarding parameters) in two additional studies [27, 28]. No study compared MICE with a control group only. From the eight studies that examined both HIIT and MICE, five favoured HIIT [25, 26, 29–31] in at least one outcome measure or one time point, while 3 studies [22–24] showed no differences between the two forms of exercise.

4.3. Risk of Bias Assessment

The Jadad score ranged between 0 and 3 out of 5 (Table 3). One study scored 0 [25]; two studies scored 1 [24, 30], four studies scored 2 [21–23, 31] and six studies scored 3 [14, 15, 26–29]. These scores indicated that approximately half of the studies were low quality. This is due to the fact that the double-blinding criterion is not feasible in these kind of RCT within exercise intervention. On the Jadad scale 40% of the score accounts for the double-blinding criterion (Hempel et al., 2011).

All the included studies were evaluated in terms of its risk of bias (Table 4). Major sources of the risk of bias were related to allocation concealment, blinding study subjects or research personnel and blinding of outcome assessment. Risk of reporting bias was low in general. Therefore, a high risk of bias might be introduced in most of the RCTs included.

Authors	Sample size/Groups	Duration / Frequency	Equipment	Exercise protocol	Outcome measures
[29]	21 participants IT/MICE	10 weeks 3days/week	Treadmill	IT **group** 4×4min at 80-90%VO2peak [33min]	IT group had greater ↑ of VO2peak compared to MICE group
				MICE group 50-60%VO2peak [41min]	
[30]	14 participants IT/MICE	16 weeks 2days/week Additional 3days/week	Treadmill, Stair-climber, Combined arm and leg cycle ergometer	IT **group** 40%VO2reserve (2 min) with intervals at 90%VO2reserve (2 min) [30min] 65% VO2reserve [Resistance exercise, 30min]	IT and Mice groups had similar ↑of VO2 Peak IT group had greater ↑ of AT
				MICE group 65% VO2reserve [30min] 65% VO2reserve [Resistance exercise, 30min]	
[31]	27 participants IT/MICE/CONTROL	12 weeks 3days/week	Treadmill	IT **group** 50–60% HRpeak (3 min) with intervals at 90–95% HRpeak (4 min) [38min]	IT group had greater ↑ of LV remodeling, VO2peak and endothelium function compared to MICE and CONTROL groups. QOL improved both after IT and MICE exercise. No changes occurred in the CONTROL group regarding the QOL.

TABLE 2: Summary of the studies included in the review. **Abbreviations:** OUES:oxygen uptake efficiency slope; HRpeak: heart rate peak; IT: interval training; MICE: moderate intensity continuous training; LV Funtion: left ventricle function; QOL: quality of life; HR: heart rate; VO2: oxygen consumption; AT: anaerobic threshold; O_2P slope: oxygen pulse; ↔: Similar improvement; ↑: Greater improvement; ↓: Reduction. FMD: Flow mediated dilation.

Authors	Sample size/ Groups	Duration/ Frequency	Equipment	Exercise protocol	Outcome measures
				MICE group 70% HRpeak [47min]	
				CONTROL group (Walking and counseling) 70% HRpeak [47min]	
[14]	80 participants IT/CONTROL	16 weeks 2days/week	Aerobic dance movements (with music) and involved the use of both upper and lower extremities, including endurance, strength, and stretching exercises	*IT* **group** 3×5–10 min at RPE = 15–18 [50min]	Greater ↑ of functional capacity, workload (watts), exercise time (seconds) and QOL significantly improved for the exercise group.
				CONTROL group Without exercise	
[15]	80 participants IT/CONTROL	1year 2days/week	Aerobic dance movements (with music) and involved the use of both upper and lower extremities, including endurance, strength, and stretching exercises	*IT* **group** 3×5–10 min at RPE = 15–18 [50min]	Greater ↑ of functional capacity, workload (watts), exercise time (seconds) and QOL significantly improved for the exercise group.
				CONTROL group Without exercise	

TABLE 2: Table continued.

Authors	Sample size/ Groups	Duration/ Frequency	Equipment	Exercise protocol	Outcome measures
[26]	59 participants IT/MICE	4weeks 5days/week	Treadmill	*IT* **group** 4×4min intervals at 90% HRmax with active pauses of 3min of walking at 70%HRmax	↑ Of VO2peak in both groups after 4 weeks. After 6 months IT group significantly improved VO2peak compared to MICE group. QOL significantly ↑ at 4weeks and 6months, with no significant difference between the groups. No changes occurred at 4 weeks regarding the blood markers and LV function. However,there was a change at 6 months on both groups.
				MICE group 70%HRmax [46min]	
[25]	20 participants IT/MICE	2 sessions 2 weeks difference	Cycle ergometer	*IT* **group** 2sets of 10min composed of repeated phases of 15s at 100% PPO, interspersed by 15s of passive recovery	IT protocol resulted in lower mean ventilation for a small difference in metabolic demand. Participants preferred the IT mainly because the perceived exertion measured by the Borg scale was lower.
				MICE group 70% PPO	
				AEROBIC group *N/A*	

Table 2: Table continued.

Authors	Sample size/ Groups	Duration/ Frequency	Equipment	Exercise protocol	Outcome measures
[27]	107 participants IT/AEROBIC	12 weeks 2days≤/week	Treadmill Aerobic exercises	*IT* **group** 4x4min intervals at 85–95% HRmax with active pauses of 3min of walking at 70% HRmax [38min]	IT group had greater ↑ of VO2peak. ↔ Improvement of endothelial function, QOL and blood markers between the groups.
				AEROBIC group *N/A*	
[28]	107 participants IT/AEROBIC	12 weeks 2days/week Measurement at 6 and 30 months	Treadmill Aerobic exercises	*IT* **group** 4x4min intervals at 85–95% HRmax with active pauses of 3min of walking at 70% HRmax [38min]	After 6 and 30 months, VO2peak in both groups declined. At 30 months the improvement of VO2peak in IT group, was still significant.
				AEROBIC group *N/A*	
[14]	22participants IT/MICE	12 weeks 3days/week	Cycle ergometer	**IT group** 10minX 1-min cycling intervals at 89% PPO separated by 1-min intervals at 10% PPO	↔ Improvement of endothelial function, between the groups. No change in HR recovery or variability following 12 weeks of exercise
				MICE group 58% of PPO [50min]	

TABLE 2: Table continued.

Authors	Sample size/ Groups	Duration/ Frequency	Equipment	Exercise protocol	Outcome measures
[15]	14 participants IT/MICE	12 weeks 2days/week	Cycle ergometer	**IT group** 10minX 1-min cycling intervals at 88% PPO separated by 1-min intervals at 10%PPO	. FMD was increased post-training with no differences between groups. There was a significant improvement in cardiorespiratory fitness following both training programs, with no group differences.
				MICE group 60% of PPO [50min]	
[24]	71 participants IT/MICE/CONTROL	16 weeks 3days/week	Treadmill	**IT group** Alternation of 90% HRpeak and 60% HRpeak every 2min [30min]	IT group had greater ↑ of O_2P slope. No changes of VE/VCO_2 slope and OUES occurred between groups.
				MICE group 70–75% HRmax [30min]	
				CONTROL group Without exercise	

Table 2: Table continued.

Authors	Sample size/ Groups	Duration/Frequency	Equipment	Exercise protocol	Outcome measures
[24]	200 participants *IT*/CONTINUOUS	12 weeks 3days/week	Cycle ergometer	*IT* **group** 4×4min at 90–95% HRpeak with active pauses of 3min of 50–70% HRpeak **CONTINUOUS group** 70-75% HRpeak	↔ Improvement of endothelial function, cardiovascular risk factors and QOL.

TABLE 2: Table continued.

Potential Score					
JADAD SCORING CRITERIA	**[29]**	**[30]**	**[31]**	**[14]**	
The study described as randomized?	1	0	1	1	
Was the method of randomization described and appropriate to conceal allocation?	1	1	1	1	
Was there a description of withdrawals and drop outs?	1	0	0	1	
Was the study described Double-blinded?	0	0	0	0	
Was the method of blinding inappropriate?	0	0	0	0	
FINAL SCORE (0 – 5)	**3/5**	**1/5**	**2/5**	**3/5**	
The study described as randomized?	1	1	1	1	
Was the method of randomization described and appropriate to conceal allocation?	1	1	1	1	
Was there a description of withdrawals and drop outs?	1	1	1	1	
Was the study described Double-blinded?	0	0	0	0	
Was the method of blinding inappropriate?	0	0	0	0	
FINAL SCORE (0 – 5)	**3/5**	**3/5**	**3/5**	**3/5**	
JADAD SCORING CRITERIA	**[25]**	**[22]**	**[23]**	**[24]**	**[21]**
The study described as randomized?	0	0	0	1	0
Was the method of randomization described and appropriate to conceal allocation?	0	1	1	0	1
Was there a description of withdrawals and drop outs?	0	1	1	0	1
Was the study described Double-blinded?	0	0	0	0	0
Was the method of blinding inappropriate?	0	0	0	0	0
FINAL SCORE (0 – 5)	**0/5**	**2/5**	**2/5**	**1/5**	**2/5**

Table 3: Assessment of the methodological quality of the studies using the Jadad score.

5. Limitations

Jadad et al. [20] reported that RCTs of high quality, must score between 3 and 5 points on the above scale. The quality assessment of the papers demonstrated that only six studies reached the minimum score to be considered of adequate quality. However,

	1	2	3	4	5	6	7
[29]	-	-	+	+	-	+	+
[30]	+	?	-	-	+	+	+
[31]	+	+	+	-	+	+	+
[14]	+	+	+	-	+	+	+
[15]	+	+	+	-	+	+	+
[26]	-	?	+	-	+	+	+
[27]	+	-	+	-	+	+	+
[28]	+	-	-	-	+	+	+
[25]	-	-	-	-	+	+	+
[22]	-	-	-	-	-	+	+
[23]	+	-	-	-	+	+	+
[24]	-	-	-	-	+	+	+
[21]	-	+	+	+	+	+	+

Table 4: Risk of bias assessment. 1, Random sequence generation (selection bias); 2, Allocation concealment (selection bias); 3 Blinding of participants and personnel (performance bias); 4, Blinding of outcome assessment (detection bias); 5, Incomplete outcome data (attrition bias); 6, Selective reporting (reporting bias); 7, Other bias. + low risk of bias - high risk of bias ? unclear risk of bias.

none of the records were excluded based on the score. Therefore, a high risk of bias exists in most studies.

The comprehensive search strategy was performed in order to minimise publication bias. Nevertheless, it may not have been sufficient to prevent bias, as identifying and improving potential biases is not easy [32]. The exclusion of non-English language records may have introduced language bias, and this is another limitation of this review. The search of the records was updated during the process of the review, to prevent any time-lag biases; however it is impossible to exclude such biases. In addition, the review included only thirteen studies and most of them had a small sample. This makes the interpretation and generalisation of the results difficult.

6. Conclusion

Despite the limitations in the studies, HIIT and MICE both improve QoL and functional capacity of patients with MI and therefore are recommended. However there seems to be a slight advantage of HIIT over MICE but this is not a universal finding. Obviously there is significant heterogeneity in methodologies among the different trials. Despite this, the findings of this review suggest that HIIT is safe and may improve QoL in patients with MI. However, additional studies with higher sample sizes and improved

methodological quality are required to confirm these findings. In light of the limitations that have been reported, the results must be interpreted with caution.

References

[1] A. Alwan, (2014). Global status report on noncommunicable diseases 2010. World Health Organization.

[2] A. E. Bauman, "Updating the evidence that physical activity is good for health: an epidemiological review 2000–2003," *Journal of Science and Medicine in Sport*, vol. 7, no. 1, pp. 6–19, 2004.

[3] S. N. Blair, H. W. Kohl III, C. E. Barlow, R. S. Paffenbarger Jr., L. W. Gibbons, and C. A. Macera, "Changes in physical fitness and all-cause mortality: a prospective study of healthy and unhealthy men," *Journal of the American Medical Association*, vol. 273, no. 14, pp. 1093–1098, 1995.

[4] M. Lee, C. C. Hsieh, and R. S. Paffenbarger, "Exercise Intensity and Longevity in Men: The Harvard Alumni Health Study," *Journal of the American Medical Association*, vol. 273, no. 15, pp. 1179–1184, 1995.

[5] M. Hulens, G. Vansant, A. L. Claessens, R. Lysens, E. Muls, and R. Rzewnicki, "Health-related quality of life in physically active and sedentary obese women," *American Journal of Human Biology*, vol. 14, no. 6, pp. 777–785, 2002.

[6] C. E. I. Lebrun, Y. T. van der Schouw, F. H. de Jong, H. A. P. Pols, D. E. Grobbee, and S. W. J. Lamberts, "Relations between body composition, functional and hormonal parameters and quality of life in healthy postmenopausal women," *Maturitas*, vol. 55, no. 1, pp. 82–92, 2006.

[7] M. L. Pollock, G. A. Gaesser, J. D. Butcher et al., "ACSM position stand: the recommended quantity and quality of exercise for developing and maintaining cardiorespiratory and muscular fitness, andflexibility in healthy adults," *Medicine Science in Sports Exercise*, vol. 30, no. 6, pp. 975–991, 1998.

[8] C. A. Barboza, L. Y. Rocha, C. T. Mostarda et al., "Ventricular and autonomic benefits of exercise training persist after detraining in infarcted rats," *European Journal of Applied Physiology*, vol. 113, no. 5, pp. 1137–1146, 2013.

[9] R. S. Taylor, A. Brown, S. Ebrahim et al., "Exercise-based rehabilitation for patients with coronary heart disease: systematic review and meta-analysis of randomized controlled trials," *American Journal of Medicine*, vol. 116, no. 10, pp. 682–692, 2004.

[10] J. Perk, G. De Backer, H. Gohlke, I. Graham, and Ž. Reiner, "European Guidelines on cardiovascular disease prevention in clinical practice (version 2012) The Fifth

Joint Task Force of the European Society of Cardiology and Other Societies on Cardiovascular Disease Prevention in Clinical Practice (constituted by representatives of nine societies and by invited experts) Developed with the special contribution of the European Association for Cardiovascular Prevention Rehabilitation (EACPR," *European Heart Journal*, p. s092, 2012.

[11] J. Kruk, "Physical activity in the prevention of the most frequent chronic diseases: An analysis of the recent evidence," *Asian Pacific Journal of Cancer Prevention*, vol. 8, no. 3, pp. 325–338, 2007.

[12] L. Azevedo and M. Santos, "High-Intensity Intermittent Exercise Training for Cardiovascular Disease," *Journal of Novel Physiotherapies*, vol. 4, p. 1, 2014.

[13] P. D. Thompson, "Exercise prescription and proscription for patients with coronary artery disease," *Circulation*, vol. 112, no. 15, pp. 2354–2363, 2005.

[14] B. B. Nilsson, A. Westheim, and M. A. Risberg, "Long-Term Effects of a Group-Based High-Intensity Aerobic Interval-Training Program in Patients With Chronic Heart Failure," *American Journal of Cardiology*, vol. 102, no. 9, pp. 1220–1224, 2008.

[15] B. B. Nilsson, A. Westheim, and M. A. Risberg, "Effects of Group-Based High-Intensity Aerobic Interval Training in Patients With Chronic Heart Failure," *American Journal of Cardiology*, vol. 102, no. 10, pp. 1361–1365, 2008.

[16] K. Meyer, C. Foster, N. Georgakopoulos et al., "Comparison of left ventricular function during interval versus steady- state exercise training in patients with chronic congestive heart failure," *American Journal of Cardiology*, vol. 82, no. 11, pp. 1382–1387, 1998.

[17] D. O'Connor, S. Green, and J. P. T. Higgins, "Defining the review question and developing criteria for including studies. In," in *Cochrane Handbook for Systematic Reviews of Interventions Version 5.1.0. [Updated March 2011]: The Cochrane Collaboration, 2011, Chapter 5, Retrieved from: www.cochrane handbook.org*, J. P. T. Higgins and S. Green, Eds., 2011.

[18] J. P. T. Higgins and J. J. Deeks, "Chapter 7: Selecting studies and collecting data," in *Cochrane Handbook for Systematic Reviews of InterventionsVersion 5.1.0. [Updated March 2011]: The Cochrane Collaboration, 2011*, J. P. T. Higgins and S. Green, Eds., 2011, Retrieved from http://www.cochrane-handbook.org.

[19] C. Cooper, A. Selwood, M. Blanchard, Z. Walker, G. Blizard, and G. Livingston, "Abuse of people with dementia by family carers: representative cross sectional survey," *British Medical Journal*, vol. 339, no. 7694, pp. 155–157, 2009.

[20] A. R. Jadad, R. A. Moore, D. Carroll et al., "Assessing the quality of reports of randomized clinical trials: Is blinding necessary?" *Controlled Clinical Trials*, vol. 17, no. 1, pp. 1–12, 1996.

[21] V. M. Conraads, N. Pattyn, C. De Maeyer et al., "Aerobic interval training and continuous training equally improve aerobic exercise capacity in patients with coronary artery disease: the SAINTEX-CAD study," *International Journal of Cardiology*, vol. 179, pp. 203–210, 2015.

[22] K. D. Currie, J. B. Dubberley, R. S. McKelvie, and M. J. MacDonald, Low-Volume, High-intensity Interval Training in Patients with Coronary Artery Disease. Medicine and science in sports and exercise,.

[23] K. D. Currie, L. M. Rosen, P. J. Millar, R. S. McKelvie, and M. J. MacDonald, "Heart rate recovery and heart rate variability are unchanged in patients with coronary artery disease following 12 weeks of highintensity interval and moderate-intensity endurance exercise training," *Applied Physiology, Nutrition, and Metabolism*, vol. 38, no. 6, pp. 644–650, 2013.

[24] G. G. Cardozo, R. B. Oliveira, and P. T. V. Farinatti, "Effects of high intensity interval versus moderate continuous training on markers of ventilatory and cardiac efficiency in coronary heart disease patients," *The Scientific World Journal*, vol. 2015, Article ID 192479, 8 pages, 2015.

[25] T. Guiraud, A. Nigam, V. Gremeaux, P. Meyer, M. Juneau, and L. Bosquet, "High-intensity interval training in cardiac rehabilitation," *Sports Medicine*, vol. 42, no. 7, pp. 587–605, 2012.

[26] T. T. Moholdt, B. H. Amundsen, L. A. Rustad et al., "Aerobic interval training versus continuous moderate exercise after coronary artery bypass surgery: a randomized study of cardiovascular effects and quality of life," *American Heart Journal*, vol. 158, no. 6, pp. 1031–1037, 2009.

[27] T. Moholdt, I. L. Aamot, I. Granøien et al., "Aerobic interval training increases peak oxygen uptake more than usual care exercise training in myocardial infarction patients: a randomized controlled study," *Clinical Rehabilitation*, vol. 26, no. 1, pp. 33–44, 2012.

[28] T. Moholdt, E. Madssen, Ø. Rognmo, and I. L. Aamot, "The higher the better? Interval training intensity in coronary heart disease," *Journal of Science and Medicine in Sport*, vol. 17, no. 5, pp. 506–510, 2014.

[29] Ø. Rognmo, E. Hetland, J. Helgerud, J. Hoff, and S. A. Slørdahl, "High intensity aerobic interval exercise is superior to moderate intensity exercise for increasing aerobic capacity in patients with coronary artery disease," *European Journal of Cardiovascular Prevention and Rehabilitation*, vol. 11, no. 3, pp. 216–222, 2004.

[30] D. E. R. Warburton, D. C. McKenzie, M. J. Haykowsky et al., "Effectiveness of high-intensity interval training for the rehabilitation of patients with coronary artery disease," *American Journal of Cardiology*, vol. 95, no. 9, pp. 1080–1084, 2005.

[31] U. Wisløff, A. Støylen, J. P. Loennechen et al., "Superior cardiovascular effect of aerobic interval training versus moderate continuous training in heart failure patients: a randomized study," *Circulation*, vol. 115, no. 24, pp. 3086–3094, 2007.

[32] J. A. C. Sterne, M. Egger, and D. Moher, "Addressing reporting biases," in *Cochrane Handbook for Systematic Reviews of Interventions, Chapter 10*, J. P. T. Higgins and S. Green, Eds., 2011.

6

Interdisciplinary Teaching in Physical Education

Despina Kaittani[1], Olga Kouli[2], Vassiliki Derri[2], and Efthymios Kioumourtzoglou[1]

[1]Department of Life & Health Sciences, University of Nicosia, 46, Makedonitissas Avenue, Nicosia, Cyprus
[2]Department of Sport Science Komotini Thrace, University Campus, Greece

Corresponding Author: Despina Kaittani; email: kaittanid@pascal.ac.cy

Abstract

The interdisciplinary approach has risen in the modern curricula as it is considered an important and challenging technique. Physical education is a prime content area for interdisciplinary learning. In order to integrate different subject areas into Physical Education lessons, the specialist needs to learn more about the academic curriculum. Integrating core subjects with physical activity can easily be done and can be very beneficial to student learners in all levels of Education. A great effort is done in addition to be integrated with other subjects. Over the last twenty years there have been frequent internal changes at international level, which also affect pre-school curricula. This trend has been intensified in recent years, with unprecedented mobility being observed, to the point of demanding a fundamental reform of the educational mission of the kindergarten. An interdisciplinary approach has been at the core of attention in primary and secondary school education recently. In this approach, teachers collaborate to invent and apply more effective means of teaching by associating the subjects and activities of a school subject in the curriculum with other subjects. The basic aim and purpose is to cultivate skills and values such as cooperatives, flexibility, adaptability, solidarity, but above all to provide basic knowledge, exploration, classification, selection, evaluation, resolution, and observation.

Keywords: Physical education, interdisciplinary teaching, primary education, secondary education

1. Introduction

"Movement activates the body's neural wiring, and thus the whole body becomes a learning instrument" [14].

The term "movement" describes both internal and external action and encompasses every kind of motor behaviour, from the response of the whole body, to the gross

and fine motor skills required to perform complex tasks [36]. Movement occurs in the womb, for quite some time, before birth. In the prenatal environment, the mother's heartbeat may represent the first rhythmic experience.

As early as 400 B.C., the human body was shown to have a critical impact on other types of development. For example, Socrates (as cited in [22]) studied and found that physical health and personal care of the body had a strong influence on the development and function of the mind. The intertwined functions of the mind and body led to philosophical conclusions that the holistic individual is actually the individual who can possess a solid balance of the mind and the body. Further, researchers proposed that the two were so interrelated that the "mind and the body are not separate entities, nor does the mind consist of independent faculties or elements and the body of independent organs and processes. The organism is a single unity" ([13], p. 297).

Movement is the primary means of communication for children. Movement symbolizes their natural response to music and is vital to early childhood musical experience. Prior to language development, children use physical movement and sound to communicate with their surroundings. According to [14], children use movement to learn how to listen and interpret, respond, and explore. Movement activates and integrates connections in the brain, thus enhancing the learning process.

In [8], (Mead, 1994; Choksy, Abramson, Gillespie, Woods, York, 2001; Houlahan & Tacka 2008); Orff (Choksy et al., Warner, 1991), as well as Gardner (1999, 2006), supported the importance of movement to the learning process. They all shared the belief that movement was an essential link to learning and thinking processes. As Hannaford [14] put it: "Thinking is a response to our physical world . . . movement is an integral part of all mental processing, from the atomic movement that fires the molecular movement that orchestrates the cellular (electrical) movement, to the thought made manifest in action" (p. 107).

Movement must be an integral part of his life and education because it helps to overcome the static perception of the passive recipient cognitive information and transform knowledge into a dynamic interaction of physical and intellectual activity (Constantinou, P., 2007).

Jehue and Carlisle [10] reported that about 50% of people learn better through movement. Also, in Gardner [17] on Multiple Intelligence, interest is directed to the learner who learns better and absorbs information, as well as passes this information from their short term memory to the long term memory more efficiently, through movement (kinesthetic student). Still, [11] stated that motion develops muscle balance, an important element in the development of speech, reading, and thought. Thus, it was proposed to implement cross-thematic programs for the following reasons:

1. Active learning is promoted in many areas [6].

2. Knowledge, behaviour, skills and the likelihood of success are being developed [6].

3. The learning of relevant topics is maintained (Garcia et al., 1996), applied [6] and transferred to new conditions (Nichols, 1994).

4. For young children, movement is a simple learning tool that leads to a more integrated interaction with the subject (Werner & Burton, 1979) and enhances the learning of basic concepts such as shape, energy, space, time and the Critical Thinking.5. Motion is a way of self-expression and social interaction.

5. Motor activities stimulate and attract children and facilitate the linking of learning experiences to everyday life (Garcia et al, 1996).

6. When body and mind are actively involved, memory develops [34, 39].

Werner (1999) argues that children who were taught academic skills through movement, learned better than those who were taught the same concepts within the traditional learning methods. Also, research results demonstrate the relationship between acquisition of knowledge and movement [9], while Stinson [34] argues that memory is enhanced when the body and the mind complement each other's feedback.

Physical education is a prime content area for interdisciplinary learning. The movement components of physical education can be used as a medium through which children are provided with opportunities to practice and strengthen language skills [33]. In ([6, 7], p. 4) agree: "interdisciplinary learning is an educational process in which two or more subject areas are integrated with the goal of fostering enhanced learning in each subject area." The interdisciplinary curriculum benefits students by enriching student learning across academic disciplines, while appreciating the knowledge and expertise brought on by other teachers.

However, according to Reed et al. [19], "Participating in regular physical activity is a necessary preventative behaviour for youth to reduce the risks of developing chronic diseases while increasing the quality and perhaps the longevity of one's life" (p. 343). If children are sitting through most of the school day, and doing homework in the evening, along with playing popular video games, there is a clear health concern. "Integrating movement into the lesson, is a practical solution to help children meet physical activity guidelines of 60 minutes or more daily" ([29], p. 318). While the movement brought into the regular classroom encourages a healthier lifestyle, research shows that many students actually learn better when physically active. "Not only does movement and exercise improve circulation and strengthen bones and muscles, it also stimulates the production of dopamine, creates stronger nerve connections, and

releases endorphins into the system ... All of these factors assist in setting the stage for learners to maximize academic achievement." ([38], p.12). According to [32], a study of kindergartners provided evidence that suggests the benefits of interdisciplinary teaching. "Results of the study indicated that the combined physical education and reading skill instruction was more effective than the traditional separate reading and physical education instruction" ([32], p. 11).

In formal physical education programs, physical education is provided in the teaching of basic motor skills, games, sports, as well as in the development of physical fitness. Although these programs often include cognitive and emotional development goals (eg, application of rules, control, development models), emphasis is put on developing students skills to become competitive players in sports or physical activities.

2. Interdisciplinary Teaching at Preschooling

Over the last twenty years there have been frequent internal changes at international level, which also affect pre-school curricula. This trend has been intensified in recent years, with unprecedented mobility being observed, to the point of demanding a fundamental reform of the educational mission of the kindergarten (Ftehakis, W., 2003). Developing new conditions with the aim of globalization and the changing profile of expectations, increasingly changing family structures and assessment of new quality of education are some of the causes that lead to redefining the importance of education and education in the search for new ways of approaching knowledge and the development of new educational programs [23]. Preschool age, according to modern scientific data, is a critical and essential period for the child's full development and therefore there is growing worldwide interest in pre-school education (Doliopoulos, E., 2005). Preschool education is a particular part of the educational community that is called upon to take on a more complex role in responding to modern social requirements and needs. Pedagogical science and especially Pre-school Education are institutions that are being created and recreated in the context of social development, oriented on modern social developments, since their aim is the prosperity and integration of the developing and ever-changing human society.

In the last decade, however, modern research has shown that the organization of traditional activities is not sufficient for effective learning [23]. The renewal and remodeling of pre-school education and education in general comes from within its content, expressed through various teaching approaches. These approaches, which are transferred to pedagogical practice through structured curricula, aim at the child's short-term and long-term development, its smooth adaptation and integration into society, ensuring a lifelong learning that will help it to remain an integral and active member

of the modern society. In addition, today, these programs have been developed in a post-modernist context and attach great importance to the diversity of group children [21] in social order and ethnicity [26, 27]. The child's autonomous position, as well as his/her rights, is also emphasized. Within this framework of synchronicity, renewal and evolution, the concept and purpose of the interdependence and the unification of knowledge emerged in the implementation of the daily program in the kindergarten, in an effort for our educational system to respond to the spirit of modern times. The interdependence on the kindergarten is the starting point of the modern educational process of the young child, which is based on the philosophy of the standardization of knowledge, starting from pre-school years. In order for the nursery to be able to cope with the new social and educational conditions in which it exists, it needs to dare to make in-depth changes, both in its theoretical and practical context, ranging from the content of teaching, the role of all those involved in the learning process, methodology of teaching, even changing the area of the kindergarten itself. In addition, through the interdisciplinary approach of knowledge acquisition, it should bring out the unity of physical and social reality. The child perceives the world as a totality, a concept which is also the basic principle of Morphological Psychology.

3. Interdisciplinary Teaching at Primary School

An interdisciplinary approach has been at the core of attention in primary school education recently. In this approach, teachers collaborate to invent and apply more effective means of teaching by associating the subjects and activities of a school subject in the curriculum with other subjects.

Interdisciplinary approach is one of the newly developed approaches that are now commonly used in a wide spectrum of disciplines. Jacobs, H. ([18], pp. 3-4) defines interdisciplinary learning as "a knowledge view and curriculum approach that consciously applied methodology and language from more than one discipline to examine a central theme, issue, problem, topic, or experience". The term *interdisciplinary* is defined in Collins English Dictionary as "involving two or more academic disciplines". The curricular concept of integrating or connecting school subject areas has gained significant attention in recent years as a plausible solution to developing a more coherent, holistic and effective approach to teaching and learning [1, 5, 10]. The integrative and multi-disciplinary curricular approach related to technology education seeks to help students learn and appreciate not only the relevance, but, most importantly, the significance of how school subjects are tied together and how each subject builds on and complements the other [37].

By employing interdisciplinary techniques teachers of different disciplines can collaborate and support each other while giving way to enliven their teaching [2], (Gray & Halbert 1998). Interdisciplinary teaching requires the application of methods and language from more than one academic discipline to deal with a theme, issue, question, problem or experience. Interdisciplinary methods create connections between discrete disciplines such as mathematics, history and English language arts. Interdisciplinarity can play an essential role in education. It helps the learners to integrate school, lesson and life with one another. Furthermore, it helps learners to realize their own thinking and learning style, enabling them to think and learn effectively. Interdisciplinarity comprehends why they are learning the topic, grasps connection through disciplines and transfers their learning from one situation to another. Furthermore, the learners can comprehend the relation between the content and the process and can acquire the integrated knowledge base. In summary, an interdisciplinary approach aims to bring teachers from different disciplines together in order to solve the problem of effective teaching. As they are aware of the levels and the needs of their students, they design their syllabus and materials accordingly. Integrating various disciplines can help children comprehend a topic which may lead to effective learning.

The starting point for all discussions about the nature of knowledge in our schools should be a thorough understanding of the disciplines. As Lawton (1975) suggests, each discipline asks different questions. There are distinct frames of reference and kinds of statements, and each of these suggests unique procedures and end results that are in fact the discipline fields. The British thinker Hirst (1964) has studied how best to present knowledge systems to young people. In his view, each discipline is a form of knowledge with separate and distinct characteristics. Within each form are unique concepts and propositions that have tests to validate their truth. The motivation for discipline divisions is in part based on the notion that the disciplines encourage efficient learning. The structure of the disciplines is necessary for knowledge acquisition. It is fundamental in order to learn how things are related (Bruner, 1975). The advantage of the disciplines is that they permit schools to investigate with systematic attention to the progressive mastery of closely related concepts and patterns of reasoning (Hirst and Peters, 1974). The decision by educators to specialize goes back to Aristotle, who believed that knowledge should be divided into three areas: the productive disciplines, the theoretical disciplines, and the practical disciplines.

Modern knowledge is organized by disciplines and throughout our schooling we are exposed to discrete bodies of knowledge. The hallmark of the twentieth century in particular is the pride of specialization. This specialization has led to remarkable advances in basic science as well as phenomenal engineering feats on scales never thought

possible by previous generations. The difficulty with this specialization is that a mindset develops which unduly exalts specialization. Compartmentalization of knowledge occurs to such a degree that the average educated person fails to see the interconnectedness of human knowledge. Since life situations come to us amorphous sets of problems and issues, artificially constructed mental walls inhibit adequate conceptualization, problem solving, and effective action. [5]

Interdisciplinary designs go further in models that Burns associates with the key actions of focusing and blending (1995 and 2002). Applebee, Burroughs, and Cruz associate the interdisciplinary approach with the active "thematic" approach, "broad-field curriculum and integrated" designs [10]. Content is revised, Burns' notion of a new "connective depth" created, and team teaching may occur. Subjects and disciplines become tools for studying a theme, a problem, a question, or an idea. Structures vary, from engaging two subjects in a single unit or course to a year-long program, or a student's entire educational experience in an "academy", "whole school", or "school-within-a-school". Likewise, a single teacher may be involved, a large team, or an entire school, department, or program. Themes vary as well, from personal issues of identity and the body to abstract intellectual questions. For younger children, teachers often select themes related to animals and marine ecology, the planetary system, and space exploration. At varying levels of complexity across school and college, students explore themes in history (e.g. immigration, genealogy, exploration, and war), social problems (e.g. conflict, hunger, poverty, racism, AIDS, drug use, ethnic tensions, and pollution), institutions (e.g. family, community, and government), systems (e.g. transportation, the economy, and ecology and the environment), and abstract concepts (e.g. conflict, change, democracy, responsibility, and globalism). Many of these themes, as the list suggests, address cross-curricular issues in the social, political and economic world, heightening students' understanding of the complex challenges they will face as they mature across levels of the educational system and as they become workers, citizens, and parents themselves. The greatest degree and scope of integrative restructuring is typically associated with "trans disciplinary" approaches. In schools, this level is embodied in the historically informed model of "curriculum integration".

Human beings best develop their innate capacity for intelligent thought and action when they purposefully use it as a powerful instrument to help them solve the multitude of perplexing problems that continually confront them in their daily lives—and when they reflect on their experiences and thereby increase their capacity for future intelligent thought and action. Intelligence does not develop simply as a result of problem-solving action and experience; it develops best as a result of reflective, strategic, real-world problem-solving action and experience [4].

4. Interdisciplinary Teaching at Secondary Education

Broadly speaking, interdisciplinary work is motivated by two distinct schools of thought. First, interdisciplinary activity is embedded in an educational framework that advocates a broad, integrative curriculum [16]. Rather than teaching students to think solely through a single disciplinary point of view, the curricula in colleges and universities should instead enable students to organize and understand knowledge from multiple fields of study [17]. This emphasis speaks to the original impetus for a liberal arts education: to develop an individual capacity to discover universal ideas that give meaning to the world. Piaget and Szeminska [30] argued that the "cognitive decentring" was brought about by such an approach that it is a central element in students' development. This broad-based effort enables students to consider multiple perspectives of social reality through a coordinated and integrated outlook.

With the implementation of the new curricula, the basic aim and purpose is to cultivate skills and values such as cooperatives, flexibility, adaptability, solidarity, but above all to provide basic knowledge, exploration, classification, selection, evaluation, resolution, and observation.

During the last three years a number of pilot programs were applied in primary and secondary education with the intention to promote a more holistic approach of education, an approach that would help pupils make the connections between different subjects, disciplines, areas of knowledge. This new trend for interdisciplinary approach in teaching and learning which can be seen to spread all over the world, is by no means revolutionary or new. It is as old as the ancient Greek ideal of the unity of knowledge.

The benefits of interdisciplinary studies are not without their disadvantages. Rahul Kanakia, author of the article titled "Talk about benefits of interdisciplinary approach, as well as some pitfalls", quotes Donald Barr as saying "professors who focus on interdisciplinary studies isolate themselves from the core of their field," "In contrast, interdisciplinary studies focus on the fringes of a field, which lowers an academic's reputation in the eyes of his peers and hurts his chances for tenure" [20]. The academic system is still very much structured on the concentration of specific majors as disciplines and the integration of interdisciplinary studies have become unusual to the traditional fields of study. Rick Szostak, author of "How and Why to Teach Interdisciplinary Research Practice" explains that the methodology of the practice of interdisciplinary is lost when a single interdisciplinary course is then considered as a major field of study.

As the interdisciplinary approach continues to synthesize the characteristics and methods of multiple disciplines while developing lifelong learning skills, they will have met the goals that Newell has laid out. Interdisciplinary curricula is time consuming and

takes collaborative team work to create, which can seem like a hard and exhausting disadvantage, but in the end, the interdisciplinary approached inhibits many favored skills that are sought by future colleges and employers. Students and their teachers will advance in critical thinking, communication, creativity, pedagogy, and essential academia with the use interdisciplinary techniques.

References

[1] Adelman, N. (1989). The case for integrating academic and vocational education. Washington, DC: Policy Studies Associates, Inc.

[2] Austin, A. E. & Baldwin, R.G. (1991). Faculty collaborating: Enhancing the quality of scholarship teaching. ASHE-ERIC Higher Education Report No. 7. Washington, DC: George Washington University, School of Education and Human Development.

[3] Boyer, Bishop, 2004. "Young Adolescent Voices: Students' Perceptions of Interdisciplinary Teaming," RMLE, v.1. http://www.eric.ed.gov/ERICDocs/data/ericdocs2sql/content_storage_01/0000019b/80/3e/a6/ef.pdf.

[4] Burton, L.J. and VanHeest, J.L., 2007. The importance of physical activity in closing the achievement gap. Quest, 59(2), pp.212-218.

[5] Cheek, D., (1992). Thinking constructively about science, technology and society education. Albany, NY: State University of New York Press.

[6] Cone, T.P., Werner, P., Cone, S.L. and Woods, A., 1998. Interdisciplinary teaching through physical education. Champaign, IL: Human Kinetics.

[7] Cone, T.P., Werner, P., Cone, S.L. and Woods, A., 1998. Interdisciplinary teaching through physical education. Champaign, IL: Human Kinetics.

[8] Dalcroze, E. (1976). Rhythm, music and education. Translated by Harold F. Rubinstein, New York: Arno Press.

[9] Dale, E. (1972). Building a learning environment. Bloomington, IN: Phi Delta Kappa Educational Foundation.

[10] Department of Labour. (1991).What work requires of schools: A SCANS report for America 2000.Washington, DC: US Government Printing Office.

[11] Fielden, S. (1995). The magical kingdom of movement. Hawaii: Edu Kinesthetics.

[12] Golden, H.M., 2013. Integrating academics with physical education: how can it realistically be done? VAHPERD Journal, 34(2), pp.12-15.

[13] Hall, S., Lindzey, G. & Campbell, J. B. (1998). Theories of personality. New York: Wiley & Sons.

[14] Hannaford, C. (1995). Smart moves. Virginia: Great Ocean Publishers.

[15] Haynes, C. ed., 2002. Innovations in interdisciplinary teaching. Westport, CT: Oryx Press.

[16] Holley, K.A., 2009. Special Issue: Understanding Interdisciplinary Challenges and Opportunities in Higher Education. ASHE Higher Education Report, 35(2), pp.1-131.

[17] Hursh, B., Haas, P., and Moore, M. (1983). An interdisciplinary model to implement general education. Journal of Higher Education, 54(1), 42–49.

[18] Jacobs, H.H., 1989. Interdisciplinary curriculum: Design and implementation. Association for Supervision and Curriculum Development, 1250 N. Pitt Street, Alexandria, VA 22314.

[19] Jones, C., 2010. Interdisciplinary Approach-Advantages, disadvantages, and the future benefits of interdisciplinary studies. ESSAI, 7(1), p.26.

[20] Kanakia, R. (2007). Talk tout benefits of interdisciplinary approach, as well as some pitfalls. Stanford Report

[21] King, E., W. (1994). Educating young children in a diverse society. Allyn & Bacon. Boston.

[22] Kirkendall, D. R. (1985). Effects of physical activity on intellectual development and academic performance. Washington, DC: American Academy of Physical Education.

[23] Kitsaras, G., (2004). Programs. Didactic methodology of pre-school education with working plans. Athena.

[24] Klein, J.T., 2004. Prospects for transdisciplinarity. Futures, 36(4), pp.515-526.

[25] Kossivaki, F & Brouzos, A, (1995). Basic positions and perceptions of critical communication teaching (pp. 325-356).

[26] McCracken, J., B. (1993). Valuing diversity the primary years. National Association

[27] McNaughton, Gl. (2002). Re-thinking gender in early childhood pedagogies.

[28] Newell, W. (1992). Academic disciplines and undergraduate interdisciplinary education. European Journal of Higher Education, 27(3), 211–221.

[29] Parks, M., Solomon, M., & Lee, A. (2007). Understanding classroom teachers' perceptions of integrating physical activity: A collective efficacy perspective. Journal of Research in Childhood Education, 21, 316-328.

[30] Piaget, J., and Szeminska, A. (1962). The child's conception of number. New York: Humanities Press.

[31] Reed, J.A., Einstein, G., Hahn, E., Hooker, S.P., Gross, V.P. and Kravitz, J., 2010. Examining the impact of integrating physical activity on fluid intelligence and academic performance in an elementary school setting: a preliminary investigation. Journal of Physical Activity and Health, 7(3), pp.343-351.

[32] Sofu, S., 2008. Determinants of preservice classroom teachers' intentions to integrate movement and academic concepts. Missouri Journal of Health, Physical Education, Recreation and Dance, 18, pp.10-23.

[33] Solomon, J. and Murata, N.M., 2008. Physical education and language arts: An interdisciplinary teaching approach. Strategies, 21(6), pp.19-23.

[34] Stinson, W. J. (1990). Moving and learning for the young children. Reston, VA: National Association for Sport and Physical Education.

[35] Szostak, R. (2007). How and Why to Teach Interdisciplinary Research Practice. Journal of Research Practice, 3(2).

[36] Taylor, D. (2000). Physical movement and memory for music. British Journal of Music Education, 6 (3), 251-260.

[37] Wicklein & Schell (1995). Case studies of multidisciplinary approaches to integrating mathematics, science and technology education. 6(2).

[38] Worrell, V. J., Kovar, S.K, Oldfather, S. (2003). Brain/body connection as it relates to physical education. Teaching Elementary Physical Education, 14 (6), 12-13, 26.

[39] Zervou, E., Derri, V. and Paterakis, A., 2004. Enhancing forth graders' knowledge on the ancient Olympic Games through integrated movement and theoretical approaches. Inquiries in Sport & Physical Education, 2(2), pp.148-154.

Assessing the Healthiness of Physical Environment and Food Business at the Female Section of King Abdulaziz University

Elham Aljaaly

Department of Clinical Nutrition, King Abdulaziz University, Jeddah, Saudi Arabia

Corresponding Author: Elham Aljaaly; email: ealjaaly@kau.edu.sa

Abstract

Background: Research has demonstrated that eating patterns are strongly influenced by the physical environment and students are more likely to eat foods that are available and easily accessible. Taking the responsibility for running university meals should be based on a healthy foundation. **Methods:** In this study, we conducted a survey on the physical environment and food business at the King Abdulaziz University's Female Section in Saudi Arabia (KAU). We visited 11 food premises "including the main cafeteria" at the female section **aiming** to assess its equipment, hygiene status and the healthiness' of food/beverage options available and served during the academic year 2013-2014 using a Nutrient Profiling (NP) model. **Results:** Of the analysed food and beverage items (n = 191), 74.3% (n = 142) were classified as high in saturated fat, salt or sugar (HFSS) with a low rate of fruit and vegetable' items. Some food items did not meet the criteria for the NP analysis and they were considered as unclassified items. All food premises were adequately equipped and some food premises did not achieve the general requirements for food hygiene that is internationally recognized, while the main cafeteria of the KAU's Female Section achieved the requirements of food hygiene. **Conclusion:** A novel aspect of the study is the objective assessment of the available and served food and drink items at KAU using the UK FSA NP system (UK FSA NP System: A Nutrient Profiling Model that was developed for the United Kingdom Food Standards Agency). It is anticipated that the findings of this research will serve as an impetus for providing appropriate nutrition services for female students at KAU.

Keywords: Physical Environment, Food Premises, Nutrient Profiling, Food Hygiene, HFSS Food

1. Introduction

Healthy eating or the consumption of a healthy diet plan consists of foods that are varied and at the same time provides energy and nutrients to cover all the body

requirements. This is in order to maintain good nutritional status. It is well established nowadays that healthy eating and physical activity are the key components in the promotion and maintenance of good health and disease prevention. The type of food we consume, the place where we access food, the structure of food, the type and number of meals per day and places where we shop food may affect our eating patterns [18, 20, 23]. Similarly, physical activities performed at work, universities or schools can affect food patterns. Work environment, study places for students, availability of shopping centres, leisure, and travel have an impact on food patterns [19]. World Health Organization (WHO) documented that physical inactivity is a worldwide problem that negatively affects the population's health. WHO's recommended goals and priority actions for countries to improve active living and National Saudi studies confirmed this recommendations (Al-Hazzaa, 2002).

In university (UNI), students become more independent and make their own decisions about food choice. They live a self-governing life after they pass their adolescence stage [15]. Studies have demonstrated that students' eating patterns are strongly influenced by both the physical and the social environment. They mostly eat food that are available and easily accessible at the food stores in their UNIs. The meals available at UNIs are mostly fast food meals that have superior energy and outsized portions of food than home-based meals. These food lead to affect the total energy intake and subsequently the weight status of individuals [20]. College students who age 19 to 25 years consume mostly fast food and the topmost causes described for its consumption were suitability and price [16]. Overweight and obesity were also found to be present in 25% of female students of those (74.5%) who were consuming fast food in a frequent of 1-2 times per week [1]. Meals are habitually skipped by college students, mainly breakfast [25]. Saudi male students at a vocational institution in Riyadh city, regularly skip dinner, lunch, and breakfast in a percentage of 28%, 20%, and 15% respectively, and 72.4% of them regularly eats between meals [9]. Fried food are consumed by almost half (46.8%) of Saudi college students at least three times a week [8].

Concerning physical environment, previous research found positive associations between closeness to food provisions and individuals' dietary patterns and weight grade [20]. Physical environment for high school Saudi female students, including places where they can access food and drinks, performing physical activities could cause students to promote unhealthy eating behaviours and lifestyle [5]. This behaviours could continue after the move from high schools to universities [12]. It also emphasize the crucial role and commitment of decision makers in caring about student consumers through given healthy environment in universities.

Educational institutes are vital settings for modelling healthier eating choices amongst students. It is particularly important to consider meals and snacks provided to UNI students and their nutritional standards in addition to factors affecting the quality of these meals such as the quality of the UNI catering, cost and type of nutrients provided by each caterer. It is also important to know if there is any supervision on these meals or snacks considered by the UNI administration [12].

Universities and colleges should commit to achieve high standards of food safety and quality. For food premises that are located in UNIs to provide high standards of food and drink items, they should equip their premises very well, employ a well-trained staff, operate clean hygienic premises and have strong policies to apply in this matter. Moreover, all University premises or under the control of the University, whether run by the University or by external Catering Providers should have their own polices to control services of these premises [11].

Despite growing correlational and measurement research about environments and physical activity, few resourceful (unpublished) studies have evaluated the KAU's Female Section's environment based on population physical activity levels and the nature of food and beverages available at the section. Moreover, using the FSA's Nutrient Profiling system for food analysis among Saudi universities was not reported. Therefore, understanding the actual physical environment for one of the leader universities in Saudi Arabia, which might have an impact on UNI students' nutrition, and health status was the aim of this study. In addition and as part of this study, the characteristics of food premises and their provided and served food and beverage items were examined using objective data.

2. Methods

2.1. Settings, Data Collection & Evaluation Tools

This cross-sectional survey used a screening and evaluating approaches, intended to screen the physical environment and analyse food and beverage items available and provided by (all available) 10 food premises (Pizza Now, Cristy's Bakery & Restaurant, Panino's, Joffreys, Al Anab Cafeteria, Rhapis Restaurant, Movenpick, Kwality Ice-cream, Mochachino & KNZ Restaurant) and the main cafeteria at the King Abdulaziz University (KAU's UNI) Female Section in Jeddah City, Saudi Arabia. The study tools were onsite

visits to the KAU's Female Section & Sports' Tent (Sports' Tent at KAU was opened by the King Khalid bin Abdul Aziz in 1980. The area is about 100 × 80 m and holds 2000 chairs and suggests many sports events, including several stadiums: Basketball, handball, volleyball, badminton, table tennis, Judo, Karate and free training. Available at: https://sports-tent.kau.edu.sa/Default.aspx?Site_ID = 806&Lng=AR) and an actual one-day sample menus or self-observed and recorded food and drink items for 3 whole academic days. All provided food and drink items were then analysed using the NP scoring system that was developed by the UK FSA for assessing processed foods in schools [17] following the NP recommended guidelines [14]. The model was used previously to assess meals and snack food options at Saudi schools [2].

The screening of hygiene and safety status of each food store was carried out by using simple general requirements that was adapted from Cambridge University Food Safety Policy [11] and modified for a screening purpose only in the present study. Screening included the availability of written and practiced policies for food production, handling, storage and transportation using a simple check list. This included the design of the food store, tidying away of garbage and recyclable stuff, ventilation, lighting and floors walls and ceilings.

The research team also screened all equipment used to serve food items. Screening included list of availability of some equipment such as freezers, fridges, toasters, microwaves, blinders, fryers, coffee machines, ventilators, burger machines and crepe machines as recommended by Southern Nevada Health District for equipment [22] and facilities general requirements (http://www.southernnevadahealthdistrict. org/food-establishments/food-establishment.php) and guidelines for [10], which was used with modification to the present study.

In addition, personal contacts with all principal providers in all canteens ad KAU supervisors for all contracts were the other sources of information about equipment, food hygiene and students' meals and snacks provided in the female section. Other information about physical environment such as Sports' Tent was obtained from the responsible female section's administrators. The study was carried out in the academic year 2013/2014.

2.1.1. Statistical analysis

All statistical analysis was conducted & calculated using Excel sheets.

2.1.2. Permission for Conducting the Research

The study protocol was approved by the Research Ethics Committee at the Faculty for Medical Applied Sciences, King Abdulaziz University in Jeddah City, Saudi Arabia. Permissions to administer this survey at the KAU's Female Section was granted by the Dean of the Women Section. Then, the permission of all food providers at the female section to collect data from their food premises, were taken personally by the main investigator before gathering data.

2.2. Research Objectives

The methods approach used to fulfil the principal aim and the objectives of this study as follows:

- To assess the physical environment at the KAU' Female Section based on accessible food and places for possible physical activities.

- To assess equipment and hygiene of the UNI's food stores and main cafeteria at the KAU' Female Section.

- To analyse the food options prepared and served by all caterers and the main cafeteria at the KAU' Female Section.

3. Results

3.1. Physical Environment at the KAU's Female Section

Concerning physical activities, and based on personal observation & personal contacts with the female section's administrator of the Sports' Tent, students at female section has an access to the KAU Sports' Tent. Students can participate in variety of sports such as football, volley ball, basketball, and tennis. The Sports' Tent is also prepared for sports events, and a number of competitions between colleges and different departments are carried out throughout the academic year. The Sports' Tent is fans fully air conditioned and has a big stadium for public. Morning times are assigned for female students to access the Sports' Tent and the afternoon time is allocated for the female academic staff. For all females, they need to get a membership to access the Sports' Tent. In order to be a member, they need to fill out a specific form that include a number of questions concerning their personal & family health history and the level of physical activity they perform and the type of sports they practice at home. Moreover, the female section is considered a very big area that has open spaces between buildings, which facilitates walking for long distances inside the campus.

3.1.1. Equipment & Hygiene of Food Stores at KAU's Female Section

Private caterers were operating, their own food premises, while the KAU main cafeteria was operated by Knight's Strong Company (ALFARES ALGAWI), which was well equipped according to the defined check list for equipment for the surveyed food premises in this study. The list of equipment included Freezers, Fridges, Toasters, Microwave, Blinders, Fryers, Coffee Machines, Burger Machines, Crepe Machines and a Ventilation System.

Table 1 presents the available equipment at the ten surveyed food premises excluding the main cafeteria. All premises are equipped with freezers & fridges except Al' Anab cafeteria that has no freezer. Toasters were available in 40% of the stores. Only Rhapis Restaurant had burger machine and Al' Anab cafeteria had crepe machines. Eight of the premises were equipped with microwaves and six of them had coffee machines and blinders. Fryers were available in three food premises. Ventilators systems were existed in 70% of the food premises.

Based on the study's general screening check lists for equipment and primary standards for food safety and hygiene of KAU's food premises, **Table 2** lists some observation to be considered for some of the surveyed food premises.

3.1.2. Meal and Snack Food Options Prepared and Served by the Caterers in the Female Section

Among the internationally known food premises and the Main Restaurant at the KAU's Female Section, 208 food and drink items were available for analysis. However, only 92% (n = 191) items were analysed because of the availability of nutrition information for these items. **Table 3** presents the results of analysis for all food and drink items. About 90.8% of the items were classified to either HFSS or Non-HFSS, while the rest of items were unclassified due to the unavailability of the item's nutrition information in the local market or the mother company. Of the analysed food and drink items (n = 191), 142 (74.3%) were HFSS, 36 (18.8%) items were non-HFSS and the rest of items (6.8%, n = 13) did not meet the criteria for the NP analysis. Therefore, they were considered as unclassified items.

4. Discussion

The overall objective of the study was to look at the physical environment & food business at KAU's Female Section in Saudi Arabia. In her review that aimed to present a theoretical structure that could guide researchers to understand factors that have an impact on eating behaviours in 2002, Mary Story has considered that the physical environment within the community 'particularly educational institutes' influences accessibility and availability of foods, and they are considered the most influential in affecting food choice of individuals. Moreover, the UNIs' students spend most of their time in UNIs, which might bound their food choices from the available brands in these UNIs. As a result, the physical environment is considered as an external context that has an effect on the students making decisions [20]. Saudi medical students (n = 194) at Taibah University in Madinah reported to consume high intakes of carbohydrates (72.1%) and lower intake of fats (19.4%) and proteins (8.4%) with low intake of fibres [7]. The observed KAU environment concluded that female students have an access to the Sport' Tent irrespective of their non-access to sports services when they were at high school [2]. KAU's female students also have wide areas to practice walking while travelling from one building to another to take lectures. In addition, food and

	Freezer	Fridge	Toaster	Microwave	Blinder	Fryer	Coffee Machine	Ventialation	Burger Machine	Crepe Machines
1. Pizza Now	Available	Available	Unavailable	Available	Available	Available	Available	Available	Unavailable	Unavailable
2. Al Anab Cafeteria	Unavailable	Available	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Available
3. Panino's	Available	Available	Available	Available	Unavailable	Available	Unavailable	Available	Unavailable	Unavailable
4. Joffreys	Available	Available	Unavailable	Available	Available	Unavailable	Available	Available	Unavailable	Unavailable
5. Movenpick	Available	Available	Unavailable	Unavailable	Available	Unavailable	Unavailable	Available	Unavailable	Unavailable
6. Kwality Ice-cream	Available	Available	Unavailable	Available	Available	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable
7. Rhapis Restaurant	Available	Available	Unavailable	Available	Unavailable	Available	Available	Available	Available	Unavailable
8. Cristy's Bakery & Restaurant	Available	Available	Available	Available	Available	Unavailable	Available	Available	Unavailable	Unavailable
9. Knz Restaurant	Available	Available	Available	Available	Unavailable	Unavailable	Available	Available	Unavailable	Unavailable
10. Mochachino food stores	Available	Available	Available	Available	Available	Available	Available	Available	Unavailable	Unavailable

Table 1: Availability of equipment in food premises.

Food Premises	Observations to be considered on Equipment and Food Safety & Hygiene for food premises
1. Pizza Now	The design and consruction of the premises was in-appropriate for the activities needed for the food business to be conducted as the used space was very strict. This is was clearly affecting the fittings for equipment used for those activities and could not permit effectia cleaning and sanitation. The floor was wet and inappropriately cleaned. There was only one small ventilator machine, which could be not allow effective removal of smokes, condensation and vapors from the food building.
2. Al Anab Cafeteria	No enough containers to keep the garbage of the food store, which could not allow for easy and effective cleaning. The place of preparing food was very small fa conducting activities of food preparation and services.
3. Panino's	No observations to be considered
4. Joffreys	According to international Standards, food premises are obligated to be equipped with a light sysem that provides necessary natural or artificial light for the activities to be conducted on he food premises. However, the lighting system in the store was insufficient fa necessary food services for students
5. Movenpick	No observations to be considered
6. Kwality Ice-cream	No observations to be considered
7. Rhapis Restaurant	The floor was wet and trnsuittly cleared, the ventilation system was insufficient to remove, smcke, steam and vapours effectively.
8. Cristy's Bakery & Restaurant	No observations to be considered
9. Knz Restaurant	No observations to be considered
10. Mochachino food stores	The lighting system was insufficient for the activities to be conducted
The Main Cafeteria	No observations to be considered.

Table 2: Show observed notes for each premises.

drink items available in the female medical Centre at KAU includes both healthy and unhealthy choices. Therefore, the environment of the Female Section at King Abdulaziz University could play an important role in students' food choice and lifestyle.

The food premises at universities should achieve the maximum standards of food safety and quality by including a highly trained staff, working in clean sanitized

Values per 100 g for foods and 100 ml for beverages			
	Food & drink items (n = 208)	HFSS% (n = 142)	Non- HFSS% (n = 36)
Pizza now	59	89.8%	10.2%
Al'Anab	7	71.4%	28.6%
Movenpick	11	90.9%	9.1%
Rhapis	17	88.2%	11.8%
KNZ Restaurant	17	82.4%	17.6%
Joffreys	17	70.6%	29.4%
Panino's	17	Unclassified	Unclassified
Cristy's Restaurant	15	80%	20%
Mochachino food stores	20	75%	25%
Kwality Ice-cream	11	90.9%	9.1%
Main Cafeteria	17	52.9%	47.1%

TABLE 3: The Percentage of HFSS and NON HFSS for all Surveyed Restaurants. Note: The total no. for the analyzed food & drink items (191 items), ** The total no. for HFSS food & drink items = 142 (74.3%) items, ** The total no. for Non-HFSS food & drink items = 36 (18.8%) items, ** The total no. for unclassified items = 13 (6.8%) items.

premises. They should also need to have clear policies related to catering providers "those are either self-operating their services or have their services run by the university [11]. Results of the present study showed clearly that all food premises at the KAU's Female Section are fairly well equipped with the basic equipment that is needed for food premises to serve a pre-prepared food or food that need preparation such as those served in the Main cafeteria. Hygiene status of the food provisions at the female section was evaluated and comparisons were made with international criteria for food hygiene status. However, comparison to national guidelines 'if available' is needed. Results showed that some basic guidelines that are needed to have a good hygiene status were not followed in some food premises. This include wet floors, inappropriate cleaning and insufficient ventilation system.

In order to evaluate the healthiness' of food/drink items at KAU food premises, the study analysis looked at different categorization of foods/drinks based on saturated fat, sugar and salt. This was done by using the developed nutrient profile model for the UK Food Standards Agency that powered the analysis and allowed for food/drink items

to be assessed objectively rather than relying on value results regarding the relative 'healthiness' of different foods within groups [21]. The model was also evidenced to classify foods in agreement with the views of health professionals, particularly nutrition practitioners [21]. The study involved the collection of original data focusing on the nature of meals and snacks served by food premises at the KAU's Female Section. Analysed data using the UK NP concluded that the served food and drink items were mainly (74%) high in saturated fat, sugar and salt (HFSS) with a low rate of fruit and vegetables. Similar results found previously when meals and snack options at Jeddah schools for girls (high & intermediate) were analysed in the academic year 2008-2009. The study revealed that 67.5% of the analysed food/drink items were HFSS [2]. The same school girls were exposed to food advertising "on the most watched TV channels" that was (70%) HFSS foods [4, 6].

This means that Saudi girls are exposed to HFSS food and drink items at school and university levels, without enough intake of fruit and vegetables.

5. Strength & Limitation of the Study

It is vital to highlight some **limitations** to this study as follows:

1. The study did not evaluate in depth the role and polices of KAU administration in supervising and controlling the food business and services provided by contractors. Therefore, further investigation is needed.

2. The study used a quick and general screening check lists that were primarily adapted from other sources to evaluate equipment and food safety and hygiene of KAU's food premises. However, further studies is needed to evaluate in depth the compliance of KAU's food premises with a defined national and international standards and policies. They also need to evaluate how well the staff are trained to handle and serve food and operate a clean hygienic premises. In spite of its limitations, the study has highlighted the need to periodically assess university's meals and snacks options and to encourage all caterers to provide healthier food items that are served in a clean hygiene environment that is in accordance with national and international standards

5.1. Strength

"To our knowledge", there is no published research examining the characteristics of food and beverage items at KAU's Female Section. As part of this study, we were interested to examine and determine the characteristics of food and beverage items provided and served at KAU's Female Section, using the FSA Nutrient Profiling system and on an objective data from actual sample menus for meals and snacks, or from a list of an observed and recorded food and beverage items from all food suppliers at the section.

6. Conclusion, Recommendations & Implications

- This cross-sectional survey is the first to determine the nature, characteristics and the content of food and beverages items provided and served at Female Section at KAU.
- There are big facilities for physical activities to be performed such as the Sports' Tent and the wide areas to walk while travelling from one building to another.
- Results confirmed that there is a considerable amount of food and beverages that are HFSS at the KAU's Female Section.
- Food premises at the section are satisfactorily equipped. Fifty percent of the international premises did not achieve the general requirements of food hygiene that is internationally recognized while the Centre Restaurant of KAU's Female Section achieved the requirements of food hygiene.
- In order to improve KAU's Female Section's levels of physical activity, a further national research work on improving the evidence-base interventions on physical activity of female university students is vital. Establishing national expenses to promote projects and policies for the development of conditions for the physical activities in university life is also needed.
- Polices "if not available" to control services of food premises are needed to be applied. Moreover, all university premises or under the control of the university, whether run by the university or by external catering providers should have their own polices to control services of these premises.
- A periodic evaluation and supervision on all foods available at the female section should be conducted continuously for these premises using a standard methods of evaluation such as nutrient profiles.

7. Some Terms and Definitions Used in the Study

7.1. The Environment

Environments such as physical and social are playing main parts in the health and nutrition of persons and societies. The air, water, and soil are the main components of **physical environment** through, which exposure to chemical, biological, and physical agents may occur.

7.2. Beverages

Is a liquid substance which is specifically prepared for human consumption (drinking).

7.3. Nutrient Profiling Used in this Study

Nutrient profiling (NP) developed by the UK Food Standards Agency (FSA) was suggested to be imposed in secondary schools in 2009 (Simpson et al., 2006). The nutrient profiling model was developed by FSA in 2003 for use in relation to the promotion of foods to children. Moreover, the model was used in relation to provision of foods through vending machines and for school lunches (Rayner et al., 2004).

8. Acknowledgment

Thanks must go for the research team members of Clinical Dietitians: **"Asmaa Abdullah", "Asmaa Shathli" and "Nsreen Banakhar"** for their great participation in collecting data, enter data in excel sheets and help in assessing the food/beverage items using the NP model. Special thanks to the Dean for the Women Section **"Dr. Hana Abdullah Al-Nuaim"** who granted the permission to the research team to administer this survey at the female side. Indebted thanks to the administrator "**Sameera Batarfi"** for her help and support in facilitating contacts and visits to all food premises. Special Thanks for "**Mr. Ahmed Yasir Hussain"** for his time in proof reading this work. Finally we are pleased for all food providers at the female section for their collaboration and help in collecting data from their food premises.

9. Competing Interests

The authors have declared that no competing interests exist.

References

[1] Alfawaz H. The relationship between fast food consumption and BMI among university female students. Pak J Nutr, 2012; 11, pp.406-10.

[2] Aljaaly E (a). Physical Activities of Young Girls in Jeddah, Saudi Arabia. Arab Journal of Nutrition and Exercise 2016 -ISSN: 2518-6590, 1(3), 174-186.

[3] Aljaaly EA, Khalifa NA & Badreldin AM. Assessing girls' school meals and snack food options in Saudi Arabia using the UK food standards agency nutrient-profiling model'. International Journal of Food, Nutrition and Public Health 2016; 8(1).

[4] Aljaaly, E (b). The impact of media and advertising of food on the eating behaviour of adolescent girls in Jeddah, Saudi Arabia/Impact des médias et de la publicité pour les produits alimentaires sur les comportements alimentaires des adolescentes à Djeddah (Arabie saoudite). Eastern Mediterranean Health Journal 2016; 22(9), 662. http://applications.emro.who.int/emhj/v22/09/EMHJ_2016_22_09_662_667.pdf

[5] Aljaaly E. Eating patterns and nutritional behaviours of Saudi young girls: influences and contributing factors'. International Journal of Food, Nutrition and Public Health 2015; 7(2).

[6] Aljaaly E. Advertising watched by adolescent girls in Saudi Arabia', International Journal of Food, Nutrition and Public Health (IJFNPH) 2012; Vol. 5, No. 4, pp.249-263.

[7] Allam AR, Taha IM, Al-Nozha OM & Sultan IE. Nutritional and health status of medical students at a university in Northwestern Saudi Arabia. Saudi Med J 2012; 33(12), 1296-303.

[8] Al-Rethaiaa AS, Fahmy AEA & Al-Shwaiyat N. Obesity and eating habits among college students in Saudi Arabia: a cross sectional study. Nutrition journal 2010; 9(1), 39.

[9] Al-Sudairy A and Howard K. Dietary habits of technical and vocational students in Riyadh, Saudi Arabia-I Meal skipping. Journal of the Royal Society of Health 1992; 112 (5): pp.217-218

[10] Australia New Zealand Food Authority. Safe food Australia: a guide to the food safety standards/ Australia New Zealand Food Authority Canberra. Standard 3.2.3 "Food Premises and Equipment 2001. http://www.foodstandards.gov.au/_srcfiles/complete_safefood.pdf

[11] Cambridge University. University Food Safety Policy, Food Safety Series 2012. Available: at: http://www.unicen.cam.ac.uk/files/university_food_safety_policy_sep12.pdf.

[12] Deliens T, Clarys P, De Bourdeaudhuij I. and Deforche B. Determinants of eating behaviour in university students: a qualitative study using focus group discussions. BMC public health 2014; 14(1): p.53. http://doi.org/10.1186/1471-2458-14-53.

[13] Department of Health, The nutrient profiling model. 14 January 2011. Available at: https://www.gov.uk/government/publications/the-nutrient-profiling-model

[14] Department of Health. The public health responsibility deal.UK (2011) Available at: "http://www.dh.gov.uk/prod_consum_dh/groups/dh_digitalassets/documents/digitalasset/dh_125237.pdf.

[15] Deshpande S., Basil MD and Basil DZ. Factors influencing healthy eating habits among college students: An application of the health belief model. Health marketing quarterly 2009; 26(2): pp.145-164.

[16] Driskell JA, Kim YN and Goebel KJ. Few differences found in the typical eating and physical activity habits of lower-level and upper-level university students. Journal of the American Dietetic Association 2005; 105(5): pp.798-801.

[17] FSA. Review of the Agency Nutrient Profiling Model: Executive Summary, 25 March 2009, Food Standard Agency, UK, Available at: http://collections.europarchive.org/tna/20100927130941/http://food.gov. uk/

[18] Livingstone S and Helsper E. Advertising foods to children: Understanding promotion in the context of children's daily lives. A review of the literature prepared for the Research Department of the Office of Communications (OFCOM), 2004.

[19] Morton KL, Atkin AJ, Corder K, Suhrcke M and Sluijs EMF. The school environment and adolescent physical activity and sedentary behaviour: a mixed□studies systematic review. Obesity reviews 2016; 17(2): pp.142-158. http://doi.org/10.1111/obr.12352

[20] Popkin BM, Duffey K and Gordon-Larsen P. Environmental influences on food choice, physical activity and energy balance. Physiology & behavior 2005; 86(5): pp.603-613.

[21] Scarborough P, Boxer A, Rayner M and Stockley L. Testing nutrient profile models using data from a survey of nutrition professionals. Public health nutrition 2007; 10(4): pp.337-345.

[22] Southern Nevada Health District (SNHD) for equipment and facilities (2017). Equipment and Facilities General Requirements available at: http://www.southernnevadahealthdistrict.org/download/eh/plan_review/food-establishment.pdf

[23] Story M, Kaphingst KM, Robinson-O'Brien R and Glanz K. Creating healthy food and eating environments: policy and environmental approaches. Annu. Rev. Public Health 2008; 29: pp.253-272.

[24] Story M, Neumark-Sztainer D and French S. Individual and environmental influences on adolescent eating behaviors. Journal of the American Dietetic Association 2002; 102(3): pp.S40-S51.

[25] Trockel MT, Barnes MD and Egget DL. Health-related variables and academic performance among first-year college students: implications for sleep and other behaviors. Journal of American college health 2000; 49(3): pp.125-131.

Leaving School and Its Outcomes on Health-related Fitness Among Drop-out Algerian High School Students

Mohammed Zerf

University Abdel Hamid Ibn Badis Mostaganem, BP 207 & 118, Mostaganem 27000, Algeria

Corresponding Author: Mohammed Zerf; email: mohamd.zerf@univ-mosta.dz

Abstract

Purpose. Schools are ideal venues for the implementation of healthy behaviors allied to the levels of physical activities as the physical and mental health correlate to psychosocial well-being of scholars. Whereas, this advantage is not reliable with dropout students. Support through psychological studies via time structure unconnected to self-efficacy relative to self-physical activity motivation among this social class, especially with the economic crisis as challenges imposed for Algerian society, concerning the high unemployment rates in line with high school dropouts. **Method**. This controlled study tested 104 high-school Male adolescent students aged around 17 years for academic years 2015–2016 and those under 18 years for academic years 2016–2017. Built on the ALPHA-Fitness test battery accompanied by questionnaire relevant to their physical and social time for both years. **Results.** Based on the design, the tests practised and the statistical processes applied within the search limitation, the results support, on one hand, the benefits of school venue as an ideal implementation of health and levels of physical activities and well-being among our scholars, and on the other, we confirmed the leaving school as a negative time trend via dropout students, poorly correlate with times physically and socially inactive. This study inspected that inactive lifestyle relate to body image disorders and disturbances concomitant to energy-expending relative to missing recreational time and sporting endeavours. **Conclusions.** Leaving school in the Algerian communities is a stress-related biological pathway that links physical disorders and depression virtual to social time structure proceeded to manage the relevant tasks, goals and objectives. Indicated in similar as best when individuals are clear about what it is they are expected to achieve.

Keywords: lifestyle, health and the fitness, excluded students, adolescents

1. Introduction

It is time for Algerian society to recognize the dropout problem as a systemic problem that can be addressed effectively only by a systemic approach to prevent [1] the drop-out students, who are the future citizen of Algeria. However, the professional experience of developed countries, such as after-school tutoring, cannot take the place of preventive systemic approaches [2]. Criticize thought time and the insufficient financial resources to significantly make an impact on the problem intervention[3]. Reported in similar studies as programs, which do not provide psychological counselling to dropout students, sited in similar studies at high risk of many social problems issues [4]. The case of this controlled study is based on the effects of school dropout problem and its relation to students' lifestyle, sports activities' motivation, before and after leaving their school. Established in similar to serious costs influencing people's comportment, the standard live and interactions with family and friends [5]. Owing to that, life satisfaction related to time spent more likely to be involved in antisocial behaviour [6]. Locate in the case of our young as the conflict between the desire to be grown-up and the stress underlies daily lifestyle [7]. Admit in their time spent dedicated to social networking. Reported as a negative side-effect thought, their virtual life becomes more important than the objectives of their families [8]. Proof, which lets us think that changes in the environment of students after their leaving school can have a significant impact on their opportunities to participate in pro-social activities, conditions that can affect the physical outcomes of their health [9]. Well-known in similar as an inactive lifestyle for teenagers [10], adolescents and young [11]. Its negative effects are claimed to mental health [12], as well as social capital [13]. Comprising the stress-related biological pathway that links physical disorders and depression [14] relative to anxious behavior, due to poverty, parental mental illness, and domestic violence, which may make teenagers more likely to engage in antisocial behavior [15] as a result of depressive behavior associated with time of inactivity spent correlate to higher body mass index (BMI) factor of obesity-related health diseases[16]. Identified in African studies as a highlight poorly aspect contribute to a decrease in participation in energy-expending recreational and sporting endeavours[17]. Recommended by the Algerian studies via the inculcation of good values, as an advantage of the adolescents' free time by doing useful activities to reduce the psychological and social pressures. Reported as absent procedures integrate into the Algerian status communities [18] to enhance their quality lifestyle. Counselled by specialists in this topic built on fitness analysis to assess the level of suitability body composition, negatively concomitant

with body fatness [19], socioeconomic status and lifestyle [20]. Aimed in this study via the excluded students oriented to the adult lifestyle, that we think that they are not yet prepared, because of economic crisis challenges imposed to Algerian society are related to high rates of male unemployment proportional to high-school dropouts [21]. As negative factors influencing self-efficacy correlate to the time of physical activity [22].

2. Methods

Our study bases its investigation on the effect of school dropout problem and its relationship with behavioral life-goals changes, inspected via this social class through their physical and social times. Considered in similar to be one of the critical challenges that today's schools are facing. Cautioned by the Center for Educational Statistics, at high risk among high-school dropout rate, set at 25 percent, qualified to increase rapidly to 50–75 percent in the few further years [23]. Admitted by our scientists as a complex situation, especially with the economic crisis as a challenge imposed on the Algerian society regarding the high unemployment rates among the high-school dropouts associated with the lack of devices made by our government regarding this concept [24]. Contrary to this, the Mexican government has implemented a program to create part-time jobs for young people to encourage them to continue their education [25]. Indicated by Earl Smith as a beneficial way to structure teenagers' time toward sports programs, or other pro-social activities[26], fixed as valuable opportunities behavior, with positive outcomes for any population or community, according to Richard Giulianotti [27].

3. Study Population and Design

The research samples were elected by intentional manner including 104 high-school students from the Mostaganem Academy, aged around 17 years for the academic years 2015–2016 and those under 18 years for the academic years 2016–2017, male, healthy with good habits, without medication on a regular basis, and familiar with the procedure taken in this study. It was based on a questionnaire relevant to the physical and social time of the students, accompanied by the ALPHA-Fitness Test Battery (Teenagers) [28] for both years. Divided into two groups, 62 of them continued their study (SCHS), since the others were excluded (SEHS). All provided their written agreements to participate in the present study.

3.1. For the questionnaire

A: Daily physical time:

Select the number that best describes your overall level of physical activity for the previous months:

1 points	Avoids physical activities
2 points	Only 120 minutes PE lesson
3 points	PE lesson + 1–3 hours regular physical exercise per week

3.1.1. B: Daily social activities' time:

Select the number that best describes your overall level of social activity for the previous months:

1 points	I share my free time between social networks and video games
2 points	I share my free time between shopping and social networks
3 points	I devote my free time to my sports leisure and social networks

3.2. For health-related physical fitness

The authors based their research on the ALPHA-Fitness Test Battery adopted by the European Union to evaluate the health-related fitness status in youngsters and teenagers. Acquainted by similar [29], as the ideal battery tests confirmed by some author in its evidence to access the impact of body fat allied with the health related to fitness according to the following tests [30]:

For the puberty test, all the participants provided their certificates signed by their doctors. Body weight was measured in the standing upright position with electronic scales with a precision of 100 gm. Body height was determined by standing height to the nearest 0.5 cm. Body mass index (BMI) was calculated as the ratio of body weight to the square of height (kg/m2) [31]. Flexed Arm Hang test was calculated from the total time recorded as stay level with the bar. While to calculate the levels of this test,

we use 1 point for 40 sec. Standing broad jump, we record the longest distance jumped, the best of three attempts. The participant's score for the 20-m shuttles run is the level and number of shuttles (20 m) reached. In the 4 x 10 m shuttle runs, we record the time to complete the test in seconds to the nearest one decimal place. As well as collecting the activities of their daily lives at the base of their confirmations.

4. Statistical Analysis

Data entry and analysis was done using SPSS 21 (SPSS for Windows, SPSS Inc., and Chicago, IL, USA). Built on the computation of the means, standard deviations, the dependent *t*-test and correlation paired samples, as a statistical treatment serving the purpose of the study, the significance level was set at $P \leq 0.05$.

5. Results

Depending on the data entered, the aims of the study and the statistical processes applied within the search limitation regarding the effect of school dropout problem and its relationship with behavioral goals changes connected to inactive physical and social times, our results improve the benefits of school settings relative to PE activities for both groups (SCHS) and (ECHS), see **Tables 1 and 3**. Estimated as a vital impact among before leaving high school in comparison to the results of the same sample after leaving the school. Confirmed by the control group of the students who continued their studies. Admitting in the case of our community via the online social networking as a privileged means to spend their free time was reported as a negative side effect as the virtual life becomes more important than the objectives of families [8]. Antisocial behavior was recorded in the present study as a side effect [15], as a result of the inactive lifestyle among the dropoutstudents associated with their higher body mass index (BMI) as risks of obesity-related health diseases [16]. Disclosed by Nina v d B et al. [32] as negatively correlated with subjective well-being and positively correlated with depressive symptoms. Confirmed in present study based on the validity of tests used in this study derived from alpha health-related fitness test recommended by the European Union as a reliable tool in the school environment. As well as the general population [33]. Certified by the significance of the dependent *t*-test, **Table 1** and correlation list in **Table 2** among the dropout students. Confirmed by the control group the case of students who continued their studies **Table 3** and correlation list in **Table 4.** In the benefit of school's venue as an ideal setting for the implementation of healthy

behaviours allied to levels of physical activities and physical mental health correlate to psychosocial well-being of scholars associated with less body fat relative to increase of physical performance. Advocated by BMI as an energy indicator allowing the comparison of athletic performance in numerous health and fitness tests [34]. Where the most appropriate profiles are related to less BMI as favourable conditions to realize optimal performance [20]. Support by African studies as messing sports police control of energy-expending allied to recreational and sporting endeavors [17]. Noted in this study as consequent health outcomes allied to lifestyle and strategies to promote weight loss or weight maintenance for overall health and behavioral modifications [35], disorders or depression. Recommended by the WHO (2016b) in measurements of BMI and central adiposity together in order to determine an individual's relative risk of obesity-related ill health [36]. The case of this study that confesses the benefits of school time structure activities in the increases of health-related fitness. Showing in previous among the benefits of PA via its influence on the levels of physical activity as well as their positive impact on health quality of life in adolescence or adulthood [37].

Advance by sports scientists in the control of body fat as one of the major factors increased levels of body dissatisfaction and disordered. Showed in similar trough lower-body power [38], which is inversely correlated with strength score, handgrip, standing broad jump, and an indicator of muscle endurance in adolescents. The case of this study record via the relation time spent on social or physical activities strongly correlate with the levels of fitness record among both the groups in **Tables 2 and 4**. Confirmed by similar in the effect of body fat associated with the health and performance of adolescents [30]. Support by the present as missing health measures practice [39] via Algerian community, after leaving their school.

Built on aims of this study regarding the impact of exit school and its outcomes on health-related fitness. Sustained by sociological studies among time spent related to behavioral goals and behavior change concomitate to inactive physical and social times shows in medical studies as a stress-related biological pathway that links physical disorders and depression [14]. Confirmed in the case of this study by increased levels of body dissatisfaction and disordered among our dropout sample [40]. Subjecting in one hand that school dropout is a factor contributing to low fitness and health relative to mental health and life satisfaction [41]. Where in other the time spent in school enhanced the benefits of PE curricular as a healthy lifestyle for our scholars. Established in this study based on the impact of body fat on student performance record after one year of their exclusions from the schools. Reported by similar as a strong inverse

		N	Mean	S. D	T	$P \leq 0.05$
Age	**Before**	**62**	**17.55**	**0.45**	**0.56**	**0.18**
	After		17.75	0.35		
Body mass index (BMI)	Before		21.26	0.76	−9.84	0.00
	After		25.19	3.36		
Flexed Arm Hang (FAH)	Before		5.85	3.49	13.52	0.00
	After		3.88	4.45		
Standing broad jump (SBJ)	Before		2.44	1.28	17.91	0.00
	After		1.84	1.37		
20-m shuttle run (SR20m)	Before		7.44	0.73	7.86	0.00
	After		5.77	0.46		
4 x10 m shuttle run (SR4x10m)	Before		9.33	0.44	−6.82	0.00
	After		10.66	0.45		
Physical times Relative daily physical activities time	Before		2.42	1.54	−13.73	0.00
	After		0.76	0.46		
Socially active time Relative daily social activities time	Before		7.43	2.51	−11.55	0.00
	After		2.44	1.52		

Table 1: Present the characteristics and differences observed in the dropout sample (pre-test and post-test).

Paired Samples Statistics	BMI	FAH	SBJ	SR20m	SR4x10m
Physical Times	−0.89**	−0.86**	−0.72**	−0.87**	0.86**
Socially active	−0.98**	−0.92**	−0.98**	−0.94**	0.88**
**. Correlation is significant at $P \leq 0.01$ level (2-tailed).					
N	62				

Table 2: Present Pearson Correlation between time spent and ALPHA health-related fitness test battery among dropout group.

correlation between BMI and the tests under study, established in a similar study as a valid test to evaluate health related to fitness in school environments [42]. Advanced in their possibility to estimate the impact of adiposity amounts on body health fitness via adolescents. Agreed in preventives thought adolescents with fatness have lower levels of fitness than their peer [43]. Declared in well-being studies through biological factors leading to antisocial behavior and abnormal emotional development as health-risk and aggressive behaviors [44]. Accounted by educational studies through the positive relationship between dropping out of school and delinquency at higher risk for behavioral problems suggested as problems correlate to physical changes and body hormone growth among pubertal stage [45]. Record in the present study midst upper body

		N	Mean	S. D	T	$P \leq 0.05$
Age	Before	62	17.68	0.32	0.45	0.12
	After		17.88	0.22		
Body mass index (BMI)	Before		22.26	0.76	−3.84	0.00
	After		21.19	0.36		
Flexed Arm Hang (FAH)	Before		5.57	3.49	−3.52	0.00
	After		6.88	4.45		
Standing broad jump (SBJ)	Before		2.49	1.28	−2.96	0.00
	After		2.91	1.37		
20-m shuttle run (SR20m)	Before		7.59	0.73	−2.86	0.00
	After		5.77	0.46		
4 x10 m shuttle run (SR4x10m)	Before		9.44	0.42	−3.82	0.00
	After		8.66	0.46		
Physical time Relative daily physical activities time	Before		2.42	1.54	−0.73	0.12
	After		2.76	0.46		
Socially active Relative daily social activities time	Before		7.43	2.44	−0.55	0.22
	After		7.54	2.52		

Table 3: Present the characteristics and differences observed in the scholar's sample (pre-test and post-test).

Paired Samples Statistics	BMI	FAH	SBJ	SR20m	SR4x10m
Physical Time	0.85**	0.84**	0.76**	0.88**	−0.85**
Socially active	0.96**	0.94**	0.95**	0.96**	−0.89**
**. Correlation is significant at $P \leq 0.01$ level (2-tailed).					
N	62				

Table 4: Present Pearson Correlation between time spent and ALPHA health-related fitness test battery among scholars.

mass index (BMI) affecting muscle strength, endurance and cardiorespiratory functions among those teenagers. Acknowledge advance by preventing studies for this category to invest her spare time in more sports activities related to more daily physical and health activities [46]. Agreement by similar to participation in outdoor sports activities [47]. Vindicated in the present study as benefits, healthy fitness practice permitting to teenage who left school to maintain an overall athletic body composition. As the desire to maintain healthy weight correlates to upper physical performance. Advance by similar via the overweight as a serious health concern in the development of the

adolescence's musculoskeletal system relative to muscle strength and body composition [48]. Indicated in psychological studies as the makeup of a particular person with regard to his/her behavioral goals and change cognitions to his/her inactive physical and social times. Sited in the present study as a consequence to body gain relative to health and fitness. Reported in a similar study as a model of an inactive lifestyle and their costs [37]. The case of our leavers recommended considering a sport and physical activity as a part of their daily lifestyle. Evidence agreed by sports scientists in a higher level of physical activity and less time spent to increase health-related quality of life among leavers. Implores in the literature as part-time work programs for these adolescents or daily routine physical activities that promote better physical and mental health and psychosocial well-being than inactive ones who make people depressed. Reminded by LeBlanc AG et al. [49]that the governmental, nongovernmental and the stakeholder organizations should collaborate in creating sustained, long-term, and well-resourced communication plans to reach the general population in order to raise awareness of the PA and SB guidelines as implementation programs to facilitate their uptake [49]. The case of this study, which recommended this practice thought lever schools. Supported by Scott K, et al [50]in the classic model of intervention for behaviour change based on behavioural conditioning, satisfaction, and motivation that emphasizes causal relationships between antecedents, consequences, and behaviours. Expected as regret decision-making measure approach to public policy that helps individuals prone to making irrational decisions achieve their goals [50].

6. Conclusions

Our findings enhance the benefits of time spent in school, improved by PE lessons as a healthy lifestyle benefit balance, exploited to optimize teens' free time. Support in the present study by the strong inverse correlation between the structure of the physical or social time with the fitness tests employed in this study, more negatively correlated with the inactive lifestyle chosen by our teens exclude affirmed by the results of the control group, which continued their studies. Sustained in ecological, prevention and medical studies as a stress-related biological pathway that links physical disorders and depression. The case of this study, which asks our teachers to integrate the outdoor education that can have an impact on health and well-being, the case of outdoor sport as a benefits habitual physical activity for the well-being that can make a significant contribution to good health and reduce the amount of time spent watching television or connecting to the Internet. As well as psychological health.

References

[1] Dominic J. Brewer, Patrick J. McEwan. (2010). Economics of Education. Burlington: Elsevier Science.

[2] Charles D. Spielberger. (2004). Encyclopedia of Applied Psychology. Oxford, Boston: Elsevier Academic Press.

[3] Sara J. de Silva, Pierella Paci, Josefina Posadas. (2014). Lessons Learned and Not Yet Learned From a Multicountry Initiative on Women's Economic Empowerment. Washington, DC: World Bank.

[4] Hugh M. Bochel, Martin A. Powell. (2016). The Coalition Government and Social Policy: Restructuring the Welfare State. Bristol: Policy Press.

[5] Yvette M Ozer. (2012). A Student Guide to Hhealth: Understanding the Facts, Trends, and Challenges. Santa Barbara, Calif: Greenwood.

[6] Larry J. Siegel. (2016). Criminology: Theories, Patterns and Typologies. USA: Cengage Learning, Ed.

[7] William Zartman. (2015). Arab Spring: Negotiating in the Shadow of the Intifada. Athens: University of Georgia Press.

[8] Mahmoud M. Elkhouly. (2017). Arab community under social networking sites effect. Australian Journal of Basic and Applied Sciences, 11(1), 1–6. Retrieved from http://www.ajbasweb.com/old/ajbas_January_2017.html.

[9] Sven E. Jørgensen, Liu Xu, Robert Costanza. (2010). Handbook of Ecological Indicators for Assessment of Ecosystem Health. USA: CRC Press.

[10] Symeon Dagkas, Lisette Burrows. (2016). Families, Young People, Physical Activity and Health. London: Routledge.

[11] Lebedinskiy V. Y., Koipysheva E. A., Rybina L. D., Kudryavtsev M. D., Iermakov S. S., Osipov A.Yu., et al. (2017). Age dynamic of physical condition changes in pre-school age girls, schoolgirls and students, living in conditions of Eastern Siberia. Journal Physical Education of Students, 21(6), 280–286. doi:dx.doi.org/10.15561/20755279.2017.0604

[12] Ken Green, Andy Smith. (2016). Routledge Handbook of Youth Sport. London: Routledge Handbook of Youth Sport.

[13] John Hattie and Eric M. Anderman. (2013). International Guide to Student Achievement. London: Routledge.

[14] Olivia I. (2015). Prevention of Late-life Depression: Current Clinical Challenges and Priorities. Cham: Humana Press.

[15] Larry J. Siegel, Brandon C. Welsh. (2014). Juvenile Delinquency: The Core. Belmont, CA: Wadsworth.

[16] Valerie Maholmes, Rosalind B. King. (2012). The Oxford Handbook of Poverty and Child Development. New York, NY: Oxford University Press.

[17] Samantha A. Kahts, Rosa D. Randt, Danie J.L. Venter. (2017). Fundamental movement skill proficiency of South African girls from a lower socio-economic community. South African Journal for Research in Sport, Physical Education and Recreation, 39(3), 41–56. Retrieved from https://www.ajol.info/index.php/sajrs/article/view/164353

[18] Mohammed Zerf. (2016). Impact of theoretical courses on physical health performance. BLDE University Journal of Health Sciences, 1(1), 44–48. Retrieved from http://www.bldeujournalhs.in/text.asp?2016/1/1/44/183285

[19] Du Wenjiang. (2012). Informatics and Management Science III. London: Springer.

[20] Zerf Mohammed, Mokkedes M. Idris, Hamek Bagdad, Houar Abelatif, Bengoua Ali. (2016). Impact of body composition on optimal competitive body and its consequences on athletic performance in healthy young. International Journal of Women's Health and Wellness, 2(4. doi:10.23937/2474-1353/1510041

[21] Sadiqi Fatima and Ennaji Moha. (2011). Women in the Middle East and North Africa: Agents of Change. USA: Routledge.

[22] Siobhan M. White, Thomas R. Wójcicki and E McAuley. (2012). Social cognitive influences on physical activity behavior in middle-aged and older adults. The Journal of Gerontology, Series B Psychological Sciences and Social Sciences, 67B(1), 18–26. doi:10.1093/geronb/gbr064

[23] Cynthia Franklin, Mary B. Harris, Paula Allen-Meares. (2012). The School Services Sourcebook: A Guide For School-based Professionals. Oxford, NY: Oxford University Press.

[24] Georges Azzi. (2018). Higher Education Governance in the Arab World: Exploring the Challenges of the Education Sector and Social Realities. Cham, Switzerland: Palgrave Macmillan.

[25] Cynthia Tompkins and Kristen Stemberg. (2004). Teen Life in Latin America and the Caribbean. Westport, CT: Greenwood.

[26] Earl Smith. (2010). Sociology of Sport and Social Theory. Champaign, IL: Human Kinetics.

[27] Richard Giulianotti. (2015). Routledge Handbook of the Sociology of Sport. London: Routledge.

[28] Jonatan R. Ruiz, José Castro-Piñero, Vanesa España-Romero, Enrique G. Artero, Francisco B. Ortega, Magdalena M. Cuenca, David Jimenez-Pavón, et al. (2011). Field-based fitness assessment in young people: The ALPHA health-related fitness. British Journal of Sports Medicine, 45(6), 518–524. doi:10.1136/bjsm.2010.075341

[29] Dragan Cvejić, Tamara Pejović and Sergej Ostojić. (2013). Assessment of physical fitness in children and adolescents. Physical Education and Sport, 11(2), 135–145.

[30] Jonatan R Ruiz, Vanesa España-Romero, José Castro-Piñero and Manuel J. C. (2017). ALPHA-fitness test battery: Health-related field-based fitness tests assessment in children and adolescents. Nutricion Hospitalaria, 1210–1214. doi:10.3305/nh.2011.26.6.5270

[31] Mohhamed Zerf, Noureddine Atouti, Farouk Abdullah Ben. (2017). Abdominal obesity and their association with total body: Fat distribution and composition. Case of Algerian teenager male high school students. Physical Education of Students, 21(3), 146–151. doi:10.15561/20755279.2017.0308

[32] Nina v den Broek, Jorien Treur, Junilla Larsen, Maaike Verhagen, Karin Verweji and Jacqueline Vink. (2017). Causal associations between body mass index and mental health: A mendelian randomization study. bioRxiv, 168690. doi:https://doi.org/10.1101/168690

[33] Robinson Ramírez-Vélez, Diogo Rodrigues-Bezerra, Jorge Enrique Correa-Bautissta, Mikel Izquierdo and Felipe Lobelo. (2015). Reliability of health-related physical fitness tests among colombian children and adolescents: The FUPRECOL study. PLoS ONE, 10(10), e0140875. doi:doi.org/10.1371/journal.pone.0140875

[34] Suxing S, Jing Li, Qi Guo, Wen Z, Xiuyang W, et al. (2015). Body Mass Index Is Associated with Physical Performance in Suburb-Dwelling Older Chinese: A Cross-Sectional Study. PLOS One, 10(3), e0119914. doi:doi.org/10.1371/journal.pone.0119914

[35] Roya Kelishadi, Riaz Gheiratmand, Gelayol Ardalan, Khosrow Adeli, Mohammad Mehdi Gouya, CASPIAN Study Group, et al. (2007). Association of anthropometric indices with cardiovascular disease risk factors among children and adolescents: CASPIAN study. International Journal of Cardiology, 117(3), 340–348. doi:pmid:1686

[36] Tim Bradshaw and Hilary Mairs. (2017). Health Promotion and Wellbeing in People with Mental Health Problems. USA: SAGE Publishing.

[37] Mahdi Talebpour, Masoud Aghaei, Amin Azimkhani, Sadegh Abbasian and Ali Ashkani. (2014). A relationship between physical activity and healthy quality of life in students. Turkish Journal of Sport and Exercise, 16(2), 15–21. doi:10.15314/TJSE.201428100

[38] F. B. Ortega, J. R. Ruiz, M. J. Castillo, M. Sjostrom. (2008). Physical fitness in childhood and adolescence: A powerful marker of health. International Journal of Obesity, 32(1), 1–11.

[39] Zerf Mohammed, Mokkedes M. Idris, Hamek Bagdad, Houar Abelatif and Bengoua Ali. (2016). Impact of body composition on optimal competitive body and its

consequences on athletic performance in healthy young. International Journal of Women's Health and Wellness, 2(6), 2016. doi:10.23937/2474-1353/1510041

[40] Jon E. Grant and Marc N Potenza. (2010). Young Adult Mental Health. Oxford, NY: Oxford University Press.

[41] C. M. Tejero-Gonzalez, D. Martinez-Gomez, J. Bayon-Serna, R. Izquierdo-Gomez, J. Castro-Piñero and O. L. Veiga. (2013). Reliability of the ALPHA health-related fitness test battery in adolescents with down syndrome. The Journal of Strength and Conditioning Research, 27(11), 3221–3224. doi:10.1519/JSC.0b013e31828bed4e

[42] Manuel J C G. (2014). The ALPHA Health-Related Fitness Test Battery for Children and Adolescents "Test Manual". EU: School of Medicine, University of Granada. Retrieved from www.thealphaproject.EU

[43] Rocío I.-Gomez, David M.-Gómez, Carlos M. T.-Gonzalez, Verónica C.-Sánchez, Jonathan R. Ruiz, Óscar L. Veiga. (2013). Are poor physical fitness and obesity two features of the adolescent with down syndrome? Nutricion Hospitalaria, 28(4), 1348–1351. doi:10.3305/nh.2013.28.4.6566

[44] Abella JL. (2016). Extent of the Factors Influencing the Delinquent Acts among Children in Conflict with the Law. J Child Adolesc Behav, 4, 288. doi:10.4172/2375-4494.1000288

[45] Charles D. S. (2004). Encyclopedia of applied psychology. Oxford , Boston: Elsevier Academic Press.

[46] Cynthia F, Mary B H, Paula A-M. (2012). The school services sourcebook : a guide for school-based professionals. Oxford , New York: Oxford University Press.

[47] Cynthia T, Kristen S. (2004). Teen life in Latin America and the Caribbean. Westport, Conn. :: Greenwood.

[48] Dominic J. Brewer, Patrick J. McEwan. (2010). ECONOMICS OF EDUCATION. Burlington: Elsevier Science.

[49] Dragan C, Tamara P, Sergej O. (2013). ASSESSMENT OF PHYSICAL FITNESS IN CHILDREN AND ADOLESCENTS. Physical Education and Sport, 11(2), 135 - 145.

[50] Earl S. (2010). Sociology of sport and social theory. Champaign, IL: Human Kinetics.

[51] Fatima S, Moha E. (2011). Women in the Middle East and North Africa: Agents of Change. USA: Routledge.

[52] Georges A. (2018). Higher education governance in the Arab world : exploring the challenges of the education sector and social realities. Cham, Switzerland: Palgrave Macmillan.

[53] Houcine B, Mohamed Z, Djamel M, and Habib B. (2017). Impact of sport activity on adolescents' reducing violence. Int J Educ Psychol Res, 3(2), 96-9. doi:10.4103/jepr.jepr_39_16

[54] Hugh M B, Martin A P. (2016). The coalition government and social policy : restructuring the welfare state. Bristol: Policy Press.

[55] William Z. (2015). Arab spring : negotiating in the shadow of the intifadat. Athens: University of Georgia Press.

[56] Janis H. C, Stevan E. H, Mary A. S. (2013). The Etiology Of Bulimia Nervosa: The Individual And Familial Context: Material Arising From The Second Annual Kent Psychology Forum, Kent, October 1990. (Taylor & Francis, Ed.) USA: Format Kindle.

[57] John H and Eric M. A. (2013). International Guide to Student Achievement. London: Routledge.

[58] Jon E G, Marc N P. (2010). Young adult mental health. Oxford, New York: Oxford University Press.

[59] Jonatan R, España-Romero V, José Castro-Piñero, Manuel J C. (2017). ALPHA-fitness test battery: health-related field-based fitness tests assessment in children and adolescents. Nutr Hosp, 1210-1214. doi:10.3305/nh.2011.26.6.5270

[60] Kelishadi R, Gheiratmand R, Ardalan G, Adeli K, Mehdi Gouya M; CASPIAN Study Group. (2007). Association of anthropometric indices with cardiovascular disease risk factors among children and adolescents: CASPIAN Study. Int J Cardiol, 117(3), 340–348. doi:pmid:1686

[61] Ken G, Andy S. (2016). Routledge Handbook of Youth Sport. London: Routledge Handbook of Youth Sport.

[62] Larry J. Siegel. (2016). Criminology: Theories, Patterns and Typologies. (Cengage Learning, Ed.) USA.

[63] Larry J. Siegel, Brandon C. Welsh. (2014). Juvenile delinquency : the core. Belmont, CA: Wadsworth.

[64] Lebedinskiy V.Y, Koipysheva E.A., Rybina L.D, Kudryavtsev M.D, ermakov S.S, Osipov A.Yu, et al. (2017). Age dynamic of physical condition changes in pre-school age girls, schoolgirls and students, living in conditions of Eastern Siberia. journal Physical Education of Students, 21(6), 280-286. doi:dx.doi.org/10.15561/20755279.2017.0604

[65] LeBlanc AG, Berry T, Deshpande S, Duggan M, Faulkner G, Latimer-Cheung AE, et al. (2015). Knowledge and awareness of Canadian Physical Activity and Sedentary Behaviour Guidelines: a synthesis of existing evidence. Appl Physiol Nutr Metab, 40(7), 716-24. doi:10.1139/apnm-2014-0464

[66] Mahdi T , Masoud A , Amin A, Sadegh A , Ali A. (2014). A relationship between physical activity and healthy quality of life in students. Turkish Journal of Sport and Exercise, 16(2), 15-21. doi:DOI: 10.15314/TJSE.201428100

[67] Mahmoud M. E. (2017). Arab Community under Social Networking Sites effect. Australian Journal of Basic and Applied Sciences, 11(1), 1-6. Retrieved from http://www.ajbasweb.com/old/ajbas_January_2017.html

[68] Manuel J C G. (2014). The ALPHA Health□Related Fitness Test Battery for Children and Adolescents "Test Manual". eu : School of Medicine, University of Granada. Retrieved from www.thealphaproject.eu

[69] Miyatake N, Miyachi M, Tabata I, Sakano N, Hirao T, Numata T. (2012). Relationship between muscle strength and anthropometric, body composition parameters in Japanese adolescents. Health, 4(1), 1–5. doi:10.4236/health.2012.41001

[70] Mohammed Z, Idris MM, Bagdad H, Abelatif H, Ali B. (2016). Impact of Body Composition on Optimal Competitive Body and its Consequences on Athletic Performance in Healthy Young. Int J Womens Health Wellness, 2(4), IJWHW-2-041. doi:10.23937/2474-1353/1510041

[71] Nikki W. (2009). Impact of Extracurricular Activities on Students. University of Wisconsin-Stout, 8.

[72] Nina v d B, Jorien T, Junilla L, Maaike V, Karin V, and Jacqueline V. (2017). Causal Associations Between Body Mass Index and Mental Health: A Mendelian Randomization Study. bioRxiv, 168690. doi:https://doi.org/10.1101/168690

[73] Olivia I. O. (2015). Prevention of late-life depression : current clinical challenges and priorities. Cham: Humana Press.

[74] Ortega FB, Ruiz JR, Castillo MJ, Sjostrom M. (2008). Physical fitness in childhood and adolescence: a powerful marker of health. Int J Obes (Lond), 32(1), 1–11.

[75] Patrick J. H. (2016). Logic: The Essentials. Australia: Cengage Learning.

[76] Richard G. (2015). Routledge Handbook of the Sociology of Sport. London: Routledge.

[77] Richard M. Lerner, Marc H. Bornstein, Tama Leventhal. (2015). Handbook of child psychology and developmental science. Hoboken, New Jersey: Wiley.com.

[78] Robinson R-V , Diogo R-B, Jorge E C-B, Mikel I, and Felipe L. (2015). Reliability of Health-Related Physical Fitness Tests among Colombian Children and Adolescents: The FUPRECOL Study. PLoS ONE, 10(10), e0140875. doi:doi.org/10.1371/journal.pone.0140875

[79] Rocío I-G, David M-G, Carlos M T-G, Verónica C-S, Jonathan R R, Óscar L. V. (2013). Are poor physical fitness and obesity two features of the adolescent with Down syndrome? Nutr Hosp, 28(4), 1348-1351. doi:10.3305/nh.2013.28.4.6566

[80] Ruiz JR, Castro-Piñero J, España-Romero V, Artero EG, Ortega FB, Cuenca MM, Jimenez-Pavón D, Chillón P, Girela-Rejón MJ, Mora J, Gutiérrez A, Suni J, Sjöström

M, Castillo MJ. (2011). Field-based fitness assessment in young people: the ALPHA health-related fitnes. Br J Sports Med, 45(6), 518-24. doi:10.1136/bjsm.2010.075341

[81] Samantha A K, Rosa D R, Danie J.L. V. (2017). Fundamental movement skill proficiency of South African girls from a lower socio-economic community. South African Journal for Research in Sport, Physical Education and Recreation, 39(3), 41-56. Retrieved from https://www.ajol.info/index.php/sajrs/article/view/164353

[82] Sara J de Silva, Pierella P, Josefina P. (2014). Lessons learned and not yet learned from a multicountry initiative on women's economic empowerment. Washington, DC: World Bank.

[83] Scott K, Andrea C. G, Peter J. F. (2014). Health Behavior Change in Populations. Baltimore : Johns Hopkins University Press.

[84] Siobhan M. W, Thomas R. W, and E M. (2012). Social Cognitive Influences on Physical Activity Behavior in Middle-Aged and Older Adults. J Gerontol B Psychol Sci Soc Sci, 67B(1), 18–26. doi:10.1093/geronb/gbr064

[85] Suxing S, Jing Li, Qi Guo, Wen Z, Xiuyang W, et al. (2015). Body Mass Index Is Associated with Physical Performance in Suburb-Dwelling Older Chinese: A Cross-Sectional Study. PLOS One, 10(3), e0119914. doi: doi.org/10.1371/journal.pone.0119914

[86] Sven E. Jørgensen, Liu Xu, Robert Costanza. (2010). Handbook of Ecological Indicators for Assessment of Ecosystem Health. USA: CRC Press.

[87] Symeon D, Lisette B. (2016). Families, Young People, Physical Activity and Health. London: Routledge.

[88] Tejero-Gonzalez CM, Martinez-Gomez D, Bayon-Serna J, Izquierdo-Gomez R, Castro-Piñero J, Veiga OL. (2013). Reliability of the ALPHA Health-Related Fitness Test Battery in Adolescents With Down Syndrome. J Strength Cond Res, 27(11), 3221-4. doi:10.1519/JSC.0b013e31828bed4e · Source: PubMed

[89] Tim B, Hilary M. (2017). Health Promotion and Wellbeing in People with Mental Health Problems. USA: SAGE.

[90] Valerie M, Rosalind B K. (2012). The Oxford handbook of poverty and child development. New York: Oxford University Press.

[91] Wenjiang Du. (2012). Informatics and Management Science III. London: Springer.

[92] Yvette M O. (2012). A student guide to health : understanding the facts, trends, and challenges. Santa Barbara, Calif: Greenwood.

[93] Zerf M. (2016). Impact of theoretical courses on physical health performance. BLDE Univ J Health Sci, 1(1), 44-8. Retrieved from http://www.bldeujournalhs.in/text.asp?2016/1/1/44/183285

[94] Zerf M, Mokkedes M I, Hamek B, Houar A and Bengoua Ali. (2016). Impact of Body Composition on Optimal Competitive Body and its Consequences on Athletic Performance in Healthy Young. International Journal of Women's Health and Wellness, 2(6), 2016. doi:10.23937/2474-1353/1510041

[95] Zerf, M., Atouti, N., Ben Farouk, A. (2017). Abdominal obesity and their association with total body: fat distribution and composition. Case of Algerian teenager male high school students. Physical education of students, 21(3), 146–151. doi:10.15561/20755279.2017.0308

Postpartum Maternal Health at a Time of Rapid Societal Change in Abu Dhabi, United Arab Emirates

Hazel Gardner[1], Katherine Green[2], Andrew S. Gardner[1], and Donna Geddes[1]

[1]School of Molecular Sciences, Faculty of Science, University of Western Australia, Crawley, WA 6009
[2]School of Education, Capella University, 225 South 6th St, Minneapolis, MN

Corresponding Author: Andrew S. Gardner; email: andrew.s.gardner@uwa .edu.au

Abstract

Background. Abu Dhabi has undergone a rapid transition from a subsistence economy to a wealthy modern state over the last 50 years. This article presents an insight into the health status of Emirati mothers during this transition through a prospective longitudinal study of mothers who gave birth in a government maternity hospital in the Emirate of Abu Dhabi. **Methods**. 125 women were interviewed within the first week after birth, as part of a larger study encompassing a wide range of cultural, social, and behavioural aspects of health. They were then re-interviewed at three-, six- and fifteen-months postpartum. A food frequency questionnaire was also administered to the mothers at birth. Data were analysed using univariate statistics. **Results**. Over 70% of the mothers had BMI in the overweight and obese categories, and approximately half of the women were dissatisfied with their weight. Contributing factors were likely to be diets high in fats and sugar, low levels of exercise and women's limited involvement in household food purchasing and preparation. Iron deficiency anaemia, diabetes, asthma and fertility problems were found to be the most common concerns amongst the participants prior to conception. Anaemia rates were high during pregnancy, with 35% having haemoglobin < 11 g/dL, and were positively associated with parity. Belief in traditional and herbal medicines was strong, with 43% of women using a variety of remedies during pregnancy. **Conclusions.** Policies and support mechanisms to encourage women to make better dietary choices and to provide more opportunities for exercising are required to improve the health of mothers in the UAE. The development of good quality healthcare has resulted in the better maternal health outcomes, although traditional practices in relation to herbal medicines are still common.

Keywords: maternal health, anaemia, obesity, diet, Abu Dhabi

1. Introduction

Prior to the development of the oil industry in the 1960s, the population of the Trucial States generally led a subsistence existence based on fishing and agriculture [1]. Following the formation of the United Arab Emirates (UAE) in 1971, there has been rapid economic and social development. This article presents an insight into the health status of Emirati mothers in Abu Dhabi, UAE during this transition.

Development and globalisation have taken their toll on the dietary habits of the inhabitants of the countries in the Arabian Gulf. The traditional diet of the region included fish, wheat, chickpeas, broad beans, lentils, sesame, fruits (especially dates) and green vegetables. This diet, low in fat and cholesterol and high in fibre, has been replaced with foods high in fat and sugar, and fast foods are readily available. Over a 40-year period (1958 to 1998), the average intake of energy per person has increased by 30% driven largely by a large increase in fat consumption (45%) [2]. Research on nutritional intake in the UAE is limited, but several studies have reported low fruit and vegetable intake in this population [3–5]. The UAE Health and Lifestyle Survey conducted in Al Ain in 2000 found that higher levels of fruit and vegetable intake were both associated with increased physical activity, and were higher in those aged over thirty years. Less than 20% of Emiratis consumed low fat or skimmed milk, and one in six drank camel milk [5].

Heart disease, diabetes, particularly non-insulin-dependent diabetes, and obesity are major health problems in the UAE [6]. In 1998, 30% of deaths in the UAE were due to cardiovascular disease [7]. The prevalence of obesity was 16% in men and 38% in women, while the prevalence of high blood pressure was 24% in men and 20% in women, respectively [7]. The prevalence of being overweight in women over 15 in the UAE was 66.2% in 2005 and rose to 71.1% in 2016 [8]. Current estimates of the prevalence of diabetes amongst the UAE population rate it as the 11th highest in the world with an adult incidence of 19.3% [9].

WHO report fluctuating prevalence of anaemia amongst pregnant women in the UAE with rates at 36.8% in 1990, decreasing to 30.0% in 2002 and rising again to 33.2% in 2016 [10]. Several aspects of the UAE diet may inhibit iron absorption such as the high consumption of tea, which contains tannins and large quantities of unleavened bread containing phytates [11]. Further, it is common for women in the UAE to be in a constant cycle of pregnancy and lactation, which also depletes maternal iron stores, increasing the risk of iron deficiency anaemia [12].

The aims of this study were to examine the prevalence of health issues and factors, which impacted on the health of Emirati women during the 15-months postpartum. The original study from 2002 is set in the context of more recent developments.

2. Methods

Data were collected in relation to maternal health and nutrition from birth to 15-months postpartum, as part of a study encompassing a wide range of cultural, social, and behavioural aspects of health in a cohort of women and infants.

One hundred and twenty-five Emirati women, together with their husbands or guardians, provided written, informed consent to participate in the study, which was approved by the Human Research Ethics Committee at Zayed University, Abu Dhabi, UAE.

Questionnaires were designed following input from international consultants and Emirati female researchers, who ensured cross-cultural equivalence of the instruments [13]. All materials were created in English and then translated into Arabic using a cross-translation technique [14]. Under this technique, an Emirati female research assistant translated the English document into Arabic, and then a different Emirati assistant (blind to the original document) retranslated the document back into English. Any differences identified were reviewed with Emirati and Western researchers and modified to minimise semantic differences. Questionnaires for the maternal health component of the study were designed to gather information on a range of health, lifestyle and nutrition practices in this population.

A pilot study was conducted in which 10 Emirati women who had given birth in the Corniche Hospital (government maternity hospital in Abu Dhabi) were recruited. As a result, further adaptations to the study were made in order to account for maternal literacy and the number of visitors in the mother's hospital room.

All Emirati women who gave birth in the Corniche Hospital over the period of one month were invited to be part of the study. Around 10% of the eligible participants declined to take part in the study, primarily due to ill health or because they were refused permission from their male guardian. An Arabic-speaking female research assistant interviewed mothers during their postpartum stay in the hospital. Additionally, their medical records were reviewed, and then they were contacted via mail and/or telephone at three (n = 94), six-months (n = 59) and fifteen-months (n = 52) postpartum. A food frequency questionnaire was also administered to the women at

Table 1: Characteristics of mothers and infants.

Participant Characteristics			
Maternal			
Age in years (mean, SD, range)	28.7	5.7	16–46
Age at marriage in years (mean, SD, range)	20.8	4.5	11–38
Parity (mean, SD, range)	3.4	2.1	1–9
Primiparous (*n*, %)	29	23%	
Education level (*n*, %)			
None	6	5%	
Primary	28	22%	
Secondary	62	50%	
Diploma/degree	29	23%	
Working before birth (*n*, %)	36	29%	
Consanguineous marriage (*n*, %)	60	48%	
Polygamous marriage (*n*, %)	7	6%	
Household			
Size of household (mean, SD, range)	7.9	4.4	3–24
Domestic helpers (mean, SD, range)	1.6	1.4	0–10
Infant			
Male (*n*, %)	62	49.6%	
Female (*n*, %)	63	50.4%	
Gestation in weeks (mean, SD, range)	39.1	2.4	25–44
Birthweight in kg (mean, SD, range)	3.2	0.6	0.7–4.4

birth (n = 125) to assess their frequency of eating some common foods, and they were also asked about their participation in food purchasing and preparation.

Data were analysed using IBM SPSS Statistics package Version 23 [15]. Fisher's exact test and Pearson's chi-squared tests were used to assess relationships as appropriate.

3. Results

Participant characteristics are shown in Table 1 and encompass a wide distribution of age, education levels and parities.

Table 2: Frequency of health concerns prior to conception.

Condition Entering Pregnancy	Frequency	Percentage
Anaemia	20	16.0
Infertility	10	8.0
Diabetes	9	7.2
Asthma	9	7.2
Breast Surgery	3	2.4
Allergy	2	1.6
Gynaecological Problems	2	1.6
Arthritis	1	0.8
Irritable Bowel Syndrome	1	0.8
Smoking	1	0.8

Iron deficiency anaemia, diabetes, asthma and fertility problems were found to be the most common concerns amongst the participants prior to conception (Table 2).

During pregnancy, the women reported a slight increase in the rate of diabetes to 8% (n = 10), and 4% (n = 5) had hypertension. Twenty (16%) mothers reported being anaemic. However, using the WHO-recommended threshold of haemoglobin < 11 g/dL, 35% (n = 44) of the participants were anaemic during pregnancy. Anaemia during pregnancy was positively related to parity (χ^2_{1df} = 7.75, p = 0.005).

The women were asked to describe their health and satisfaction with their weight at three-, six- and fifteen-months postpartum (Table 3). A common postpartum problem was the failure to return to pre-pregnancy weight. Approximately half the women were dissatisfied with their weight at all time points. The mean BMI of the 125 participants at three months postpartum was 27.7 with a range from 19 to 40.5. The majority of the women were overweight or obese (45%, and 26%, respectively) with the remaining 29% being in the normal weight range. BMI was positively related to the age of the participants (χ^2_{1df} = 5.2 p = 0.02).

When asked at 3-months postpartum if they had suffered any health problems since the birth, 25 of the 92 respondents (27%) gave a positive response. These health problems included: back pain (n = 8), abdominal pain (n = 4), pain from caesarean section (n = 4), haemorrhoids (n = 2), anaemia (n = 2), respiratory problems (n = 2), abnormal vaginal bleeding (n = 1), breast pain (n = 1), and headaches (n = 1).

At six-months postpartum, 86% of participants reported excellent or good health. By 14–15-months postpartum, 28 (54%) reported problems with their health, fifteen

Table 3: Self-reported assessment of health and satisfaction with weight at 3-, 6- and 15-months postpartum.

	3 months		6 months		15 months	
Self-reported Health	**N (94)**	**%**	**N (59)**	**%**	**N (51)**	**%**
Excellent	31	33	18	30.5	23	45.1
Good	44	46.8	33	55.9	24	47.1
Fair	14	14.9	5	8.5	3	5.9
Poor	5	5.3	3	5.1	1	2
Self-reported Satisfaction with Weight	**N (90)**	**%**	**N (59)**	**%**	**N (51)**	**%**
Very satisfied	19	21.1	11	18.6	11	21.6
Reasonably satisfied	24	26.7	17	28.8	16	31.4
Unhappy	47	52.2	31	52.5	24	47.1

(29%) claimed to be overweight and three (6%) underweight, although none of the women were below normal BMI calculated from the figures provided. Twenty-four (47%) of the women were unhappy with their weight. However, only 12 (23%) of the participants were dieting and 24 (48%) reported exercising, most commonly by walking. Only 39 of the women supplied their current weight and height, and this was used to calculate the BMI. The results showed that 12 (31%) participants were in the normal range, 17 (44%) were overweight, and 10 (25%) were obese. Several other health problems were common; with 10 (19%) participants being anaemic; 1 (2%) diabetic, 4 (8%) suffering from depression, and 3 (6%) were hypertensive.

At 14 to 15 months after the birth of the infants, 11 (22%) of the 52 respondents in the study were pregnant again, with five in the 1st, one in the 2nd, and four in the 3rd trimesters, with one having already given birth). A further five women were unsure whether they were pregnant or not.

The results from the food questionnaire are summarised in Table 4.

Seventy nine percent of the participants reported consuming boiled rice six or more times each week, often accompanied with yogurt. Fish (usually grouper, locally known as hammour) was consumed by 45% of participants three or more times each week. Only one in five women reported consumption of more than four pieces of fruit and vegetables daily; 12% had a relatively poor intake of fruit, consuming less than one piece daily; and 14% consumed less than one vegetable per day. Vegetable oil is commonly used and is liberally added to boiled rice and other traditional dishes such

Table 4: Frequency of weekly consumption of common foods.

Food	Weekly Consumption								Total
	≥ 6		3 to 5		1 to 2		Rarely		
	n	%	n	%	n	%	n	%	
Meat	10	8	24	19.2	45	36	46	36.8	125
Fish	11	8.9	45	36.6	54	43.9	13	10.6	123
Pasta	1	0.8	19	15.3	61	49.2	43	34.7	124
Rice	99	79.2	12	9.6	13	10.4	1	0.8	125
Potatoes	12	9.6	34	27.2	50	40	29	23.2	125
Fried food	9	7.2	41	32.8	53	42.4	22	17.6	125
Biscuits	11	8.8	24	19.2	42	41.6	38	30.4	125
Sweets	26	20.8	24	19.2	36	28.8	39	31.2	125

as biryani and harees. Full cream milk was generally consumed by the women (71%), whilst only 1% used skimmed milk. No significant relationship was found between nutritional intake and education level.

Sixty percent (n = 70) of the participants reported that a male family member bought food for the household and only 29% (n = 36) of the participants shopped for food. In addition, only 66% (n = 83) of the women determined what was to be eaten at meal times. Eighteen percent (n = 23) said their mother or mother-in-law decided, while 10% (n = 13) said their husband decided. In this sample, only 46% (n = 57) of the women reported that they prepared food for themselves and their families, while household staff prepared the food in 42% (n = 53) of the households.

4. Supplements and Traditional Medicine

During pregnancy, 100 participants (80%) took iron supplements, 77 (62%) took folic acid, and 56 (45%) took multivitamins. Participants with higher levels of education were more likely to take folic acid, iron supplements, minerals and multivitamins during pregnancy (Table 2). Seventeen participants (14%) reported consuming pills given to them by health professionals that they were unable to identify and unable to say why they were prescribed. Forty three percent (n = 54) of the women used traditional herbs and medicines during pregnancy (Table 5).

Table 5: Frequency and perceived purpose of traditional remedies used during pregnancy.

Type of Remedy	n	(%)	Reported Reasons for Using
Thyme	23	18.4	Gas/ease delivery/postpartum
Al Holul (*Senna*)	20	16.0	Stomach cleansing/constipation/ease delivery
Cinnamon	8	6.4	Ease delivery (often only used at the end of pregnancy)
Fenugreek	5	4.0	Initiate and ease labour
Honey/black honey	4	3.2	Strength during delivery/initiate labour
Sage	4	3.2	Ease delivery/postpartum/gas
Al musawafa	4	3.2	Gas/lowering blood sugar/widening the uterus/ foetal growth
Oil	4	3.2	Allergy/during hot weather/preventing nipple cracking
Chamomile	3	2.4	Stomach/gas/headaches
Castor oil	3	2.4	Stomach cleansing
Yaada (*Teucrium stocksianum*)	3	2.4	Heartburn
Aniseed	3	2.4	Not reported
Mint	3	2.4	Not reported
Black seed (*Nigella sativa*)	2	1.6	Preparation for delivery
Al zohorat (*Tribulus* sp.)	2	1.6	Not reported
Dates and raisins	2	1.6	Strengthen blood/prepare for labour
Sheeh (White wormwood *Artemisia herba-alba*)	1	0.8	Stomach cleansing
Rose	1	0.8	General well-being and ease labour
Hibiscus	1	0.8	Not reported

5. Discussion

This study found that 71% of the Emirati women participating were overweight at three-months postpartum. Obesity is recognised as a serious health problem in the UAE, and other studies have also reported a high prevalence of obesity in the female population [5, 6, 16–18]. Previous research into obesity levels in the UAE has focussed on dietary intake [3–5, 19]. A recent study suggested that the environment in the UAE was conducive to women becoming overweight or obese due to an excessive intake of

foods with high sugar content and snacking [17]. In addition to nutritional factors, physical activity levels are low amongst Emirati women, exacerbating these health issues [17, 20]. Little research has been carried out in the UAE on physical-activity levels, and attitudes towards Emirati women participating in sports. A third of the participants in the current study reported exercising regularly, but more research is needed to determine the duration and intensity of exercise in this population. Factors associated with obesity in the Arab population include age, age at marriage, education level, socio-economic status and employment status. The prevalence of obesity increased with age, and was lower in women with higher levels of educational attainment and those in employment [21–24]. In Bahrain, Saudi Arabia, Qatar and Iran, it has been reported that women in employment were less likely to be obese or overweight, due to increased exposure to social and health education information, and increased levels of mobility [22, 23, 25, 26]. Women often attribute problems with weight gain to pregnancy, and there is some evidence to support this [27, 28].

Anaemia has been identified as a serious health problem for pregnant women in the Eastern Mediterranean region, particularly in Arab countries [18, 29]. Data on the incidence of anaemia collected from the participants medical records in this current study show a higher prevalence of anaemia during pregnancy in comparison with two previous studies conducted in the UAE [11, 12]. Although this could be reflective of the smaller sample size, participants with larger families were more likely to suffer from anaemia, a finding also reported in an Omani population with similar characteristics [30]. In addition, participants with lower education levels were less likely to have taken folic acid and iron supplements during pregnancy. It is interesting to note that the self-reported incidence of anaemia during pregnancy was significantly different, which suggests that the women were unaware that they were anaemic or were reluctant to report it.

The Emirati women who participated in this study reported a diet based on rice, with a relatively high intake of fats, sweets and fried foods. Interestingly, the women reported having limited involvement in food purchasing and preparation. Only 29% of the participants were responsible for food shopping, 46% were involved in food preparation for the household, and 66% determined what was eaten at mealtimes. Nutritional intake and practices relating to food consumption have a significant impact on the health of Emirati women, [17, 18] and which, along with low levels of physical activity, have important public health implications. If addressed, these factors could result in dramatic improvements in the health of the UAE population, especially for Emirati women.

There is a long history of the use of traditional herbal medicines in the UAE and traditional healers remain an integral component of the health system. Participants consumed a wide range of traditional remedies during pregnancy, birth and the neonatal period and belief in these remedies remains strong among this population [31]. In the Arab world, it is estimated that over 260 varieties of medicinal plants are in use [32]. Some traditional remedies have been associated with adverse effects such as gastrointestinal disruption and allergies, and there have been reports of thyme being associated with reduced breast milk production. Often multiple medicinal plants are taken at once, which may lead to negative interactions with other medications [31, 33].

6. Conclusion

Obesity, anaemia and diabetes were among the most common health problems reported in this cohort of Emirati women. These issues are associated with societal changes brought about during the rapid development of Abu Dhabi, with foods high in fat and low in nutritional value becoming readily available, and limited physical exercise. However, traditional practices remain strong, particularly in relation to the use of traditional and herbal remedies. The challenge for health professionals is to develop policies and support mechanisms to encourage women to make better dietary choices, take more involvement in food preparation and to provide more opportunities for exercising in order to improve maternal health in the UAE.

Conflict of Interests

The authors declare no conflict of interests.

Ethical Clearance

This study was approved by the Human Research Ethics Committee at Zayed University, Abu Dhabi, UAE.

Acknowledgements

The authors gratefully acknowledge the contributions of the Emirati mothers who took part in the study. Thuraya Al Shamsi facilitated access to the mothers at the Corniche

hospital through her role as the director of research for HH Sheikha Fatima's office and Nahied El-Temtamy provided translation and data input services.

Funding

The funding for this research was received from Zayed University Research Incentive Fund.

Author Contributions

HG – research design, data collection and analysis, drafted manuscript. KG – research design, data collection, contributed to and approved final manuscript. AG – data analysis, contributed to and approved final manuscript. DG – contributed to and approved final manuscript.

References

[1] Heard-Bey, F. (2001). The tribal society of the UAE and its traditional economy, in I. Al Abed and P. Hellyer (eds.) *United Arab Emirates: A New Perspective 2001.* Abu Dhabi: Trident Press Ltd.

[2] Miladi, S. S. (1998). Changes in food consumption patterns in the Arab countries. *International Journal of Food Sciences and Nutrition*, vol. 49, pp. S23–S31.

[3] Musaiger, A. O. and Radwan, H. M. (1995). Social and dietary factors associated with obesity in university female students in United Arab Emirates. *Journal of the Royal Society of Health*, vol. 115, pp. 96–99.

[4] Musaiger, A. O. and Abuirmeileh, N. M. (1998). Food consumption patterns of adults in the United Arab Emirates. *Journal of the Royal Society of Health*, vol. 118, pp. 146–150.

[5] Badrinath, P., Al-Shboul, Q. A., Zoubeidi, T., et al. (2002). *Measuring the Health of the Nation: United Arab Emirates Health and Lifestyle Survey 2000*. Al Ain, UAE: UAE University.

[6] El Mugamer, I. T., Ali Zayat, A. S., Hossain, M. M. et al. (1995). Diabetes, obesity and hypertension in urban and rural people of bedouin origin in the United Arab Emirates. *Journal of tropical Medicine and Hygiene*, vol. 98, pp. 407–415.

[7] Musaiger, A. O. (1998). Risk factors for cardiovascular disease in the United Arab Emirates. *International Journal of Food Sciences and Nutrition*, vol. 49, pp. S65–S72.

[8] World Health Organization. (2018). Global health observatory data repository. Overweight/obesity by country.

[9] World Bank. (2015). *Diabetes Prevalence (% of population ages 20 to 79)*. World Bank. Retrieved from https://data.worldbank.org/indicator/SH.STA.DIAB.ZS?year_low_desc=true (accessed 9 October 2017).

[10] Index Mundi. (2017). *United Arab Emirates: Prevalence of Anaemia*. Retrieved from https://www.indexmundi.com/facts/united-arab-emirates/prevalence-of-anemia (accessed 16 June 2018).

[11] Bagchi, K. (2004). Iron deficiency anaemia – An old enemy. *Eastern Mediterranean Health Journal*, vol. 10, pp. 754–760.

[12] Fareh, O. I., Rizk, D. E. E., Thomas, L., et al. (2005). Obstetric impact of anaemia in pregnant women in United Arab Emirates *Journal of Obstetrics and Gynaecology*, vol. 25, pp. 440–444.

[13] Knudsen, H. C., Vasuez-Barquero, J. L., Welcher, B., et al. (2000). Translation and cross-cultural adaptation of outcome measurements for schizophrenia. *British Journal of Psychiatry*, vol. 177, pp. s8–s14.

[14] Brislin, R. W. (1976). Comparative research methodology: Cross-cultural studies. *International Journal of Psychology*, vol. 11, pp. 215–229.

[15] IBM Corp. (2015). IBM SPSS statistics, version 23.0. Armonk, NY: IBM Corp

[16] Carter, A. O., Saadi, H. F., Reed, R. L., et al. (2004). Assessment of obesity, lifestyle, and reproductive health needs of female citizens of Al Ain, United Arab Emirates. *Journal of Health and Population Nutrition*, vol. 22, pp. 75–83.

[17] Ng, S. W., Zaghloul, S., Ali, H., et al. (2011). Nutrition transition in the United Arab Emirates (UAE). *European Journal of Clinical Nutrition*, vol. 65, p. 1328.

[18] Musaiger, A. O. (2011). Overweight and obesity in Eastern Mediterranean region: prevalence and possible causes. *Journal of Obesity*, vol. 2011.

[19] Fikri, M. and Farid, S. (2000). *United Arab Emirates Family Health Survey*. Abu Dhabi: United Arab Emirates Ministry of Health.

[20] Mabry, R., Reeves, M., Eakin, E., et al. (2010). Gender differences in prevalence of the metabolic syndrome in Gulf Cooperation Council Countries: A systematic review. *Diabetic Medicine*, vol. 27, pp. 593–597.

[21] Al-Awadi, F. and Amine, E. K. (1997). Recent trends in infant feeding patterns and weaning practices in Kuwait. *Eastern Mediterranean Health Journal*, vol. 3, pp. 501–510.

[22] Khashoggi, R. H., Madani, K. A., Ghaznawy, H. I. (1994). Socioeconomic factors affecting prevalence of obesity among patients attending primary health care centers in Jeddah, Saudi Arabia. *Ecology of Food and Nutrition*, vol. 31.

[23] Musaiger, A. O. and Al-Ansari, M. (1992). Factors associated with obesity among women in Bahrain. *International Quarterly of Community Health Education*, vol. 12, pp. 129–136.

[24] Musaiger, A. O., Al Khalaf, F. A., and Shahbeek, N. E. (1998). Factors associated with obesity among women attending health centres in Quatar. *International Journal of Food Sciences and Nutrition*, vol. 49, pp. S53–S57.

[25] Musaiger, A. O., Al-Mulla, A. A., and Al-Mannai, M. A. Social, lifestyle and health factors associated with obesity among out-patients in Qatar. *Bahrain Medical Bulletin*. Retrieved from `http://www.bahrainmedicalbulletin.com/issue-sept2000.htm`

[26] Esmaeily, H., Azimi-Nezhad, M., Ghayour-Mobarhan, M., et al. (2009). Association between socioeconomic factors and obesity in Iran. *Pakistan Journal of Nutrition*, vol. 8, pp. 53–56.

[27] Hunt, S. C., Daines, M. M., Adams, T. D., et al. (1995). Pregnancy weight retention in morbid obesity. *Obesity Research*, vol. 3, pp. 121–130.

[28] Rossner, S. and Olin, A. (1990). Maternal body weight and relation to birth weight. *Acta Obstetricia Gynecologica Scandinavica*, vol. 69, pp. 475–478.

[29] Fathalla, M. F. (2006). Reproductive health: A call to the research community. *Eastern Mediterranean Health Journal*, vol. 12.

[30] Al-Farsi, Y. M., Brooks, D. R., Werler, M. M., et al. (2011). Effect of high parity on occurrence of anaemia in pregnancy: A cohort study. *BMC Pregnancy and Childbirth*, vol. 11, p. 7.

[31] Al Braik, F. A., Rutter, P. M., and Brown, D. (2008). A cross-sectional survey of herbal remedy taking by United Arab Emirate (UAE) citizens in Abu Dhabi. *Pharmacoepidemiology and Drug Safety*, vol. 17, pp. 725–732.

[32] Ghazanfar, S. A. (1994). *Handbook of Arabian Medicinal Plants.* Boca Raton, Florida: CRC press.

[33] Mathew, E., Muttappallymyalil, J., Sreedharan, J., et al. (2013). Self-reported use of complementary and alternative medicine among the health care consumers at a tertiary care center in Ajman, United Arab Emirates. *Annals of Medical and Health Sciences Research*, vol. 3, p. 215.

The Impact of Skipping Breakfast on the Body Weight of Children and Young People in Saudi Arabia

Hanan S Alhilabi[1] and Anne Payne[2]

[1]Clinical Nutrition Department, Security Forces Hospital Makkah, Rabwat Alshuhadaa, Madina road, Makkah, Saudi Arabia
[2]The University of Plymouth, Faculty of Health & Human Sciences, School of Health Professions

Corresponding Author: Hanan S. Alhilabi; email: hanohilabi@gmail.com halhilabi@sfhm.med.sa

Abstract

Aim: To review evidence of the impact of skipping breakfast on the body weight of children and young people of Saudi Arabia. **Method:** A systematic search of the Cochrane Library, EBSCO (AMED, MEDLINE, and CINAHL), Web of Science, SCOPUS, PubMed, and EMBASE was conducted in March 2018 to identify primary published research. Additional studies were identified by hand searching in other sources such as subject-specific journals and grey literature. Any observational study published in the English language in the last 20 years (1998–2018), involving healthy children and/or young people (5–24 years) in Saudi Arabia was included, and the effect of skipping breakfast on their body weight was evaluated. Pre-defined information was extracted from each study onto a data-extraction form for evaluation, following the Cochrane method for undertaking a systematic review. Study quality was evaluated using a Quality Assessment Tool for Quantitative Studies. **Results:** Eight studies met the inclusion criteria, of which seven graded weak in quality assessment, while one article scored moderate. Six studies show that regular breakfast consumption has a protective effect against overweight/obesity, of which three studies tested the correlation, while controlling for confounding variables. Two of the eight studies demonstrated no significant correlation. Breakfast intake was also found to have a positive association with student's academic performance, with two out of three trials demonstrating a significant relationship, but in linking regular breakfast habit with socioeconomic status, no effect was found. **Conclusion:** The findings suggest that skipping breakfast is associated with a higher risk of overweight and obesity in children and adolescents in Saudi Arabia and thus breakfast consumption is associated with a reduced risk of overweight and obesity. However, in view of the array of methods used to define breakfast skipping and overweight/obesity, as well as the less robust nature of observational studies, we cannot conclusively assume this relationship, suggesting further more controlled studies are required.

Keywords: obesity, overweight, breakfast, breakfast skipping, children, young people, Saudi Arabia

1. Introduction

Globally, obesity rates have risen markedly from 1975 to 2014, increasing from 3.2% to 10.8% in males, and from 6.4% to 14.9% in the female population [24]. This constitutes a large financial and health burden on society ([34]; WHO, 2016). In Saudi Arabia, for example, the World Obesity Federation (2015) reported that the prevalence of obesity was 24.1% in males and 33.5% in females in 2013. A global epidemic level has been reached in childhood obesity as well. In 2012, there were 23.8% and 22.6% of boys and girls, respectively, who were overweight or obese in developed countries, while the percentages were 12.9% and 13.4%, respectively, in developing countries [51]. While in Saudi Arabia the 2010 estimated prevalence of overweight and obesity among school-aged children was 19.6% and 7.9%, respectively, higher rates were reported for adolescents, with 26.6% overweight and 10.6% obese [22]. Body weight status during early life – whether overweight or underweight – has a direct impact on the overall health of an individual by its consequences later throughout the life course [2].

Nutritionally, breakfast is deemed to be the most essential meal of the day [60]. Many studies have shown the proven positive impact of breakfast in appetite regulation [4] and in reducing the risk of type 2 diabetes [53]. Despite all these facts, breakfast is frequently skipped, especially among the young generation, with almost 74% of female students being found to be skipping or irregularly consuming breakfast in Saudi Arabia [48].

Many causes of skipping breakfast and changing eating patterns could be considered. For instance, Saudi cultural and economic shifts, such as a recent increase in the number of working mothers together with the increasing economic wealth of the population may have contributed to changing family habits and food choices [8, 9, 54]. This has been found to have had a negative impact on children's breakfast intake [59].

Appetite has been found to fluctuate across the course of a day, with its lowest point occurring in the early morning; thus, the relatively early school and work start time in Saudi Arabia may contribute to a reduced appetite [28, 33].

Research from other countries have indicated a correlation between skipping breakfast and obesity and overweight in children and adolescents, but the evidence are contradictory between studies. It was found to be significant only for boys in several studies [21, 61, 62, 67], while in others, significant only for girls [29, 36, 52, 66]. On the other hand, some studies take into consideration that apart from just skipping breakfast, there are other family behavior factors and breakfast locations that indirectly influence body weight changes, [43, 64], and some studies address nutrient intake

along with breakfast as predictors for overweight prevention [6, 66, 73]. However, surprisingly, Hopkins et al. (2017) demonstrated no significant effect of breakfast intake on body weight in adolescents of urban families living in the USA.

With all this uncertainty and a lack of adequate research examining the hypothesis of an association between breakfast skipping and body weight in Saudi children and young people, this systematic review aims to review the evidence on the impact of skipping breakfast on the body weight of children and young people of Saudi Arabia and the strength of that impact. The objectives of this review are:

- To evaluate the association between breakfast skipping of children and young people and their body weights.
- To establish a comprehensive picture of the phenomenon through different studies conducted in different regions of Saudi Arabia where the issue of skipping breakfast is common.

2. Methods

Many different approaches and frameworks have been developed as a guide for conducting systematic reviews [23, 39, 42]. These guidelines are similar in linking to the main concept of a systematic review but have minor differences. The Cochrane online framework includes an easy-to-access handbook, tools for review of studies, and provides an online short training course on the process of conducting a systematic review. Reviewers following the Cochrane method are also able to use tools from different sources according to the suitability [26, 39]. Therefore, the Cochrane approach was selected to be used for the current systematic review. Although the Cochrane handbook for systematic reviews of interventions is designed mainly for randomized trials, it can also be used for supporting reviews that include other observational studies [39]. Following Cochrane guidance, a protocol for this systematic review was registered on PROSPERO (2018) with the registration number CRD42018094084.

2.1. Inclusion and exclusion criteria for selection of studies

2.1.1. Type of studies

All types of studies, including observational studies, were considered for this systematic review as no experimental studies were identified during a preliminary scan of the literature. Furthermore, the publication period extended over the past 20 years

to include studies published from 1998 to 2018 as the initial background search of 10 years yielded only a few studies.

2.1.2. Type of participants

Only children and young people living in Saudi Arabia were included. The subjects' age in primary studies ranged from 5 to 24 years, as they are all students (from primary school to undergraduate university). Children under 5 years were excluded as their breakfast habits may differ from older children, taking into account that they are at home generally and therefore having the access to food differently. Participants of both genders were included and no study with disease-specific participants was eligible.

2.1.3. Types of intervention and comparison

All studies that considered breakfast as an intervention were included, whether considered alone or evaluated with other lifestyle variables. Furthermore, the current review included studies that define breakfast skippers as people who consume breakfast a few times a week, as well as studies that define them as never or rarely consuming breakfast.

2.1.4. Types of outcome measures

Body weight was the main outcome measure identified in the present review, and this was measured in terms of Body Mass Index (BMI). Considering that age ranges varied, all different cut-off references were included with no specifications.

Moreover, two secondary outcome measures were included. First, students' academic achievements as measured and classified, if applicable, by the Saudi grading system into 'Excellent, Very good, Good, Pass, and Fail' [25]. Second, the socioeconomic status (SES) of participants and their families, using, if applicable, the classification of 'low, medium, and high' in terms of their income, educational level, and occupation.

2.2. Search strategy

One reviewer selected studies for inclusion in the review, following stages 1 to 5 of the Cochrane process. **Stage 1 (Bibliographic database search):** as guided by Cochrane [39]; the following bibliographic databases were located during March 2018:

- Cochrane Library
- EBSCO: AMED
- EBSCO: MEDLINE
- EBSCO: CINAHL
- Web of Science
- SCOPUS
- PubMed
- EMBASE

By using the following PICO question [37]: What is the impact of skipping breakfast on the body weight of children and young people in Saudi Arabia?, Figure 1 shows the retrieved key terms which were used for the systematic search. The 'OR' operator was used in each category below, then an 'AND' operator was used to combine those terms to identify relevant articles. An example of one electronic search strategy is provided in Appendix 1.

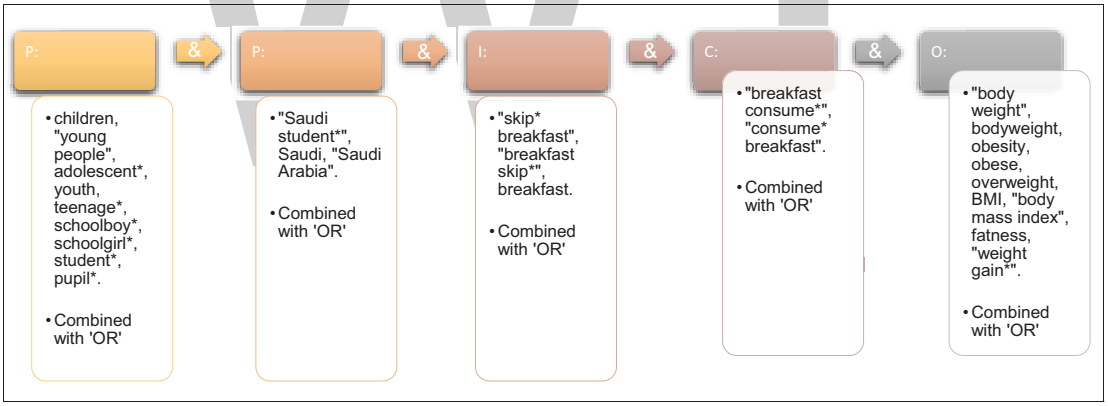

Figure 1: Literature search terms; P = population, I = intervention, C = comparison, and O = outcome.

Stage 2 (Hand searching)

Referring to the Cochrane [39], subject-specific journals, such as *BMC Obesity, BMC Nutrition, Nutrition Journal, and Journal of Nutrition Science* were searched manually for articles that examine the habit of breakfast intake in Saudi Arabia and its effect on body weight. The searching panels in those journals were not of the same level of advance as in the bibliographic databases, therefore, the keywords used were limited to 'breakfast, skipping, and Saudi Arabia'.

Stage 3 (Grey literature)

Sources such as Google Scholar, Openthesis, DOAJ, Ethos, and Open grey were searched for any PhD thesis or unpublished studies. The following stages of search (4 and 5) will be explained after the study selection section.

2.3. Study selection

Retrieved studies from stages 1 to 3 were screened in two ways for removing any duplication. Manually by looking at titles and then by the Mendeley ® Software for reference management (2018). Afterward, both lists were checked and compared.

Following that, studies' titles and abstracts were screened against the inclusion criteria for the purpose of selecting the relevant and excluding any irrelevant articles. In case of being unsure, the full article was reviewed to make the final decision [39].

Stage 4 – of searching – (Hand searching of the sources)

The reference list of all finally selected studies was screened in order to locate any potentially relevant studies.

Stage 5 (Citation search)

In terms of forward citation search, Web of Science database was used to check if any included studies were cited by other articles that may be relevant for this review.

2.4. Data extraction and study quality assessment

Two independent reviewers performed the process of data extraction and study-quality assessment of the selected studies. For data extraction, it was recommended to design a form suitable for the review, as it can vary from topic to topic [39]. Thus, a specially designed form was used for that purpose (Appendix 2) that included the key items recommended by the Cochrane for data extraction [39].

The Effective Public Health Practice Project (EPHPP) quality assessment tool for quantitative studies (Appendices 3 and 4), established by Thomas and Ciliska in 1999 [45], was utilized for the current review, as it is suitable for all quantitative studies and covers the quality assessment domains. It is also simple, easy to use, and showed a

fair inter-rater agreement in terms of individual domains, and an excellent agreement of final decision [20].

Both data extraction and study-quality assessment steps were undertaken first in a pilot phase. It was completed independently by both reviewers using two studies, to check for any modification needed. It was planned that in case of any disagreement between both reviewers, this would be resolved by discussion, consulting a third reviewer, or if needed the author of the primary study will be contacted for any additional information required to aid in solving the disagreement.

2.5. Data synthesis

Once data was extracted and the quality of each study was assessed, a descriptive analysis of all included studies was undertaken. A narrative synthesis was also performed in combination with the analysis of risk of bias between studies. Moreover, due to the considerable heterogeneity between the included studies in terms of intervention and outcome definitions, a quantitative analysis of the results and meta-analysis was not appropriate.

2.5.1. Ethical consideration

Conducting a systematic review does not require any ethical approval, however, ethical requirements were highly considered in the primary studies for evaluation and quality assessment.

3. Results

3.1. Identified studies

Details of the search process results are presented in the Preferred Reporting Items for Systematic Reviews and Meta-analysis (PRISMA) flow diagram (2015) in Figure 2. A total of 57 articles were screened to remove duplications (n = 16). The remaining 41 studies were screened for their titles and abstracts, of which 26 did not meet the inclusion criteria. The final 15 articles needed a full-paper review in order to make the decision, which yields back only 8 eligible articles to be included, while 7 articles were excluded due to reasons listed in Figure 2. Forward and backward citation searches did

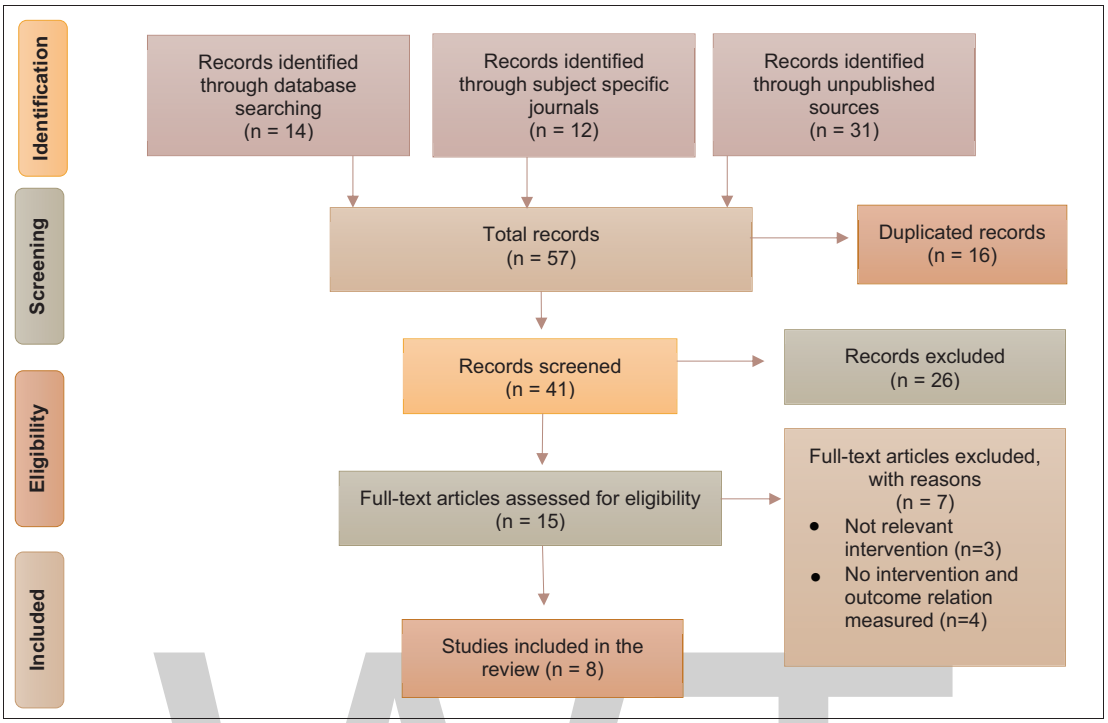

Figure 2: PRISMA flow chart of search result and selection process.

not result in any potentially relevant studies. Therefore, the final number of included studies was eight.

3.2. Descriptive analysis of included studies

The summary of studies characteristics and key findings are presented in Table 1. All included studies used the cross-sectional design in their method. The geographic location varied among those articles. Two studies have covered three major cities (Jeddah, Riyadh, and Alkhubar) in Saudi Arabia [13, 14], while one study covered a governorate in the eastern part of the country [19]. The remaining five studies [1, 12, 15, 17, 18] have surveyed one city each, resulting in covering different areas around the country. These cities and areas were: Arar 'northern', Riyadh –twice – 'central', Jeddah 'western', and Rass 'central', respectively.

3.3. Study participants

Both genders were involved in three studies [1, 13, 14]. Only one considered females alone [15], while Amin et al. (2008), Alsubaie (2010), Alenazi et al. (2014), and Alrethaiaa et al. (2010) have included only male participants in their surveys. As shown in

Table 1, the participant's age groups ranged from 5 to 24 years old, at different school levels.

3.4. Definition of intervention/comparison

There were variations in terms of defining 'breakfast skipping' among included articles (Table 1). Five studies have considered the frequency of breakfast intake/week as a method, either by categorizing them into 3–4 groups as in Alsubaie (2010), Aloboudi, (2010), Alhazzaa et al. (2012), and Alrethaiaa et al. (2010); or numerical data of breakfast intake frequency without categorization as found in Alhazzaa et al. (2011). Two studies defined skipping as irregular breakfast intake compared to regular intake Alenazi et al. (2014), and Abalkhail and Shawky (2002). While Amin et al. (2008) have combined two methods of identification. In other words, using 'yes, no' question for asking if breakfast was taken at home on the same day of the interview, as well as the frequency of breakfast intake/previous week. Moreover, most studies have used a self-reported questionnaire for defining the intervention, while only two depended on an interview using a structured questionnaire (Table 1).

3.5. Definition of the main outcome

Body weight outcome definitions also varied across the included studies (Table 1). Overweight/
obesity was defined by height and weight measurements to determine BMI, but the cut-off values were referenced differently among the studies. However, that was not clearly defined in two papers Alenazi et al. (2014) and Aloboudi (2010). The cut-off references in the remaining six studies were the IOTF by Cole et al. (2000), the adult reference [70], the National Institutes for Health [50], and the National Health and Nutrition Examination Survey (NHANES) by Must et al. (1991).

BMI was not the only indicator, Alrethaiaa et al. (2010) and Alhazzaa et al. (2012) have considered combining BMI with % of body fat (%BF), and visceral fat (VF); as well as waist/height ratio (WHtR), respectively, in terms of defining abdominal obesity.

3.6. Studies quality assessment

Both reviewer's feedbacks were similar in terms of assessing the risk of bias, except for two papers, where there was a disagreement in the final scoring and resolved

Table 1: Descriptive analysis of included studies, part 1 of 2.

Study	Settings	Participants	Definition of breakfast skipping	Method for ascertainment	Definition of overweight/obesity	Method of collecting
Abalkhail and Shawky (2002) (Cross-sectional)	Private and governmental schools in Jeddah city	800, 376 males and 424 females (9–21 years)	Regular versus irregular	In-person interview using a structured questionnaire	BMI calculated, NHANES cut-off reference was used	Height and weight measured by the researchers and clearly explained
Alenazi et al. (2014) (Cross-sectional)	Primary schools in Arar city	Confusing numbers (559 or 359) males (5–9 year)	Regular versus irregular	Self-reported questionnaire	BMI, calculated but no cut-off reference stated	Height and weight measured by the researchers and clearly explained
Alhazzaa et al. (2011) (Cross-sectional)	Private and governmental secondary schools in Riyadh, Jeddah and Al-Khobar	2908, 1401 males and 1507 females (14–19 years).	Numerical frequency/week (0–7 days/week).	Self-reported questionnaire	BMI calculated, Cole et al.'s cut-off reference was used for adolescents (14–17 years), and WHO cut-offs for older participants (> 18 years)	Height and weight measured by the researchers and clearly explained
Alhazzaa et al. (2012) (Cross-sectional)	Private and governmental secondary schools in Riyadh, Jeddah and Al-Khobar	2906, 1400 males and 1506 females (14–19 years)	Frequency/week) ≥ 5, 3–4 and < 3 days	Self-reported questionnaire	BMI calculated, Cole et al.'s cut-off reference was used for adolescents (14–17 years), and adult cut-offs for older participants (> 18 years)	Height and weight measured by the researchers and clearly explained. Waist to height ratio was also measured for abdominal obesity
Aloboudi (2010) (Cross-sectional)	Governmental primary schools in Riyadh city	120 females (9–13.9 years)	Frequency/week: usual/always (5–7), often (2–4) and rare/never (0–1)	Self-reported questionnaire	BMI, calculated but no cut-off reference stated	Height and weight measured by the researchers but not clearly explained
Alrethaiaa et al. (2010) (Cross-sectional)	College of Health Sciences in Rass city	357 males (18–24 years)	Frequency/week: (daily, 3–4, 1–2, rarely)	Self-reported questionnaire	BMI calculated, NIH cut-off reference was used	Height and weight measured by the researchers but not clearly explained. % of body fat and visceral fat was also measured for abdominal obesity

Study	Settings	Participants	Definition of breakfast skipping	Method for ascertainment	Definition of overweight/obesity	Method of collecting
Alsubaie (2010) (Cross-sectional)	Private and governmental secondary schools in Riyadh city	1501 males (15–20 years)	Frequency/week, (skippers are less than 5 times/week)	Self-reported questionnaire	BMI calculated, Cole et al.'s cut-off reference was used for adolescents (15–17 years), and adults cut-offs for older participants (> 18 years)	Height and weight measured by the researcher and clearly explained
Amin et al. (2008) (Cross-sectional)	5th and 6th grades of governmental primary schools in Al-Hassa Governorate	1139 males (10–14 years)	Frequency/last week: (Daily, 3–6, less than 2), and at the same day of interview (yes or no)	FFQ by personal interview	BMI calculated, Cole et al.'s cut-off reference was used	Height and weight measured by the researchers and clearly explained

TABLE 1: *Continued*, part 2 of 2.

Study	Adjusted confounders	Key results	Socioeconomic status	Academic performance
Abalkhail and Shawky (2002)	None	There was no difference in regular daily breakfast intake by gender or BMI	No difference in regular daily breakfast intake by social class was found	Students with poor school results reported significantly less breakfast intake than those with excellent results (statistical data is missing)
Alenazi et al. (2014)	None	Irregular breakfast consuming children were more likely to have an 'abnormal' BMI (overweight/underweight) ($p < 0.001$, OR 0.02)	Not included	Not included
Alhazzaa et al. (2011)	Age	Statistically but not clinically significant relationship was found between breakfast eating and BMI in females ($r = -0.09$, $p < 0.001$) and males ($r = -0.13$, $p < 0.001$), (r was very low)	Not included	Not included
Alhazzaa et al. (2012)	Age	In controlling of age, consuming breakfast on < 3 days per week was significantly associated with overweight and obesity (aOR 1.44, 95% CI 1.20–1.71, $p = 0.000$)	Not clearly measured but assuming that private school pupils have higher SES. And being in a private school was associated with being obese or overweight (aOR 1.50, 95% CI 1.26–1.78, $p = 0.000$)	Not included

Study	Adjusted confounders	Key results	Socioeconomic status	Academic performance
Aloboudi (2010)	None	Significantly, breakfast consumers were more likely to be in normal weight and skippers in overweight or underweight (p = 0.046)	Not included	A difference of mean grades rates of three subjects was found in participants for the benefit of breakfast consumers but not significant (p = 0.132, 0.401, and 0.264)
Alrethaiaa et al. (2010)	None	No significant relationship was found between breakfast habit and BMI status (p = 0.075)	Not included	Not included
Alsubaie (2010)	Age, parent's education, and type of school	In controlling of confounders, BMI has significant negative association with eating breakfast regularly among students, $p < 0.001$	No relationship was found between SES with both breakfast intake and BMI status	Good academic performance was positively associated with eating breakfast regularly, $p \leq 0.001$
Amin et al. (2008)	None	Significantly more obese versus non-obese children were likely to have breakfast only 3–6 times/week (OR 2.6, $p < 0.001$) or < 2 times/week (OR 1.6, $p < 0.001$), taking breakfast at home had an inverse relationship with obesity and overweight (OR 0.54, p = 0.018)	Obesity and overweight were significantly associated with an urban residence (OR 1.85, p = 0.011), low maternal education (OR 1.87, p = 0.020), working mothers (OR 1.85, p = 0.014), and small family size (OR 1.95, p = 0.004)	Not included

Note: **BMI = Body Mass Index**; **IOTF = International Obesity Task Force**; **FFQ = Food Frequency Questionnaire**; **NIH = National Institute for Health**; **NHANES = The first National Health and Nutrition Examination Survey**; **SES =** Socioeconomic Status; **OR =** Odds Ratio; **aOR =** Adjusted Odds Ratio; **r =** Pearson Correlation Coefficient; **CI =** Confidence Intervals.

Table 2: Analysis of study quality for included articles.

Study	Reviewer	Selection bias	Study design	Confounders	Blinding	Data collection	Withdrawals	Overall score
Abalkhail and Shawky (2002)	1	S	W	W	W	M	N	W
	2	S	W	W	W	W	M	W
Alenazi *et al.* (2014)	1	W	W	W	W	W	N	W
	2	M	W	W	W	W	N	W
Alhazzaa *et al.* (2011)	1	M	W	S	M	S	N	M
	2	M	W	M	M	S	M	M
Alhazzaa *et al.* (2012)	1	M	W	W	W	M	N	W
	2	M	W	M	W	W	N	W
Aloboudi (2010)	1	M	W	W	W	W	N	W
	2	W	W	W	W	W	N	W
Alrethaiaa *et al.* (2010)	1	S	W	M	W	S	N	W
	2	S	W	S	W	S	N	W
Alsubaie (2010)	1	S	W	W	W	M	N	W
	2	M	W	W	W	W	N	W
Amin *et al.* (2008)	1	W	W	W	M	S	N	W
	2	M	W	W	W	S	S	W

S = Strong, M = Moderate, W = Weak, N = N/A.

via discussing and reviewing the dictionary attached to the quality assessment tool (Appendix 4). Although both reviewer's scorings in the final stage were the same in terms of the overall rate of each study, there were some minor differences in the scoring rate of each section of the tool (Table 2). The majority of studies scored weak in the current review except for one study Alhazzaa et al. (2011) which had a moderate risk of bias.

3.7. Synthesis of key findings

3.7.1. Skipping breakfast and body weight

An association between skipping breakfast and BMI status of participants was found in six papers. Alsubaie (2010) found an independent and positive association between regular breakfast intake and having low BMI with a p value of ≤ 0.001 when controlling for confounding factors such as students' age, type of school, and parent's education.

The same was found by Alhazzaa et al. (2012) when controlling for the effect of age only, the survey indicates that consuming breakfast on < 3 days per week was significantly associated with overweight and obesity (aOR 1.44, 95% CI 1.20–1.71, p = 0.000), it was also associated significantly with abdominal obesity (aOR 1.47, 95% CI 1.22–1.76, p = 0.000). While Alhazzaa et al. (2012) controlled for age concluding that there was a statistically significant relationship between breakfast eating and BMI in both females (r = −0.09, p < 0.001) and males (r = −0.13, p < 0.001); however, it was noticed that it was statistically significant but not clinically significant as the r value, as shown, is very low.

Aloboudi (2010), and Alenazi et al. (2014) found that frequent breakfast skippers were more likely to have an abnormal weight (overweight/underweight) with a statistical significance of (p = 0.046) and (p < 0.001, OR 0.02), respectively. While Amin et al. (2008) showed that significantly more obese versus none obese children were likely to have breakfast only 3–6 times/week (OR 2.6, 95% CI 1.9–3.6, p < 0.001) or < 2 times/week (OR 1.6, 95% CI 1.2–2.2, p < 0.001). Also, taking breakfast at home had an inverse relationship with the development of obesity and overweight (OR 0.54, 95% CI 0.33–0.89, p = 0.018).

On the other hand, the remaining two studies have indicated no significant relationship between breakfast intake and BMI status [1, 17] (Table 1). However, the latter did not provide sufficient statistical data to support the findings, as no p value was mentioned.

3.7.2. Secondary outcomes

Half of the studies did not include the measurement of socioeconomic status (SES) as illustrated in Table 1. Abalkhail and Shawky (2002) and Alsubaie (2010) have evaluated the association of socioeconomic status with breakfast intake status and found no difference in regular breakfast intake by SES. While Alsubaie (2010) and Amin et al., (2008) examined the relationship of SES with BMI status, Alsubaie (2010) found no association, but Amin et al. (2008) stated that living in urban areas (OR 1.85, p = 0.011), low maternal education (OR 1.87, p = 0.020), maternal occupation status (OR 1.85, p = 0.014), and being in small family (OR 1.95, p = 0.004) have significantly positive association with being overweight or obese. The same was indicated by Alhazzaa et al. (2012), but the SES was not clearly measured or classified. It was based on an assumption that children in private schools have higher SES and vice versa. The

survey indicated that being in private school was significantly associated with being overweight or obese (aOR 1.50, 95% CI 1.26–1.78, p = 0.000).

The breakfast intake and academic performance association was measured only in three studies [1], [15], and [18]. Alsubaie (2010) found a negative association between low academic performance and eating breakfast regularly with a p-value of ≤ 0.001. Abalkhail and Shawky's (2002) findings indicated that regular breakfast intake has an influence on school performance, 95% CI reporting 62.9–83.1 for fail/pass, 77.7–90.3 for good, 82.5–89.9 for very good, and 83.8–91.8 for excellent in regular breakfast consumers. While Aloboudi (2010) found insignificant association.

3.7.3. Summary

In terms of the main outcome, the evidence generally indicates that breakfast skipping has a negative effect on student's body weight. Therefore, students who skip breakfast are more likely to have a higher BMI than those who take breakfast regularly. Gender and age effects are demonstrated as strong confounders, showing that females and older subjects are more likely to skip breakfast. The overall weakness of study quality has limited the strength of evidence, largely a consequence of poor study design and a poor description of the study design in published papers, with uncontrolled confounding factors.

4. Discussion

This systematic review indicates that regular breakfast intake reduces the risk of overweight and obesity in children and young people in Saudi Arabia. They are more likely to have a normal BMI levels when compared to their peers who skip breakfast. Similar findings have been reported in the literature outside Saudi Arabia [6, 21, 29, 36, 43, 52, 61, 62, 64, 66, 67, 73]. Similarly, a systematic review and meta-analysis involving 19 observational studies conducted in Asian countries suggested the protective effect of breakfast consumption against developing overweight and obesity [41]. Also, in the USA children who skipped their breakfast are reported as having elevated levels of BMI when compared to consumers of breakfast [30].

However, in this present systematic review the relationship between breakfast and BMI was not statistically significant in two small studies by Alrethaiaa et al. (2010) with n = 357 subjects and Abalkhail and Shawky (2002) with n = 800 subjects. Both are in agreement with the recently published cross-sectional survey on 239 US adolescents

by Hopkins et al.'s (2017), where the effect was also not significant ($p < 0.10$). However, their focus group was only low-income urban families, and mostly African Americans, which cannot be generalized to the whole population [31].

4.1. Intervention and outcome definitions

This present systematic review has identified considerable variation in the method of defining overweight/obesity and measuring breakfast intake in this research field. Van Lippevelde et al. (2013), Tin et al. (2012), Tee et al. (2018), and Hopkins et al. (2017) used the same definition of breakfast as 'any food' consumed after wake up in the morning, while Utter et al. (2007) was focusing on 'at home breakfast' and defines it as 'anything' eaten 'at home' before going to school. A question could be raised here, whether eating 'anything' could be considered as enough to reflect breakfast? Only Arora et al. (2012) defined breakfast as the first 'meal' consumed in the morning. Adolphus, Lawton, and Dye (2013) suggest including breakfast frequency and composition in the evaluation, as well as distinguishing between weekends and weekdays. Unfortunately, no specification was indicated among included studies.

Moreover, the four different cut-off references found in the included studies have also created confusion. In the USA three reference values were compared on children and adolescents [35]. They reported similar estimates among three reference values, but they were not identical, especially when observing different age groups and genders. Inconsistency in comparison findings were found [35] and similar observations were presented by Wang and Wang (2000). Surprisingly, found significant differences between overweight and obesity prevalence – in percentages – in their sample of French children when comparing between four BMI cut-off values. The findings revealed 16.3%, 18.1%, 20.6%, and 23.9% of overweight and obesity using French, Cole et al.'s, CDC, and Must et al.'s values, respectively [58].

Abrantes, Lamounier and Colosimo (2003) and Flegal et al. (2001) have recommended the use of Cole et al.'s cut-off values for international level comparisons.

4.2. Considering other factors

This systematic review has found the same level of effect in both genders, which supports the findings of Nurul-Fadhilah et al., (2013) and Croezen et al. (2009). An age difference effect was also observed, as younger children are more likely to regularly consume their breakfast, as previously reported in earlier studies [6, 21, 62, 64, 66].

It is well-known that observational studies do not reflect the cause and effect relationship [38]. However, several lifestyle and dietary factors that underlie the association between skipping breakfast and weight status were found both in the literature and reviewed papers. For instance, regular breakfast intake was strongly associated with less consumption of high-fat food, and soft drinks; and more consumption of milk and dairy [13, 18]. BMI levels were also associated with physical activity, consumption of sugar-sweetened beverages, and snacking habits [14, 17, 18]. Moreover, eating with family negatively [17] and eating away from home was positively [19] associated with obesity and overweight.

4.3. Secondary outcomes

4.3.1. Socioeconomic status (SES)

Among all indicators of SES measurement, the income level was missing. Also, Abalkhail and Shawky (2002) have considered only mother's education and employment status. In Uganda, mother's educational status was the stronger predictor for children's health and nutrition status when compared to other SES indicators [68], the same finding was reported in Cambodia [47], and China [72] but that was only for rural areas. Al-agha et al. (2017) have explained that generally as children's eating patterns are mainly influenced by their mothers, therefore mother's education and occupation have a strong impact on their health and nutritional status. However, recent Spanish cohort demonstrated a significant direct impact of both parent's SES on the health of their children, in fact, they also found that the effect was more from father's than mother's SES [55]. Fortunately, Alomar, Parslow and Law (2018) have recently formulated two new indices that cover the SES diversities over all geographical regions in Saudi Arabia, as well as a SES classes, established from common perceptions of the population. It is anticipated that these suggested indices will contribute to a significant improvement in research in this field if a unified tool for SES is available in Saudi Arabia.

4.3.2. Academic performance

The analysis of Abalkhail and Shawky (2002), and Alsubaie (2010) were concerned with overall academic performances. However, it could be argued that self-reported academic performances in both papers may have resulted in inaccurate reporting, especially when it comes to a sensitive area for students [65].

Aloboudi (2010) focused on three subjects to evaluate the academic performance (Math, Science, and Reading). Arguably, there could be a chance of subject grades variability, children may achieve differently in different subjects as found by Ma (2001). It could also be anticipated that for that reason the result showed an association but failed to reach the significant level.

4.4. Ethical considerations

All included studies state that research approvals was obtained from different governmental authorities. In Saudi Arabia, the main ethics committee is The National Committee of Medical and Bioethics (NCBE) [32]. However, the primary studies of this current systematic review did not state clearly the inclusion of that registered committee.

In addition, children are categorized as a 'vulnerable' group, and additional precautions should be taken into account when conducting research involving this category [10]. The Research Ethic Guidebook (2018) clearly emphasizes the importance of children and parents consents and this is also found at the top of almost all ethic guidelines of Arabian countries [11]. However, 5 out of 8 papers in the present systematic review did not state whether any participants or parents informed consent was obtained. One study stated that in Saudi Arabia parent's consents are not considered necessary especially when there is an approval from the Ministry of education [18].

4.5. Strength and limitation

This systematic review has successfully reached its aim of identifying studies evaluating the nutritional habits of children in many different cities around Saudi Arabia, both from published and unpublished sources, to reduce the chance of publication bias. This is the first study, to the best of the author's knowledge, to investigate the correlation between breakfast habit and children's body weight for that particular country. The review has also succeeded in correlating the relationship. However, several unavoidable limitations were observed and should be acknowledged.

A limited number of relevant studies were obtained, most of which failed to focus on breakfast as the main element of investigation. With a shortcoming caused by the study design. Moreover, failure to undertake meta-analysis was due to the clinical heterogeneity of interventions and outcomes [39]. Lack of standardized definitions of

breakfast intake/skip, overweight/obesity, and the secondary outcomes were significant among the included studies. Which may contribute to incomparable variations in evidence.

5. Conclusion and Recommendations

Overall, this systematic review suggests that breakfast consumption is associated with reducing the risk of overweight and obesity in children and young people living in Saudi Arabia, by having a direct impact on their BMI. However, the overall quality of included studies was not strong enough to support that evidence. Therefore, ascertainment and causality should not be assumed based on findings of this review, strongly suggesting a need for further large research studies in this field, to answer the question of the mechanism of that impact.

In addition, our findings suggest adopting awareness programs for children and their families, with more focus on adolescents. Such programs should target schools, universities, community centers, and media in highlighting the impact of breakfast intake in the prevention of overweight/obesity. Additionally, when children are not consuming breakfast at home, it could be highly beneficial to have healthy breakfast meal sessions at school before starting their academic lessons, where children are able either to bring their packed breakfast or have a balanced meal from the school, organized by dietitians.

In research, there is a need for a unified definition of breakfast and how to measure its frequency, a unified cut-off values of BMI suitable for the Saudi population, as well as a well-known index of measuring SES. This will all ensure a higher level of evidence reported in Saudi studies.

Conflicts of Interest

This research was conducted as a part of the MSc Advanced Professional Practice program with the University of Plymouth, UK, and the authors declare no conflict of interest or funding for this project.

Acknowledgment

The authors are grateful to the staff of the University of Plymouth for their support in completing this work, especially the library specialist as well as the statistician for

their contribution and valuable help. They also acknowledge their families and friends for their endless support and encouragement.

References

[1] Abalkhail, B. and Shawky, S. (2002). Prevalence of daily breakfast intake, iron deficiency anaemia and awareness of being anaemic among Saudi school students. International Journal of Food Sciences and Nutrition, vol. 53, no. 6, pp. 519–528. DOI: 10.1080/09637480220164370

[2] Abarca-Gómez, L., et al. (2017). Worldwide trends in body-mass index, underweight, overweight, and obesity from 1975 to 2016: A pooled analysis of 2416 population-based measurement studies in 128·9 million children, adolescents, and adults. The Lancet, vol. 390, no. 10113, pp. 2627–2642. DOI: 10.1016/S0140-6736(17)32129-3

[3] Abrantes, M. M., Lamounier, J. A., and Colosimo, E. A. (2003). Comparison of body mass index values proposed by Cole et al. (2000) and Must et al. (1991) for identifying obese children with weight-for-height index recommended by the World Health Organization. Public Health Nutrition, vol. 6, no. 03, pp. 307–311. DOI: 10.1079/PHN2002426

[4] Adolphus, K., et al. (2017). Methodological challenges in studies examining the effects of breakfast on cognitive performance and appetite in children and adolescents. Advances in Nutrition: An International Review Journal, vol. 8, no. 1, pp. 184S–196S. DOI: 10.3945/an.116.012831

[5] Adolphus, K., Lawton, C. L., and Dye, L. (2013). The effects of breakfast on behavior and academic performance in children and adolescents. Frontiers in Human Neuroscience, vol. 7(August), pp. 1–28. DOI: 10.3389/fnhum.2013.00425

[6] Affenito, S. G., et al. (2005). Breakfast consumption by African-American and white adolescent girls correlates positively with calcium and fiber intake and negatively with body mass index. Journal of the American Dietetic Association, vol. 105, no. 6, pp. 938–945. DOI: 10.1016/j.jada.2005.03.003

[7] Al-agha, A. E., et al. (2017). Parental socioeconomic status and occupation in relation to childhood obesity. International Journal of Modern Research & Development, pp. 0–8.

[8] Al-Ahmadi, H. (2011). Challenges facing women leaders in Saudi Arabia. Human Resource Development International, vol. 14, no. 2, pp. 149–166. DOI: 10.1080/13678868.2011.558311

[9] Al-Munajjed, M. (2010). Women's Employment in Saudi Arabia: A major challenge. Booz & Company Inc. Available at: https://www.hashdoc.com/documents/4474/women-s-employment-in-saudi-arabia-a-major-challenge

[10] Alahmad, G. (2017). The Saudi Law of Ethics of Research on Living Creatures and its implementing regulations. Developing World Bioethics, vol. 17, no. 2, pp. 63–69. DOI: 10.1111/dewb.12114

[11] Alahmad, G., Al-Jumah, M., and Dierickx, K. (2012). Review of national research ethics regulations and guidelines in Middle Eastern Arab countries. BMC Medical Ethics, vol. 13, no. 1. DOI: 10.1186/1472-6939-13-34

[12] Alenazi, S. A., et al. (2014). Effect of breakfast on Body Mass Index (BMI) in male Region Saudi Arabia. Khyber Medical University Journal, (December), pp. 4–7.

[13] Alhazzaa, H. M., et al. (2011). Physical activity, sedentary behaviors and dietary habits among Saudi adolescents relative to age, gender and region. International Journal of Behavioral Nutrition and Physical Activity, vol. 8, no. 1, p. 140. DOI: 10.1186/1479-5868-8-140

[14] Alhazzaa, H. M., et al. (2012). Lifestyle factors associated with overweight and obesity among Saudi adolescents. BMC Public Health, vol. 12, no. 1, p. 354. DOI: 10.1186/1471-2458-12-354

[15] Aloboudi, L. M. (2010). Impact of breakfast eating pattern on nutritional status, glucose level, iron status in blood and test grades among upper primary school girls in Riyadh City, Saudi Arabia. Pakistan Journal of Nutrition, vol. 9, no. 2, pp. 106–111. DOI: 1680-5194

[16] Alomar, R. S., Parslow, R. C., and Law, G. R. (2018). Development of two socioeconomic indices for Saudi Arabia. BMC Public Health, pp. 1–10. DOI: 10.1186/s12889-018-5723-z

[17] Alrethaiaa, et al. (2010). Obesity and eating habits among college students in Saudi Arabia: A cross sectional study. Nutrition Journal, vol. 9, no. 1. Available at: http://ovidsp.ovid.com/ovidweb.cgi?T=JS&PAGE=reference&D=emed12&NEWS=N&AN=51079548

[18] Alsubaie, A. S. R. (2010). An epidemiological investigation of health-related behaviours among male high School adolescents in Riyadh, Saudi Arabia.

[19] Amin, et al. (2008). Overweight and obesity and their relation to dietary habits and socio-demographic characteristics among male primary school children in Al-Hassa, Kingdom of Saudi Arabia. European Journal of Nutrition, vol. 47, no. 6, pp. 310–318. DOI: 10.1007/s00394-008-0727-6

[20] Armijo-Olivo, S., Stiles, C., Hagen, N., et al. (2012). Assessment of study quality for systematic reviews: A comparison of the cochrane collaboration risk of bias tool and effective public health practice project quality assessment tool: Methodological research. Journal of Evaluation in Clinical Practice, vol. 18, no. 1, pp. 12–18. DOI: https://doi.org/10.1111/j.1365-2753.2010.01516.x

[21] Arora, M., et al. (2012). Association of breakfast intake with obesity, dietary and physical activity behavior among urban school-aged adolescents in Delhi, India: Results of a cross-sectional study. BMC Public Health, vol. 12, no. 1, p. 1. DOI: 10.1186/1471-2458-12-881

[22] Elmouzan, M., Foster, P., Alherbish, A., et al. (2010). Prevalence of overweight and obesity in Saudi Children and adolescents. Annals of Saudi Medicine, vol. 30, no. 3, pp. 203–208. DOI: 10.4103/0256-4947.62833

[23] Centre for Reviews and Dissemination (CRD). (2009). Systematic reviews: CRD's guidance for undertaking reviews in health care. Centre for Reviews and Dissemination, University of York. DOI: 10.1016/S1473-3099(10)70065-7

[24] Di Cesare, M., et al. (2016). Trends in adult body-mass index in 200 countries from 1975 to 2014: A pooled analysis of 1698 population-based measurement studies with 19.2 million participants. The Lancet, vol. 387, no. 10026, pp. 1377–1396. DOI: 10.1016/S0140-6736(16)30054-X

[25] Classbase. (2012). Grading System in Saudi Arabia. Available at: https://www.classbase.com/Countries/saudi-arabia/Grading-System (accessed on August 13, 2018).

[26] Cochrane Training. (2015). Training. Available at: https://training.cochrane.org/ (accessed on August 13, 2018).

[27] Cole, T. J., et al. (2000). Establishing a standard definition for child overweight and obesity worldwide: international survey. BMJ, vol. 320(Table 1), pp. 1–6. DOI: 10.1136/bmj.320.7244.1240

[28] Cooper, S. B., Bandelow, S., and Nevill, M. E. (2011). Breakfast consumption and cognitive function in adolescent schoolchildren. Physiology and Behavior, vol. 103, no. 5, pp. 431–439. DOI: 10.1016/j.physbeh.2011.03.018

[29] Croezen, S., et al. (2009). Skipping breakfast, alcohol consumption and physical inactivity as risk factors for overweight and obesity in adolescents: Results of the E-MOVO project. European Journal of Clinical Nutrition, vol. 63, no. 3, pp. 405–412. DOI: 10.1038/sj.ejcn.1602950

[30] Deshmukh-Taskar, P., Nicklas, T., O'Neil, C., et al. (2010). The relationship of breakfast skipping and type of breakfast consumption with nutrient intake and weight status

in children and adolescents: The National Health and Nutrition Examination Survey 1999-2006'. Journal of the Academy of Nutrition and Dietietics, vol. 110, no. 6, pp. 869–878. DOI: https://doi.org/10.1016/j.jada.2010.03.023

[31] Druckman, J., Green, D., Kuklinski, J., et al. (2011). Cambridge Handbook of Expermintal Political Science. Cambridge University Press.

[32] Duke Clinical Research Institute. (2018). Ethics Committee Information: Saudi Arabia. Available at: https://www.nihcollaboratory.org/sites/CbyC/Lists/ETHICS%20COMMITTEE%20INFORMATION/DispForm.aspx?ID=36&ContentTypeId=0x01000F9988E277B3584D96CBED4023CCC88A (accessed on August 13, 2018).

[33] Farghaly, N. F., et al. (2007). Life style and nutrition and their impact on health of Saudi school students in Abha, Southwestern region of Saudi Arabia. Saudi Medical Journal, vol. 28, no. 3, pp. 415–421.

[34] Finkelstein, E. A., et al. (2009). Annual medical spending attributable to obesity: Payer-and service-specific estimates. Health Affairs, vol. 28, no. 5, pp. 822–831. DOI: 10.1377/hlthaff.28.5.w822

[35] Flegal, K., et al. (2001). Prevalence of overweight in US children: Comparison of US growth charts from the Centers for Disease Control and Prevention with other reference values for body mass index. American Journal of Clinical Nutrition, vol. 73, no. 6, pp. 1086–1093. Available at: http://search.ebscohost.com/login.aspx?direct=true&db=rzh&AN=107062966&site=ehost-live&scope=site

[36] Godlin Jeneta, J. and Preetha. (2016). Effect of breakfast in body mass index among college going students. Journal of Pharmaceutical Sciences and Research, vol. 8, no. 6, pp. 545–551.

[37] Hastings, C. and Fisher, C. (2014). Searching for proof: Creating and using an actionable PICO question. Nursing Management, vol. 45, no. 8, pp. 9–12.

[38] Hickson, M. (2008). Research Handbook for Healthcare Professionals. Oxford: Blackwell Publishing.

[39] Higgins, J. P. T. and Green, S. (ed.). (2011). Cochrane Handbook for Systematic Reviews of Interventions, Version 5.1.0 [updated March 2011], The Cochrane Collaboration, 2011. Available at: www.handbook.cochrane.org

[40] Hopkins, L. C., et al. (2017). Breakfast consumption frequency and its relationships to overall diet quality, using Healthy Eating Index 2010, and Body Mass Index among adolescents in a low-income urban setting. Ecology of Food and Nutrition, vol. 56, no. 4, pp. 297–311. DOI: 10.1080/03670244.2017.1327855

[41] Horikawa, C., et al. (2011). Skipping breakfast and prevalence of overweight and obesity in Asian and Pacific regions: A meta-analysis. Preventive Medicine, vol. 53, no. 4–5, pp. 260–267. DOI: 10.1016/j.ypmed.2011.08.030

[42] Joanna Briggs Institute (JBI). (2018). The JBI Approach. Available at: http://joannabriggs.org/jbi-approach.html#tabbed-nav=JBI-approach (accessed on August 13, 2018).

[43] Van Lippevelde, W., et al. (2013). Associations between family-related factors, breakfast consumption and BMI among 10- To 12-year-old european children: The cross-sectional energy-study. PLoS ONE, vol. 8, no. 11. DOI: 10.1371/journal.pone.0079550

[44] Ma, X. (2001). Stability of school academic performance across subject areas. Journal of Educational Measurement, vol. 38, no. 1, pp. 1–18. DOI: 10.1111/j.1745-3984.2001.tb01114.x

[45] McMaster University. (2018). Effective Public Health Practice Project. Available at: https://merst.ca/ephpp/ (accessed on August 13, 2018).

[46] Mendeley. (2018). Software Reference Manager. Available at: https://www.mendeley.com/homepage4/?switchedFrom= (accessed on August 13, 2018).

[47] Miller, J. E. and Rodgers, Y. V. (2009). Mother's education and children's nutritional status: New evidence from Cambodia. Asian Development Review, vol. 26, no. 1.

[48] Musaiger, A. (2007). Overweight and obesity in the Arab countries: The need for action. Arab Center for Nutrition (January).

[49] Must, A., Dallal, G. E., and Dietz, W. H. (1991). Reference data for obesity: 85th and 95th percentiles of Body Mass Index and Triceps Skinfold Thickness. American Journal of Clinical Nutrition.

[50] National Institutes of Health. (1998). Clinical guidelines on the identification, evaluation, and treatment of overweight and obesity in adults. WMJ Official Publication of the State Medical Society of Wisconsin, vol. 158, Suppl. 2, pp. 51S–209S. DOI: 10.1001/jama.2012.39

[51] Ng, M., et al. (2014). Global, regional, and national prevalence of overweight and obesity in children and adults during 1980–2013: A systematic analysis for the Global Burden of Disease Study 2013. The Lancet, vol. 384, no. 9945, pp. 766–781. DOI: 10.1016/S0140-6736(14)60460-8

[52] Nurul-Fadhilah, A., et al. (2013). Infrequent breakfast consumption is associated with higher body adiposity and abdominal obesity in Malaysian School-aged adolescents. PLoS ONE, vol. 8, no. 3, pp. 1–6. DOI: 10.1371/journal.pone.0059297

[53] O'Neil, C. E., et al. (2014). The role of breakfast in health: Definition and criteria for a quality breakfast. Journal of the Academy of Nutrition and Dietetics, vol. 114, no. 12, pp. S8–S26. DOI: 10.1016/j.jand.2014.08.022

[54] Papandreou, C., Mourad, T. A., Jildeh, C., et al. (2008). Obesity in Mediterranean region (1997-2007): A systematic review. Obesity Review, vol. 9, no. 5, pp. 389–399. DOI: 10.1111/j.1467-789X.2007.00466.x

[55] Pinilla, J., Lopez-Valcarcel, B. G., and Urbanos-Garrido, R. M. (2017). Estimating direct effects of parental occupation on Spaniards' health by birth cohort. BMC Public Health, vol. 17, no. 1, pp. 1–9. DOI: 10.1186/s12889-016-3997-6

[56] Preferred Reporting Items for Systematic Reviews and Meta-Analysis (2015) PRISMA Flow Diagram. Available at: http://www.prisma-statement.org/PRISMAStatement/FlowDiagram (accessed on August 13, 2018).

[57] PROSPERO. (2018). Available at: https://www.crd.york.ac.uk/PROSPERO/. (accessed on August 13, 2018).

[58] Rolland-Cachera, M. F., et al. (2002). Body mass index in 7-9-y-old French children: Frequency of obesity, overweight and thinness. International Journal of Obesity, vol. 26, no. 12, pp. 1610–1616. DOI: 10.1038/sj.ijo.0802146

[59] Sakuma, A., Maeoomichi, N., Oda, M., et al. (2004). Correlation of health condition, physique and dietary-lifestyle of first grade and sixth grade primary school children and their mothers. Nihon Koshu Eisei Zassh, vol. 51, no. 7, pp. 483–495.

[60] Spence, C. (2017). Breakfast: The most important meal of the day? International Journal of Gastronomy and Food Science, vol. 8 (January), pp. 1–6. DOI: 10.1016/j.ijgfs.2017.01.003

[61] Szajewska, H. and Ruszczyński, M. (2010). Systematic review demonstrating that breakfast consumption influences body weight outcomes in children and adolescents in Europe. Critical Reviews in Food Science and Nutrition, vol. 50, no. 2, pp. 113–119. DOI: 10.1080/10408390903467514

[62] Tee, E. S., et al. (2018). Breakfast consumption among Malaysian primary and secondary school children and relationship with body weight status – Findings from the MyBreakfast Study. Asia Pacific Journal of Clinical Nutrition, vol. 27, no. 2, pp. 421–432. DOI: 10.6133/apjcn.062017.12

[63] The Research Ethic Guidebook. (2018). Research with Children. Available at: http://www.ethicsguidebook.ac.uk/Research-with-children-105 (accessed on August 13, 2018).

[64] Tin, S. P. P., et al. (2012). Location of breakfast consumption predicts body mass index change in young Hong Kong children. International Journal of Obesity, vol. 36, no. 7, pp. 925–930. DOI: 10.1038/ijo.2011.262

[65] University of Washington. (2018). Assessing Student Learning. Available at: http://www.washington.edu/teaching/teaching-resources/assessing-a (accessed on August 13, 2018).

[66] Utter, J., et al. (2007). At-home breakfast consumption among New Zealand children: Associations with Body Mass Index and Related Nutrition Behaviors {A figure is presented}. Journal of the American Dietetic Association, vol. 107, no. 4, pp. 570–576. DOI: 10.1016/j.jada.2007.01.010

[67] Veltsista, A., et al. (2010). Relationship between eating behavior, breakfast consumption, and obesity among Finnish and Greek adolescents. Journal of Nutrition Education and Behavior, vol. 42, no. 6, pp. 417–421. DOI: 10.1016/j.jneb.2009.12.004

[68] Wamani, H., et al. (2004). Mothers' education but not fathers' education, household assets or land ownership is the best predictor of child health inequalities in rural Uganda. International Journal for Equity in Health, vol. 3, pp. 1–8. DOI: 10.1186/1475-9276-3-1

[69] Wang, Y. and Wang, J. Q. (2000). Standard definition of child overweight and obesity worldwide. BMJ, vol. 321, no. 7269, p. 1155. DOI: 10.1136/bmj.321.7269.1155

[70] World Health Organization. (2000). Obesity: Preventing and managing the global epidemic. WHO Technical Report Series.

[71] World Obesity Federation. (2015). Obesity prevalence worldwide-adult. Available at: https://www.worldobesity.org/data/map/overview-adults (accessed on August 13, 2018).

[72] Wu, X. (2011). Child Health and Parental Socioeconomic Status: Evidence From Urban and Rural China.

[73] Wunstel, J. W., et al. (2015). Habitual eating breaskfast consumption frequency of selected food and overweight prevalence in adolescents. Developmental Period Medicine, pp. 193–201.

Vitamin D Supplementation does not Effect Adiposity in Healthy Adults

Zujaja-Tul-Noor Hamid Mehmood and Dimitrios Papandreou

Department of Natural Sciences and Public Health, Zayed University, Abudhabi, UAE

Corresponding Author: Zujaja-Tul-Noor Hamid Mehmood; email: ztnoor4@gmail.com

Abstract

Introduction: Vitamin D is crucial for skeletal and extraskeletal health outcomes as Vitamin D binding receptors are located through out body, and epidemiological data supports its link with many conditions. Data on vitamin D levels and especially Vitamin D supplementation in U.A.E. is essentially inadequate.

Design: Subjects (n = 20) in this 1 month prospective study were given 2000 IU of daily Vitamin D without any special dietary or physical activity changes. Anthropometrics (weight, waist circumference, hip circumference), Vitamin D/ Calcium food frequency questionnaire and 24 –Hour recall were collected.

Results: Mean age of subjects was 28.7 years, and baseline mean serum Vitamin D level of 17.5 ng/mL ±6.47. It increased Vitamin D serum levels by a mean of 6.76 ng/mL. Hip Circumference also reduced statistically significantly by moderate 2% (p 0.03 ± 0.59),

Conclusion: Vitamin D supplementation moderate dose daily can be pivotal in acquiring health benefits and reducing adiposity related factors. However, this surely calls for further investigation for longer period.

Keywords: Vitamin D; weight loss; body mass index; Calcium, VDR

1. Introduction

Literature reviews have abundantly identified Vitamin D deficiency and insufficiency as a pandemic since decades, with initial review specifically addressing this issue in terms of skeletal importance [11, 23]. According to the Institute of Medicine (IOM) Committee, the scientific evidence supports key role of Vitamin D in skeletal health and extraskeletal health, however, the extraskeletal health research outcomes are not yet consistent to establish cause-and-effect relationship (Institute of Medicine [14]. Vitamin D is considered to mediate its genomic role through Vitamin D binding receptors that are transcription factor responsible for extensive biological responses. It is shown to play role in cell proliferation inhibition, cell maturation, or in many other tissues, such as, skin, immune system, and possibly colonic, breast and prostate

cancer [26]. This Hypovitaminosis D would be further discussed in terms of its potential relationship with chronic diseases, specially focusing on obesity as the basic agenda.

In the 2011 conference of Institute of Medicine, the RDA for Vitamin D was set at 600 IU/d for ages 1-70 years and 800 IU/d for ages 71 years and older(Institute of Medicine [14]. However, the doses are still subjective, especially in obese population. Vitamin D deficiency is defined as a 25(OH)D below 20 ng/ml (50 nmol/liter) and vitamin D insufficiency as a 25(OH) D of 21–29 ng/ml (52.5–72.5) nmol/liter [12]. Humans may meet these needs through endogenous production, but the dietary sources support increased demand.

Factors to explain Vitamin D deficiency have been described from long times. Sunlight exposure is the key player in natural production of Vitamin D, and any factor influencing the access to the specific Ultraviolet B rays range for Vitamin D effect cutaneous synthesis of Vitamin D. This can include sunscreen use, increased skin pigmentation, angle at which sun reaches the earth (angles at zenith), time of day, season covering body completely at all times outside, aging as precursor of Vitamin D_3 reduces in body, and obesity due to fat storage in adipocytes [13, 24].

WHO states that in 2014 more than 1.9 billion adults were overweight, of which 600 million were obese(WHO, 2015). The avoidable risk factors for the healthy years lost due to rising disease burden include high BMI and physical inactivity according to the Global Burden of Disease report of USA, [14]. Obese people had two fold higher chances of having multi-morbidities [1]. In many studies. on various chronic conditions, overweight and obesity were considered to be major contributors to burden of chronic diseases [6, 16, 18]. Obesity is also linked as a risk factor for several cancers, with obese patients having poorer prognosis and response to standard treatment [21]. Obesity is majorly an imbalance between energy intake and expenditure. The key to manage obesity and chronic conditions could be through diet.

Many studies report changes in Vitamin D status with BMI changes. A change in serum Vitamin D levels as a function of adiposity/weight loss was noted over 1-2 years [4, 8]. An inverse relationship between Vitamin D and BMI was recognized in mendelian randomization analysis [29], and link with visceral or subcutaneous adipose tissue was also recognized [10, 17]. In meta-analysis of observational studies until April 2014 in PubMed/Medline, an association between obesity and Vitamin D was found, irrespective of age, latitude and cut-offs to define vitamin D deficiency [22]. BMI was strongly associated with plasma 25(OH)D and PTH concentrations with possible contribution of plasma 25(OH)D in the pathogenesis of hypertriglyceridemia and atherogenic dyslipidemia through inflammation, because the association disappeared when uCRP (ultrasensitive C Reactive Protein) was introduced as covariable [9]. 25OHD low levels and unfavorable lipid patterns has been found in children too [25].

The purpose of this study is:

1. To identify Vitamin D status of Emarati females in a convenient sample from Abu Dhabi and their dietary Vitamin D and Calcium consumption.

2. To explore changes in Vitamin D levels with supplementation of 2000 IU of Vitamin D3 for 1 month in Vitamin D deficient and insufficient females.

3. To explore changes in selected anthropometrics after intervention.

4. Compare changes in selected anthropometrics of Vitamin D deficient and insufficient subjects after intervention.

5. Compare changes in selected anthropometrics between marginally underweight + normal weight and overweight + marginally obese subjects after intervention

2. Methodology

The prospective intervention study included 24 healthy female residents and nationals of Abu Dhabi, U.A.E with end-results subject size of 21 females. Full Ethical Clearance from Zayed University research committee was obtained for this study, and all subjects signed a consent form.

2.1. Participants

Females from Zayed University and in general community between 18-45 years were conveniently asked to participate in this research. The exclusion criteria with potential participants were discussed before recruit to prevent dropout, however, all participants were finalized after screening by their first blood results. The exclusion criteria included pregnancy, breast-feeding status, renal disease, pre-existing parathyroid, thyroid, or calcium metabolism disorders, sarcoidosis, intake of calcium channel blockers, diabetes, active malignancies (other than non-melanoma skin cancer), Vitamin D supplementation intake in past 6 months.

Participants were invited and recruited from 1st February 2016 until 28th February 2016. An information sheet was circulated disclosing the detail of the procedure to provide complete information. Subjects signed consent from to voluntarily agree and commit to protocol.

2.2. Anthropometric Information

Adiposity measures were measured using weight, BMI, Waist Circumference, Hip Circumference, Waist-to-hip ratio. Anthropometric information was collected at the baseline and after 1 month. The height measurement was taken using portable stadiometer standing in an upright position, to the nearest 0.5 cm, and weight on an electronic scale with accuracy of ±0.1 kg without shoes and light clothing before breakfast in early morning between 6am to 10am. Waist and Hip circumference were recorded at each visit using non-stretchable measuring tape (measured to nearest ± 0.5cm) according to the standard procedure by World Health Organization (WHO) [13]. Waist circumference was taken with placement of measuring tape around the midpoint between the bottom of the rib cage and above the tip of the iliac crest. Subjects stood with arms at the sides, feet positioned close together, and weight evenly distributed across the feet. They were requested to inspire and expire normally first, and then waist was measured, in accordance to WHO standards [13]. Hip circumference to further calculate Waist-to-Hip ratio was taken as the largest circumference of the buttocks with tape running parallel to the floor [30]. Women: > 88 cm (35 inches), Men: > 102 cm (40 inches) waist circumference were classified as abdominally obese (National Institute of Health). Abdominal obesity is further defined as waist–hip ratio above 0.90 for males and above 0.85 for females, or a BMI above 30.0 [30]. Body mass index will be calculated as bodyweight divided by body height squared.

2.3. Questionnaires

A general questionnaire was given to all participants for screening purposes with questions regarding their medical conditions, age, smoking status, and were also asked to self-identify their weight and physical activity status.

2.4. Dietary Information

Food frequency questionnaire that has previously been validated in Zayed University students was used to assess Vitamin D and calcium intake amongst participants at beginning of the study and at the end (Papandreou et al., 2014). It includes foods with Vitamin D and Calcium commonly consumed in U.A.E , such as, Milk, tea, yogurt, cheeses, greens, breads, fish, eggs etc, and was listed in standard serving/ portion sizes with pictures to assist further. Participants mentioned their average serving per day and per week, which was then used to find an average consumption of Vitamin D and Calcium per day.

	Frequency	Percent	Cumulative Percent
Deficient	9	43	43
Insufficient	11	52	95
Sufficient	1	5	100
Total	21	100	

Table 1: Sample distribution by Vitamin D sufficient, insufficient and deficient categories.

24-Hour recall was collected at baseline and at the end to identify the patient's intake and assess if it was maintained throughout the study period. As per study protocol, all subjects consumed 2 tablets for 1000IU (as available in pharmacies) together before food, every day for 1 month. The tablets consumed were counted in the periodically.

2.5. Statistics

The data accumulated was processed using SPSS version 18 software. Descriptive statistics were used to explore baseline characteristics and normal distribution using the histograms, kurtosis, skewness and Q-Q plots. Final decision for normality was based on Kolmogorov-Smirnova test. In descriptive analyses, continuous variables were reported as mean +/- SD (Standard Deviation) and/or median with IQR (interquartile range) in the case of non-normally distributed continuous data. Levene's test was used to look at variances in group for normaly distributed data. Paired sample T-test was used to analyze changes from baseline after treatment in normally distributed data. Mann-whitney U test for analyzing heterogeneity between two independent groups for non-normal data and Wilcoxon for after intervention effects in continuous data in paired samples.

3. Results

The final subject size includes 20 females for which results were analyzed statistically.

3.1. Subject Characteristics

Subjects from this sample included almost equal size of females with deficient and insufficient category of Vitamin D serum levels. For observing changes in Vitamin D levels with supplementation in deficient or insufficient categories, the participant with sufficient Vitamin D level was excluded.

BMI Categories	Frequency	Percent	Cumulative Percent
Underweight	2	10	10
Normal weight	8	40	50
Overweight	8	40	90
Obese	2	10	100
Total	20	100	

Table 2: Subject distribution by BMI categories Obesity.

	Mean	Std. Deviation	Median	Interquartile Range
Age (yrs)	28.7	9.26	24.5	17
Calcium (mg/dL)	9.3593	0.28901	9.34	0.3
Vitamin D (ng/mL)	17.51	6.47	16.2	8.25
Calorie Intake (Kcal/day)	1248.2	359.8	1167	479
MET-minutes/week	2036.45	1976.83	1234	2392
Dietary Vitamin D intake (IU/day)	289.25	246.11	180	410
Dietary Calcium Intake (mg/day)	1618.6	858.38	1505	1428
Weight (Kg)	62.63	11.89	64.3	20.52
BMI (Kg/m^2)	24.54	4.66	25.9	8.1
Waist Circumference (inches)	29.65	3.96	29.5	5.88
Hip Circumference (inches)	39.75	4.05	40.5	8.5
Waist-to-hip ratio	0.74	0.05	0.74	0.07

Table 3: Baseline Characteristics of the subjects.

Subjects by their BMI were equally distributed. 10 females were in normal weight and by a small margin in underweight category, and other 10 subjects in overweight or marginally obese category.

Baseline characteristics of subjects are demonstrated in the following table with mean values and their standard deviations for all normally distributed data, and/or median with their interquartile ranges for non-normally distributed data indicated with. Calcium, Vitamin D, Calorie intake, Dietary Calcium intake, Weight, BMI, Waist Circumference, Hip Circumference and Wasit-to-hip ratio are normally distributed, and their mean and standard deviation are more representative of sample population. Whereas, for rest of the variables, due to non-normal distribution, Table 3. shows the average age for this study subjects was 28.7 and Vitamin D was 17.5 ng/mL. The Dietary Vitamin D consumption was low as compared to the guidelines by Endocrine society [12].

All the subjects improved their Vitamin D status, and many reached optimal levels.

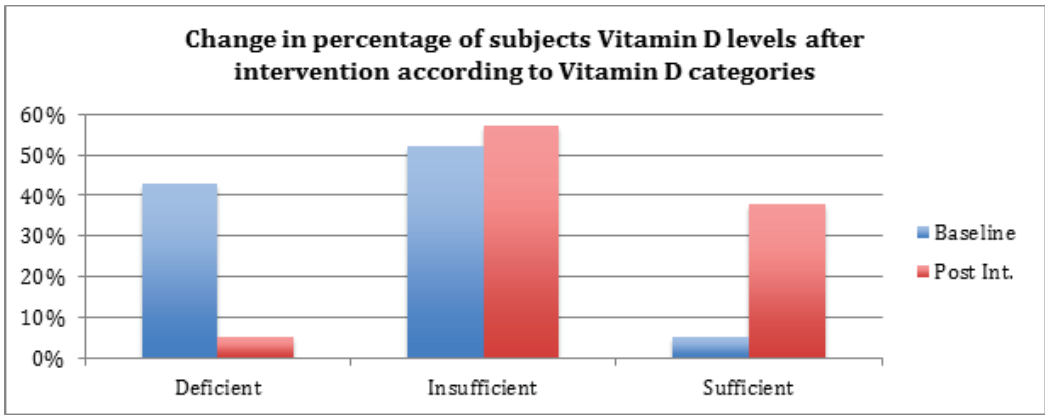

Figure 1: Improvement in Vitamin D status depicted as percentage change from baseline.

4. Discussion

Endocrine society recommends adults aged 19-50 years to consume 600 IU/d to maximize bone health and muscle function. And, to further rise Vitamin D serum levels above 30 ng/mL they require at least 1500 – 2000 IU of Vitamin D. However, as observed in this data the dietary Vitamin D is inadequate to meet the regular needs and thus can explain deficiency in U.A.E. females. Moreover, since this study was conducted during spring and/or early summer it is assumed that outdoor exposure to sunlight was more than rest of the year, but still the Vitamin D levels did not reach above 30ng/mL to sufficient levels in this sample. This study supports the previous results of very high Hypovitaminosis D in U.A.E. females [3, 19, 28]. Other significant result noticeable is that dietary Vitamin D is not linked to Vitamin D status in general population of Emarati females from Abu Dhabi, and this was also observed in previous studies in university sample from Abu Dhabi [2], hence supplement use might me be the best way to achieve Vitamin D sufficient levels in this temperate country females. In this study Vitamin D supplementation of 2000IU for 1 month yielded 39% increase in Vitamin D level from baseline (mean change of 6.76 ng/mL), thus supporting the thesis.

The results of this study do not report significant changes in weight or BMI, and this is consistent with a meta-analysis which concludes that BMI and body weight were less meaningful measure for reporting adiposity change after Vitamin D supplementation compared to fat mass and distribution [5]. Although clinically mild change of -2%, but statistically significant relationship was observed between Vitamin D supplementation and hip circumference, and only a small change in waist circumference of 1% reduction was observed, which is better than changes in BMI or weight (0% change), and thus also supports the previous conclusion. This could be explained by the alteration in expression of inflammatory cytokines, as it was previously discussed that cytokines

may be differently expressed in subcutaneous or visceral adipose tissue. Some studies do not support any link between Vitamin D supplementation and obesity. Supplementation with vitamin D showed no effect on adiposity measures in adults [5] An increase in serum levels of 25OHD or other inflammatory markers in overweight and obese youths with 150,000IU supplementation every 3 months was not registered in one study, which demands investigation regarding potential dosage and frequency [27] since, another trial with dosage as low as 400IU up till 4800IU daily yielded serum changes when administered for 12 months [7]. Hypovitaminosis D in overweight or obese individuals is registered in many studies, usually accompanied with other health conditions.

5. Study Limitations

One of the major limitation of this study was that in the last 2 weeks of intervention period it was spring break, due to which few subjects were active by maximum 100 MET-minutes/week more than baseline. This also resulted in weight increments for few subjects as 4 subjects reported overeating or out-of-normal eating, and this was also reflected by increment in their calorie consumption in 24-hour recall at the end of the study. Other limitation was the small subject size due to exclusion criteria, blood test, and especially going to a specific facility for blood test because this was the main reason of refusal upon invitation for participation.

Most of the studies have been carried out for atleast 8 weeks and commonly 12 weeks, and even endocrine society recommends Vitamin D supplementation for 8 weeks to achieve optimal serum levels. This study due to time restraints could be carried for 1 month, however, the strength lies in its results, which are in accordance with previous studies, and it also demonstrates strong statistical significance for those results. Longer duration trial would surely be helpful and would allow to further asses the requirement of maintenance plan. One variable that was missed in this study for investigation was to assess the sun exposure or sun avoidance in the subjects to find any relationship with improvement in Vitamin D status. A control group similarly could have assisted further in comparing the results.

6. Conclusion and Recommendations

The latest research supports Vitamin D role in obesity prevention and occurrence. Vitamin D supplementation trials reflect the benefits too, however, due to heterogeneity in dosage, biochemical analysis, trial period, BMI variations etc, further trials are needed

because some review analysis do not support the conclusion, and specifically designed trials with minimal heterogeneity can answer those questions.

This study supports the high Hypovitaminosis D figures in UAE females as reported previously. It can be concluded that Vitamin D supplementation has mild effects on reducing weight or BMI, however, as per previous study it supports changes in fat mass by reduction in hip and waist circumference in subjects. This study also evaluates the dietary role of Vitamin D but there was no relationship with serum Vitamin D, hence in this population supplements could be more pivotal. Further studies on variable doses of Vitamin D and maintenance therapy are needed because data on Vitamin D in UAE population is higly inadequate to make references to the whole population. Supplementation can be the best approach, because it has been shown from a previous study on UAE population and in this study that serum Vitamin D and dietary Vitamin D do not follow a strong correltion.

References

[1] C. B. Agborsangaya, E. Ngwakongnwi, M. Lahtinen, T. Cooke, and J. A. Johnson, "Multimorbidity prevalence in the general population: The role of obesity in chronic disease clustering," *BMC Public Health*, vol. 13, pp. 1161–2458, 2013.

[2] F. Al Anouti, J. Thomas, L. Abdel-Wareth, J. Rajah, W. B. Grant, and A. Haq, "Vitamin D deficiency and sun avoidance among university students at Abu Dhabi, United Arab Emirates," *Dermato-Endocrinology*, vol. 3, no. 4, pp. 235–239, 2011.

[3] F. Al Anouti, S. Al-Ameri, S. Thomas et al., "Sun avoidance among indoor employees leading to vitamin D deficiency and depression in the united arab emirates," *International Journal of Medicine and Medical Sciences*, vol. 5, no. 11, pp. 503–509, 2013.

[4] L. Ceglia, J. Nelson, J. Ware et al., "Association between body weight and composition and plasma 25-hydroxyvitamin D level in the Diabetes Prevention Program," *European Journal of Nutrition*, vol. 56, no. 1, pp. 161–170, 2017.

[5] P. D. Chandler, L. Wang, X. Zhang et al., "Effect of vitamin D supplementation alone or with calcium on adiposity measures: A systematic review and meta-analysis of randomized controlled trials," *Nutrition Reviews*, vol. 73, no. 9, pp. 577–593, 2015.

[6] L. S. Flor, M. R. Campos, A. F. Oliveira, and J. M. Schramm, *Diabetes burden in brazil: Fraction attributable to overweight, obesity, and excess weight. Revista De Saude Publica*, Schramm JM. Diabetes burden in brazil, Fraction attributable to overweight, 2015.

[7] J. C. Gallagher, M. Peacock, V. Yalamanchili, and L. M. Smith, "Effects of vitamin D supplementation in older African American women," *The Journal of Clinical Endocrinology & Metabolism*, vol. 98, no. 3, pp. 1137–1146, 2013.

[8] A. Gangloff, J. Bergeron, E. Pelletier-Beaumont et al., "Effect of adipose tissue volume loss on circulating 25-hydroxyvitamin D levels: Results from a 1-year lifestyle intervention in viscerally obese men," *International Journal of Obesity*, vol. 39, no. 11, pp. 1638–1643, 2015.

[9] S. Kumar, N. Vasudeva, and S. Sharma, "GC-MS analysis and screening of antidiabetic, antioxidant and hypolipidemic potential of Cinnamomum tamala oil in streptozotocin induced diabetes mellitus in rats," *Cardiovascular Diabetology*, vol. 11, no. 95, 2012.

[10] A. Hannemann, BH. Thuesen, N. Friedrich, H. Volzke, A. Steveling, and T. Ittermann, "Adiposity measures and vitamin D concentrations in northeast germany and denmark," *Nutrition Metabolism*, vol. 2015; 12, pp. 24–015, 2015.

[11] M. F. Holick, "Vitamin D: important for prevention of osteoporosis, cardiovascular heart disease, type 1 diabetes, autoimmune diseases, and some cancers," *Southern Medical Journal*, vol. 98, no. 10, pp. 1024–1027, 2005.

[12] M. F. Holick, N. C. Binkley, H. A. Bischoff-Ferrari et al., "Evaluation, treatment, and prevention of vitamin D deficiency: an endocrine society clinical practice guideline," *The Journal of Clinical Endocrinology & Metabolism*, vol. 96, no. 7, pp. 1911–1930, 2011.

[13] M. F. Holick and T. C. Chen, "Vitamin D deficiency: a worldwide problem with health consequences," *American Journal of Clinical Nutrition*, vol. 87, no. 4, pp. 1080S–1086S, 2008.

[14] *Metrics and Evaluation. The State of US Health: Innovations, Insights, and Recommendations from the Global Burden of Disease Study*, Institute for Health Metrics and Evaluation, Seattle, WA: IHME, 2013.

[15] *Institute of Medicine (US) Committee to Review Dietary Reference Intakes for Vitamin D and Calcium*, National Academies Press, Washington, D.C., 2011.

[16] K. Kearns, A. Dee, A. P. Fitzgerald, E. Doherty, and I. J. Perry, "Chronic disease burden associated with overweight and obesity in ireland: The effects of a small BMI reduction at population level," *BMC Public Health*, vol. 14, pp. 143–2458, 2014.

[17] R. Kremer, P. P. Campbell, T. Reinhardt, and V. Gilsanz, "Vitamin D status and its relationship to body fat, final height, and peak bone mass in young women," *The Journal of Clinical Endocrinology*, vol. 94, no. 1, pp. 67–73, 2009.

[18] L. Marino and F. R. Jornayvaz, "Endocrine causes of nonalcoholic fatty liver disease," *World Journal of Gastroenterology*, vol. 21, no. 39, pp. 11053–11076, 2015.

[19] H. Narchi, J. Kochiyil, S. Al Hamad, J. Yasin, L. Laleye, and A. Al Dhaheri, "Hypovitaminosis D in adolescent females - An analytical cohort study in the United Arab Emirates," *Paediatrics and International Child Health*, vol. 35, no. 1, pp. 36–43, 2015.

[20] National Institute of Health, Losing Weight, Body Mass Index, 2016. Extracted form: http://www.nhlbi.nih.gov/health/educational/lose_wt/BMI/bmi_dis.htm.

[21] C. H. O'Flanagan, L. W. Bowers, and S. D. Hursting, "A weighty problem: Metabolic perturbations and the obesity-cancer link," in *Hormone Molecular Biology and Clinical Investigation*, vol. 23, pp. 47–57, Bowers LW Hursting SD. A weighty problem, Metabolic perturbations and the obesity-cancer link. Hormone Molecular Biology and Clinical Investigation, 2015.

[22] M. Pereira-Santos, P. R. Costa, A. M. Assis, C. A. Santos, and DB. Santos, "Obesity and vitamin D deficiency: A systematic review and meta-analysis," in *Proceedings of the Santos DB. Obesity and vitamin D deficiency: A systematic review and meta-analysis. Obesity Reviews : An Official Journal of the International Association for the Study of Obesity*, vol. 16, pp. 341–349.

[23] W. E. Plehwe, "Vitamin D deficiency in the 21st century: An unnecessary pandemic?" *Clinical Endocrinology*, vol. 59, no. 1, pp. 22–24, 2003.

[24] A. C. Ross, J. E. Manson, S. A. Abrams et al., "The 2011 report on dietary reference intakes for calcium and vitamin D from the Institute of Medicine: what clinicians need to know," *The Journal of Clinical Endocrinology & Metabolism*, vol. 96, no. 1, pp. 53–58, 2011.

[25] RE. Rusconi, V. De Cosmi, G. Gianluca, C. Giavoli, and C. Agostoni, "Vitamin D insufficiency in obese children and relation with lipid profile," *International Journal of Food Sciences and Nutrition*, vol. 66, no. 2, pp. 132–134, 2015.

[26] J. W. Ryan, P. H. Anderson, and H. A. Morris, "Pleiotropic activities of vitamin D receptors - adequate activation for multiple health outcomes," *The Clinical Biochemist Reviews*, vol. 36, no. 2, pp. 53–61, 2015.

[27] S. Shah, DM. Wilson, and LK. Bachrach, "Large doses of vitamin D fail to increase 25-hydroxyvitamin D levels or to alter cardiovascular risk factors in obese adolescents: A pilot study," *The Journal of Adolescent Health : Official Publication of the Society for Adolescent Medicine*, pp. 19–23, 2015.

[28] S. B. Sridhar, P. G. Rao, S. K. Multani, and M. Jain, "Assessment of prevalence of hypovitaminosis D in multiethnic population of the united arab emirates," *Journal of Advanced Pharmaceutical Technology & Research*, vol. 7, no. 2, pp. 48–53, 2016.

[29] K. S. Vimaleswaran, D. J. Berry, C. Lu, E. Tikkanen, S. Pilz, and L. T. Hiraki, "Causal relationship between obesity and vitamin D status: Bi-directional mendelian

randomization analysis of multiple cohorts," *PLoS Medicine*, vol. 10, no. 2, pp. 1–13, 2013.

[30] World Health Organization, Waist circumference and waist-hip ratio : report of a WHO expert consultation, Geneva, 8-11 December 2008. Geneva : World Health Organization; 2011. Available from: http://www.who.int/iris/handle/10665/44583.

[31] World Health Organization, Overweight and Obesity, 2016. Extracted from: http://www.who.int/mediacentre/factsheets/fs311/en.

Disordered Eating Attitudes and Exercise Behavior among Female Emirati College Students in the United Arab Emirates

Haleama Al Sabbah and Shatha Muhsineh

Natural Sciences and Public Health Department, Zayed University, Dubai, UAE

Corresponding Author: Haleama Al Sabbah and Shatha Muhsineh; email: haleemah.alsabah@zu.ac.ae

Abstract

Background: Growing evidence is showing high levels of physical inactivity and disordered eating attitudes among young females in the United Arab Emirates. This is clearly concerning, but little is known about the activity level of those with disordered eating attitudes and their dieting behavior. This study examines the female Emirati college students' disordered eating attitudes and its relation to exercise behavior.

Method: A cross- sectional study using a validated and reliable questionnaire was conducted on 242 Emirati female students attending a public university in Dubai. Eating Attitudes Test- 26 (EAT26) was used to measure eating attitudes and the short International Physical Activity Questionnaire (IPAQ) was included to measure physical activity level. A systematic random sampling from a list of classes in the fall 2014 semester was used for recruitment. The university's Research Ethics Committee approved the study and consents were obtained from participants. SPSS v.21 was used for data analysis. Chi-square test was used to compare frequencies. Significance level was set at 0.05.

Results: The participants' mean age and standard deviation (Mean ± SD) was 19 ± 1.3 years. 31.4% of the participants showed disordered eating attitudes. The percentage of participants engaged in at least one concerning behavior in the past six months was 43.8%. A membership in a health club was significantly related to disordered eating attitudes ($p < 0.01$). A high level of physical activity was correlated with laxative use, over the counter supplements, and exercising for more than 60 minutes to control weight ($p < 0.05$).

Conclusion: There is a great need for intervention programs and policies to contain the level of abnormal eating attitudes and promote healthy level of physical activity among college students.

Keywords: Eating disorders, Physical activity, College Students, UAE

1. Introduction

Eating disorders are defined as a group of serious conditions caused by preoccupation with food and weight that might threaten individual's health and quality of life [3]. The Diagnostic and Statistical Manual for Mental Health Fifth Edition (DSM V) classifies them into: Pica, Rumination Disorder, Avoidant/ Restrictive Disorder, Anorexia Nervosa, Bulimia Nervosa and Binge Eating Disorder [2]. The link between these disorders and several serious physical and psychological complications, such as amenorrhea, osteoporosis, heart diseases, depression, and death in some cases is established [3, 23].

Increasing evidence supports the link between having disordered eating attitudes and the likelihood of developing eating disorders which makes studying the former a predictor of the latter [22]. Extreme dieting behaviors such as restricted food intake and compulsive physical activity have been associated with abnormal eating attitudes and are worth in-depth study [14, 33]. It is important to note that studying these attitudes is preferred using a multi-dimensional perspective, since a number of interpersonal, psychological and social risk factors have been linked to its development [18, 24]. For example, the history of abuse and disturbed personal relationships, having low self-esteem, stress, depression, lack of control and being from a culture where "thinness" is glorified were found to increase the likelihood of eating disorder development [18, 24].

Physical activity is linked to positive outcomes and proposed as a treatment method for individuals with eating disorders [3]. The association between physical activity and many positive outcomes such as decreased risk of obesity, chronic diseases and improved psychological health is documented [29]. A positive relationship between increased obsession about physical activity and eating disorders has been found, especially among athletes and known as "anorexia athletica" [14, 27, 33]. Studies highlight that in most cases this obsession becomes dysfunctional, leading to spending hours in exercising, mood changes and withdrawal symptoms, such as missing social gatherings frequently, as well as physical and psychological problems. This phenomenon was described by earlier studies as "Exercise Dependence" [19, 33].

The Academy of Eating Disorders estimates that one in five women struggle either with eating disorders or disordered eating attitudes [1]. In the UAE, a study by Thomas, et al. found 24.6% of the surveyed undergraduate Emirati females with abnormal eating attitudes and 74.8% were dissatisfied with their body size [25]. Zmijewski, Howard and Musharrafieh, et al. found a positive relationship between disordered eating attitudes, hours spent in exercise and exercise-dependent symptoms among university students [16, 33]. Nevertheless, this relationship needs to be investigated among the UAE population before accepting it.

The United Arab Emirates (UAE) is a young country with more than one third of its population considered overweight and obese, not to mention cardiovascular diseases and type2 diabetes, the leading causes of death, that are linked to obesity in the country [11]. Growing evidence shows increased physical inactivity among UAE population and high levels of disordered eating attitudes among young females [17, 25, 26, 28, 29]. This is clearly concerning, but little is known about the activity level of those with disordered eating attitudes and their dieting behavior. This study aims to provide better insights into undergraduate university student's disordered eating attitudes in relation to exercise behavior and the effect of selected social factors on student dieting behavior.

2. Methododology

2.1. Study Design

A cross-sectional study was used to explore the relationship between eating attitudes and exercise behavior among Emirati college students attending a public university in Dubai during October- November 2014. An ethical clearance was obtained from the university's Research Ethics Committee; an informed consent that stated the purpose of the study, benefits and the right to withdraw at any stage was attached to the study questionnaire. The questionnaire was translated into Arabic and piloted on a group female students who are not included in the analysis for this study. IBM SPSS Statistics v.21 was used for analysis. The Chi-square test was employed to compare frequencies. Significance level was set at 0.05.

2.2. Sample Selection

A systematic random recruitment of classes was used as a sampling method. A list of all the classes offered by University College in fall 2014 semester at the Dubai campus was imported from the University's Banner Web. There were 180 classes and it was estimated that each class has approximately 22 students. Every 6th class was contacted to take part in the study. A total of a sample of 365 participants was reached from the responses. This was filtered by the inclusion criteria (females, UAE citizens, aged 17-25 years old, free from diseases and in the first or second year of college) to reach a net sample of 242.

2.3. Instrument

A 7-page self-administered questionnaire was distributed. The cover page entailed formal informed consent. The following six pages consisted of four sections: personal information, eating attitudes, physical activity level and exercise dependence.

2.3.1. Section 1

Sought to explore demographic information such as age, year of study, residency, etc. Also, it looked at different personal and social factors that might influence levels of physical activity and eating attitudes.

2.3.2. Section 2

Was a pre-validated, widely used reliable screening tool for eating attitudes, EAT26. Eating Attitudes Test- 26 (EAT26) was first developed in 1993, and aims to identify the risk of developing eating disorders among adolescent and adult age groups through a set of 26 items and five behavioral statements [9]. Items in this test cover four main areas: dieting scale, bulimia and food preoccupation scale, oral control subscale and behavioral questions. EAT-26 has been used as a screening tool for eating disorders and reported an accuracy of 90% when compared against a diagnostic interview by a qualified professional [13]. In EAT26, respondents are asked to respond to the given behaviors/thoughts by choosing the frequency of their occurrence in the past six months (scale: always to never). Then a certain scoring protocol is followed. Participants who score above 20 and others who answer positively to one or more of the behavioral statements are advised to go through a clinical interview by a qualified professional for further investigation [9, 13].

2.3.3. Section 3

Aimed to explore the level of physical activity using an English and Arabic version of the short International Physical Activity Questionnaire (IPAQ). Developed in 1998 and tested for years among many countries for reliability and validity, the short IPAQ was found to be an acceptable measure for physical activity practices in cross-sectional studies when direct measurements of physical activity are not feasible [5, 12]. The IPAQ measures the level of physical activity based on a recall of all activities performed in the past seven days. The level of physical activity is expressed by the MET-minute/week, which is calculated based on the type of activity, its duration and

number of days/week they exercise. In this study, participants' level of activity was classified based on cutoff points: MET= 600 and 1200 for young adults and adolescents respectively. These points were calculated based on meeting the international recommendations of physical activity (30 minutes for adults and 60 minutes for adolescents of moderate physical activity for at least five days a week) [29].

2.3.4. Section 4

Consisted of a pre-validated Exercise Dependence Questionnaire (EDQ). The original EDQ was developed by Ogden, et al. [19]. It consists of 29-items that measure nine areas: interference with social/family life, positive reward, withdrawal symptoms, exercise for weight control, exercise for health reasons, insights into the problem, exercise for social reasons and stereotyped behavior [19]. Participants are asked to state their level of agreement with certain statements using a 7-point Likert scale (1 = Strongly disagree, 7 = Strongly agree) [19, 33]. For the purpose of this study, only questions related to positive reward, withdrawal symptoms, exercise for health reasons and interference with social/family life were included.

3. Results

The participants' mean age and standard deviation (Mean ± SD) was 19 ± 1.3. The prevalence of disordered eating attitudes among the surveyed sample was 31.4% (n = 76). Table1 presents the sample's main characteristics and their relation to eating attitudes measured by EAT-26. The *p*-value describes the level of significance when chi-square test was used. The effect of age, marital status, number of children, employment status, and year of study was found to be insignificant. However, having a membership in a gym or health club was found to be significantly related to disordered eating attitudes ($p < 0.01$).

A significant positive correlation was found between EAT-26 scores and Body Mass Index (BMI) (r^2=0.181, p<0.01, a two-tailed bivariate correlation), meaning that the increase in BMI was associated with increased risk of developing disordered eating attitudes (Table 2). When examining the correlation between the various EAT-26 scales and the level of reported physical activity, we found a strong positive correlation between higher scores on the dieting scale and a higher level of physical activity (r^2=0.193, p= 0.006, two tailed bivariate correlation). Indicating that the higher engagement in dieting behaviors was linked to more hours spent exercising. Bulimia, food preoccupation and oral control subscale were not found to have an effect on the level of physical activity expressed by MET ($p > 0.05$) (Table 2).

			Eating Attitudes		P-value
		Total N = 242	Normal N = 166	Disordered N = 76	
		N(%)	**N (%)**	**N (%)**	
Age	17-19	72 (71.1)	121 (70.3)	51 (29.7)	
	20-25	70 (28.9)	45 (64.3)	25 (35.7)	0.357
Marital Status	Single	216 (90.0)	149 (67)	67 (31)	
	Engaged	10 (4.2)	8 (80)	2 (20)	0.617
	Married	14 (5.8)	8 (57.1)	6 (42.9)	
Number of Children	0	7 (50)	4 (57.1)	3 (42.9)	
	1	3 (21.4)	2 (66.7)	1 (33.3)	
	2	2 (14.3)	1 (50)	1 (50)	0.614
	3	2 (14.3)	2 (100)		
Employment Status	Full time	1 (0.4)	1 (100)		
	Part time	6 (2.6)	2 (33.3)	4 (66.7)	
	Not employed	226 (97)	157 (69.5)	69 (30.5)	0.26
Year of Study	1st	138 (57.2)	96 (69.6)	42 (30.4)	
	2nd	103 (42.8)	69 (67)	34 (33)	0.726
GYM membership	Present	57 (23.6)	30 (52.6)	27 (47.4)	
	No membership	185 (76.4)	136 (73.5)	49 (26.5)	<**0.01**

Table 1: Sample main characteristics in relation to Eating Attitudes Test scores. *Chi-square test was used.

Table 3 presents the associations concerning behaviors with dieting as measured by EAT-26. All of the surveyed behaviors were performed at a higher frequency among the sub-sample with disordered eating attitudes. In addition, a higher level of physical activity was found to be correlated with a higher frequency of engagement in behaviors examined by the EAT-26, such as use of laxatives and over- the-counter supplements and exercising for more than 60 minutes daily to control weight in the past six months (r^2 = 0.191, $p < 0.05$, a two-tailed bivariate correlation).

To understand the behaviors of those who reported higher levels of physical activity and disordered eating attitudes, we examined some addictive behaviors related to exercise explored by the Exercise Dependence Questionnaire (EDQ) [19]. Increased

Eating Attitudes Test (EAT-26) Score classification	Body Mass Index Classification				
	n = 239				p- value (r^2)
	Underweight	Normal	Overweight	Obese	
Disordered Eating Attitudes	3 (4%)	56 (74.7%)	6 (8%)	10 (13.3%)	
					<0.01
Normal Eating Attitudes	18 (11%)	130 (79.3%)	12 (7.3%)	4 (2.4%)	-0.181

Table 2: Body Mass Index Classification in relation to Eating Attitudes Test Score. The table is based on two tailed bivariate correlation test.

Concerning behaviors as measured by EAT-26	Sample engagement in concerning behaviors in the past 6months measured by Eating Attitudes Test (EAT-26)											
	All sample*(N=242)*						Sub-sample with disordered eating attitudes*(n=76)*					
	Never	Once a month or less	2-3 times/ month	Once a week	2-6 times a week	Once a day or more	Never	Once a month or less	2-3 times/ month	Once a week	2-6 times a week	Once a day or more
Frequent binge eating episodes	100 (41.3%)	62 (25.6%)	23 (9.5%)	31 (12.8%)	15 (6.2%)	11 (4.5%)	19 (25%)	22 (28.9%)	8 (10.5%)	13 (17.1%)	8 (10.5%)	6 (7.9%)
Vomiting to control weight or shape	218 (90.1%)	11 (4.5%)	3 (1.2%)	2 (0.8%)	3 (1.2%)	5 (2.1%)	59 (77.6%)	7 (9.2%)	3 (3.9%)	2 (2.6%)	2 (2.6%)	3 (3.9%)
Use of laxatives or Over The Counter weight loss supplements	209 (86.4%)	11 (4.5%)	4 (1.7%)	5 (2.1%)	6 (2.5%)	7 (2.9%)	51 (67.1%)	8 (10.5%)	3 (3.9%)	4 (5.3%)	5 (6.6%)	5 (6.6%)
Exercise >60minutes to burn off calories	81 (33.5%)	48 (19.8%)	20 (8.3%)	25 (10.3%)	46 (19%)	22 (9.1%)	14 (18.4%)	18 (23.7%)	6 (7.9%)	8 (10.5%)	16 (21.1%)	14 (18.4%)
Significant weight loss (10kg or more)	Yes			No			Yes			No		
	38 (15.8%)			203 (83.9%)			19 (25%)			57 (75%)		

Table 3: Frequency of engagement in concerning behaviors in the past 6 months measured by Eating Attitudes Test.

time spent in exercise was found to be linked to interference with social life – meaning that participants would miss social events in order to exercise— and withdrawal symptoms such as irritability if they were unable to exercise (two tailed t-test, $p< 0.05$). There was no strong significant correlation between exercising to feel better or for health reasons and the time spent in exercise (Table 4).

	Study's main variables	
Exercise Dependence Questionnaire categories	**Level of exercise**	**Eating attitudes scores**
	N = 193	**N = 193**
Interference with social life		
Pearson Correlation	0.155	0.209
Significance (2 tailed)	<0.05	<0.01
Positive reward		
Pearson Correlation	0.147	0.167
Significance (2 tailed)	<0.05	<0.05
Withdrawal Symptoms		
Pearson Correlation	0.21	0.322
Significance (2 tailed)	<0.01	0
Exercise for health reasons		
Pearson Correlation	0.079	0.089
Significance (2 tailed)	0.277	0.218

Table 4: The correlation between the main variables of the study and Exercise Dependence Questionnaire categories. The test was performed using a two tailed bivariate correlational test.

In addition, correlational tests were run to examine if social factors related to family and peers' diets and expressing negative comments about participant's weight influenced participants' eating attitudes, but there was no significant correlation.

Figure 1 highlights participants' responses to the given statements related to diet behaviors and social support. About one third of sub-population at risk to eating disorders stated that they heard negative comments about their weight from peers and family members, indicating social pressure; surprisingly, some 70% of them were convinced about the need to be thin on their wedding night.

4. Discussion

Disordered eating attitudes measured by EAT-26 have been used as an indicator of eating disorder development risk, and studies validated its use in the mild cases of

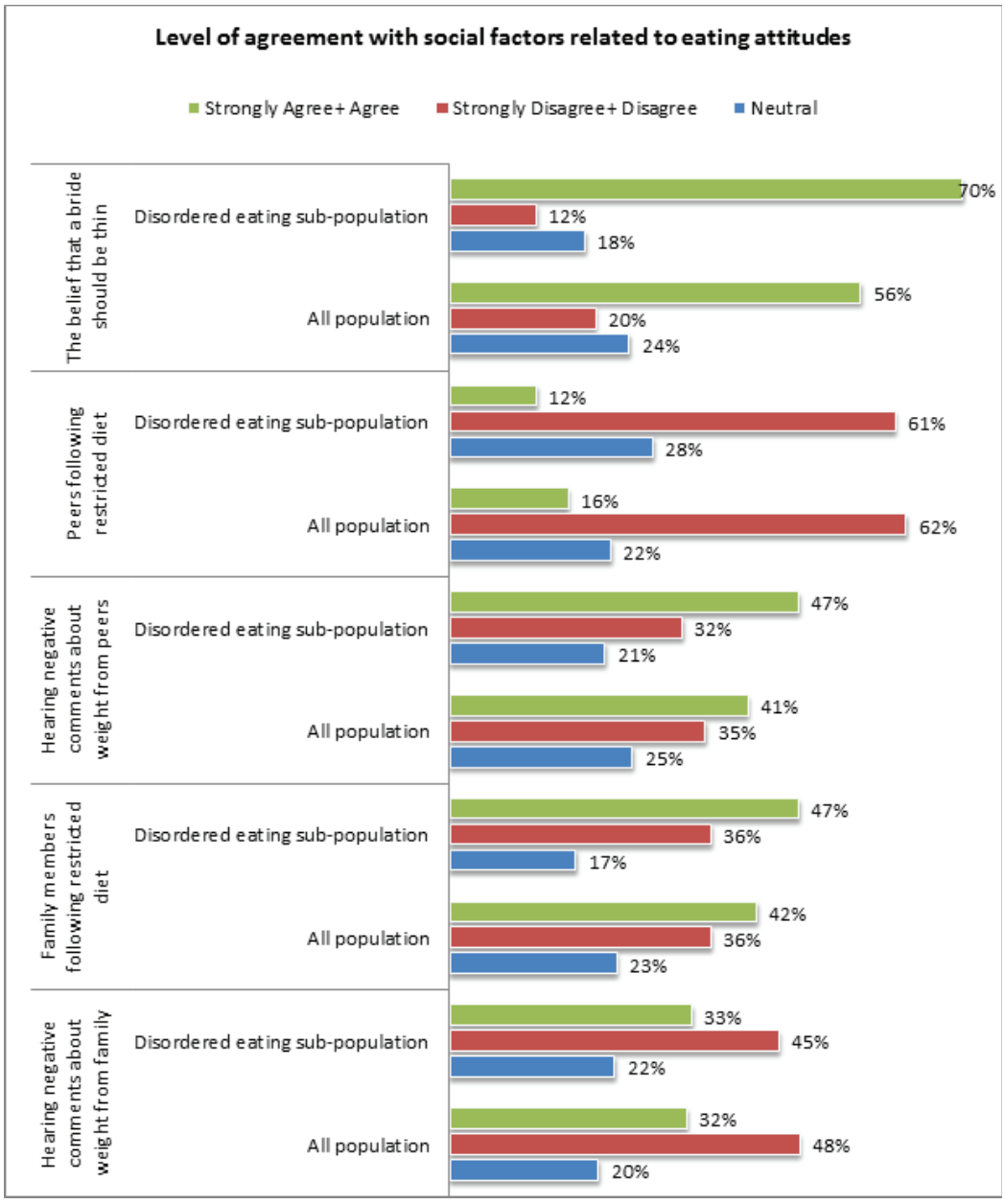

Figure 1: Level of agreement with statements related to social factors that might influence participants' eating attitudes.

eating disorders [13, 20]. The prevalence of eating disorders risk found in this study (31.4%) is higher than what was reported by number of earlier studies targeting the UAE population; there, scores above the EAT-26 cutoff did not exceed a quarter of the surveyed population [7, 25, 26]. It is also higher than reported scores among university students in other countries such as Malaysia and the Academy of Eating Disorders estimates (21.3%, 20% respectively) [1, 8]. The only study with a similar prevalence in the UAE found 33.5% of the surveyed adolescent females (n = 243) with abnormal eating attitudes [15].

Although Thomas, et al [17] focused on female university students with a similar sample size, the higher prevalence of abnormal eating attitudes found in this study (31.4% compared to 24.6%) could be due to a change in the attitudes of students towards dieting. It can also be related to greater accuracy in responding to the EAT-26 statements, since Arabic translation was provided in this study, a limitation cited in the former study.

The comparatively high socio-economic status that many Emiratis experience and their increased exposure to media ideals, especially in a rapidly developing city like Dubai (where most of the participants live) could have increased the risk of eating disorders by creating a disturbed self-image [10, 24]. This can be supported by the high level of body dissatisfaction reported in earlier studies [25, 26]. Little has been reported about the behaviors measured by EAT-26 in the literature, but the findings of the study in this area are alarming. Knowing that 9.9% and 13.6% of the whole sample used potentially damaging methods to control weight, such as vomiting and laxative consumption, emphasizes the need for intervention strategies to tackle these behaviors.

Social factors related to eating and exercise behavior were explored in this study to some extent to gain a better understanding of the population. No significant correlation found between the given statements and studied variables might be related to reporting bias or a low level of influence of these factors. The younger generation might be more influenced by media, as Swami, et al. [17] state, a factor that was not explored in this study. However, the level of agreement with exposure to peers and family negative comments was high among those with disordered eating attitudes, indicating some level of association between these variables as suggested by the National Eating Disorders Academy [18].

A significant positive correlation was found between BMI and EAT-26 scores, indicating a higher risk for developing eating disorders in those who are overweight or obese. The correlation can perhaps be justified by the UAE culture of modern body image, that is increasingly promoting a lean body, as suggested by studies and local reports [4, 6, 21, 25].

The significant relationship between dieting behavior and level of exercise examined in this study implies the presence of some symptoms associated with anorexia nervosa. The level of exercise dependence and its association with the time spent in exercise matches the findings of earlier studies, indicating that addictive behavior can appear among those who spend a lot of time in exercise to a level that impairs their social lives [14, 27, 33].

5. Conclusion

High levels of abnormal eating attitudes and engagement in behaviors deemed concerning were found in this study, along with some level of exercise addiction among those who meet the international recommendation for physical activity. It is important to note that abnormal eating attitudes do not necessarily mean a probable development of eating disorders. However, the presence of the former, increase the likelihood of the latter [3, 22]. Considering the devastating health effects associated with eating disorders, such as risk of heart disease, renal failure and other diseases, intervention is urgently needed [2, 25]. Effective interventions should be applied at an institutional level to guarantee better results. General campaigns in public places could help in raising awareness about eating disorders and their complications.

Integrating courses or specific lessons in high school curricula and university courses in regard to self-image acceptance, healthy weight loss methods, problem- solving skills, basic exercise knowledge and practices can greatly help in preventing eating disorders and exercise dependence among the general population as stated by the National Eating Disorders Academy [18]. In addition, frequent assessment should be done for students to detect abnormal trends, while the availability of trained psychologist is needed to help those with eating disorders in overcoming this problem.

Finally, the field of mental health and eating disorders is still new in the UAE; further research is needed to understand at a deeper level the reasons behind the increase in disordered eating attitudes among Emiratis such as found in this study and some of the correlates related to it.

The main limitation of this study is the reliance on self-reported behaviors and the lack of evidence to determine the direction of causality between disordered eating attitudes and the other characteristics measured. The nature of this study being a cross-sectional gives us information about the present behaviors and attitudes at the time of filling the survey only. Thus, our conclusions are speculations based on available evidence from the literature and observation.

6. Competing Interests

The authors declare that they have no competing interests

References

[1] "Academy for Eating Disorders. Prevalence of Eating Disorders [Data file]," *Eating Disorder Statistics*, 2011, Available form: https://www.uni.edu/wellrec/

sites/uni.edu.wellrec/files/documents/EDstats.pdf.

[2] American Psychiatric Association, Diagnostic and Statistical Manual of Mental Disorders fifth edition [DSM-V]. Arlington: USA; 2013.

[3] American Psychological Association (APA), Eating Disorders; 2014. Available from: http://www.apa.org/topics/eating.

[4] J. Bell, Parents' pressure on eldest child increase the risk of eating disorders. The National 2014. Retrieved from LexisNexis.

[5] M. L. Booth, "Assessment of physical activity: an international perspective," *Research Quarterly for Exercise and Sport*, vol. 71, no. 2, pp. 114–120, 2000.

[6] H. Dajani, Body image pushing girls to attempt suicide. The National, 2000. Retrieved from LexisNexis.

[7] V. Eapen, A. A. Mabrouk, and S. Bin-Othman, "Disordered eating attitudes and symptomatology among adolescent girls in the United Arab Emirates," *Eating Behaviors*, vol. 7, no. 1, pp. 53–60, 2006.

[8] W. Gan, M. Nasir, S. Zalilah, and A. Hazizi, "Disordered eating behaviors, depression, anxiety and stress among Malaysian University students. The College Student Journal," *Disordered eating behaviors*, vol. 45, no. 2, pp. 296–309, 2011.

[9] DM. Garner, "Self-report measures for eating disorders," *Social and Behavioral Sciences*, vol. 5, no. 20, pp. 12–15, 1993.

[10] R. A. Gordon, Eating Disorders East and West. Eating Disorders and cultures in transition. Brunner-Routledge: New York, 2001.

[11] Health Authority Abu Dhabi [HAAD] Health Statistics, Available at http://www.haad.ae/HAAD/LinkClick.aspx?fileticket=JYosMXQXrOU%3dtabid=1243.

[12] P. H. Lee, D. J. Macfarlane, T. H. Lam, and S. M. Stewart, "Validity of the international physical activity questionnaire short form (IPAQ-SF): a systematic review," *International Journal of Behavioral Nutrition and Physical Activity*, vol. 8, article 115, 2011.

[13] L. B. Mintz and M. S. O'Halloran, "The eating attitudes test: Validation with DSM-IV eating disorder criteria," *Journal of Personality Assessment*, vol. 74, no. 3, pp. 489–503, 2000.

[14] V. Modoio, H. Antunes, P. de Gimenez, M. Santiago, S. Tufik, and M. de Mello, "Negative addiction to exercise: are there differences between genders?" *Clinics*, vol. 66, no. 2, 2011.

[15] A. O. Musaiger, M. Al-Mannai, R. Tayyem et al., "Risk of disordered eating attitudes among adolescents in seven Arab countries by gender and obesity: A cross-cultural study," *Appetite*, vol. 60, no. 1, pp. 162–167, 2013.

[16] U. Musharrafieh, H. M. Tamim, A. C. Rahi et al., "Determinants of university students physical exercise: a study from Lebanon," *International Journal of Public Health*, vol. 53, no. 4, pp. 208–213, 2008.

[17] J. Muttappallymyalil, E. Mathew, J. Sreedharan, S. A. Sharbatii, R. B. Shaikh, and S. A. Basha, "Self reported physical activity among University Students in Ajman, UAE," *Pakistan Journal Of Medical Sciences*, vol. 26, no. 4, pp. 782–786, 2010.

[18] National Eating Disorders Association [NEDA], Eating disorders and their precursors [Data file], 2005. Available at: https://www.uni.edu/wellrec/sites/uni.edu.wellrec/files/documents/EDstats.pdf.

[19] J. Ogden, D. Veale, and Z. Summers, "The development and validation of the exercise dependence questionnaire," *Addiction Research & Theory*, vol. 5, no. 4, pp. 343–356, 1997.

[20] Z. Scheinberg, M. Koslowsky, A. Bleich et al., "Sensitivity, Specificity, and Positive Predictive Value as Measures of Prediction Accuracy: The Case of the Eat-26," *Educational and Psychological Measurement*, vol. 53, no. 3, pp. 831–839, 2016.

[21] Sean, (Dec, 13,2012). — Research: Western culture to blame for body dissatisfaction in the UAE. 7 Days. Retrieved from LexisNexis.

[22] F. R. E. Smink, D. van Hoeken, and H. W. Hoek, "Epidemiology of eating disorders: incidence, prevalence and mortality rates," *Current Psychiatry Reports*, vol. 14, no. 4, pp. 406–414, 2012.

[23] H.-C. Steinhausen, "Outcome of Eating Disorders," *Child and Adolescent Psychiatric Clinics of North America*, vol. 18, no. 1, pp. 225–242, 2009.

[24] V. Swami, D. A. Frederick, T. Aavik et al., "The attractive female body weight and female body dissatisfaction in 26 countries across 10 world regions: results of the international body project I," *Personality and Social Psychology Bulletin*, vol. 36, no. 3, pp. 309–325, 2010.

[25] J. Thomas, S. Khan, and A. A. Abdulrahman, "Eating attitudes and body image concerns among female university students in the United Arab Emirates," *Appetite*, vol. 54, no. 3, pp. 595–598, 2010.

[26] S. J. Schulte and J. Thomas, "Relationship between eating pathology, body dissatisfaction and depressive symptoms among male and female adolescents in the United Arab Emirates," *Eating Behaviors*, vol. 14, no. 2, pp. 157–160, 2013.

[27] M. Weik, B. D. Hale, and B. D. Weik M Hale, "Contrasting gender differences on two measures of exercise dependence," *Br J Sports Med*, vol. 43, no. 1, pp. 204–207, 2009.

[28] S. Wen Ng, S. Zaghloul, H. Ali et al., "obesity, diet and physical activity in the United Arab Emirates (UAE)," *FASEB journal*, vol. 25, pp. 591–595, 2011.

[29] World Health Organization [WHO], (February, 2014). Physical Activity fact sheet N385. Available at: http://www.who.int/mediacentre/factsheets/fs385/en/.

[30] World Health Organization [WHO], (August, 2014). Obesity and Overweight fact sheet N311. Available at: http://www.who.int/mediacentre/factsheets/fs311/en/.

[31] World Health Organization [WHO], Global Recommendations on Physical Activity for Health. Available at: http://www.who.int/dietphysicalactivity/factsheet_recommendations/en/.

[32] World Health Organization [WHO], Physical Inactivity: A Global Health Problem, (2014). Available at: http://www.who.int/dietphysicalactivity/factsheet_inactivity/en/.

[33] C. F. Zmijewski and M. O. Howard, "Exercise dependence and attitudes toward eating among young adults," *Eating Behaviors*, vol. 4, no. 2, pp. 181–195, 2003.

Dietary and Activity Habits in Adolescents Living in the United Arab Emirates

Dalia Haroun, Ola ElSaleh, and Lesley Wood

Zayed University, Dubai, United Arab Emirates

Corresponding Author: Dalia Haroun; email:dalia.haroun@zu.ac.ae

Abstract

Background: The Global School Health Survey 2010 reported that 40% of pupils aged 12-15 years are overweight or obese; double what was reported in 2005. Following such concerns the government introduced mandatory school health education sessions to students, and produced strict guidelines on school food and drink provision (September 2011). The aim of this survey was to obtain information about adolescents' dietary and activity habits, and their association with the increased prevalence of obesity.

Methods: A cross-sectional study of 1,022 students (539 boys; 483 girls) aged 12-16 years, from 17 government schools in Dubai, UAE. Dietary practices and physical activity was collected using a short self-completed questionnaire.

Results: Non-Emirati pupils, especially the girls appear to eat more healthily than their Emirati counterparts. Overall, 16% of students reported never eating breakfast, 31% reported drinking sugar sweetened beverages everyday 18% said they never drank milk and 15% never ate fruits. 67% reported buying food from school every day; Emiratis spending more than non-Emiratis. 37% of pupils reported exercising or playing sport daily, whereas 60% reported they daily watch more than 2 hours of TV.

Conclusion: Despite the recent changes in school policies, pupils are still failing to eat a healthy diet and engage in physical activity. There needs to be further interventions promoting changes in lifestyle amongst adolescents, and enhancing provision of healthy food in schools to be more appealing to students.

Keywords: dietary habits, physical activity, sedentary behaviors, UAE, adolescents

1. Introduction

Studies of dietary habits and nutritional status in Mediterranean countries emphasize the significant change in the diet of the population [34]. These changes show up most

clearly in children and young people, because of their greater vulnerability to advertising and a more permissive attitude of parents towards consumption of cariogenic foods. Today, we know that certain risk factors are determined from a very early age and eating habits established during childhood and school age persist over time and influence the subsequent habits [17].

There is a real concern about the increase of unhealthy dietary habits, including skipping breakfast and greater consumption of sweetened soft drinks by young people, and the possible role of these habits in the pathogenesis of childhood obesity [11, 13, 14]. Data from a study conducted on American adolescents indicated that breakfast consumption during school years was associated with about a 30% lower likelihood of later becoming overweight or obese [10]. Moreover, research studies and reviews indicate that breakfast skipping is highly prevalent among adolescents in the United States and Europe [32]) as well as in many Arab countries [1, 9, 26].

Over the last decade, the unhealthy lifestyle and poor dietary habits have been of great concern to the local health authorities in most Arab countries [28] where obesity has reached an epidemic rate for both children and adults [28]. This current epidemic of childhood obesity is largely due to an environment that promotes excessive food consumption and encourages sedentary behaviors [22]. The diet of Arab adolescents is characterized by a low intake of fruit, vegetables, and milk and a high intake of sugar-sweetened beverages, fast foods, and sweets [3, 5, 8]. The prevalence of overweight and obesity in children in the United Arab Emirates (UAE) is extremely high; the Global School Health Survey (GSHS) 2010 reported that approximately 40% of school children are overweight or obese. Specifically, the prevalence of obesity was found to be highest in students aged 12 to 15 years [27]. Obesity not only affects children's physical health and well-being, but it has also been shown to have a negative impact on children's mental health. Being overweight or obese can be particularly devastating for children and teens, who are often the targets of early social discrimination and subject to negative stereotyping by peers. They experience more teasing and are more likely to be bullied. Thus, being overweight can have a negative impact on a child's self-esteem, behavior, friendships and academic performance [15, 16, 23, 35, 36].

Also, the GSHS reported that almost 73% of school students didn't engage in sufficient amount of daily physical activity (obtaining at least 60 minutes of physical activity per day), which is very similar to results reported by Guthold et al. where 85% of girls and 75% of boys aged 13–15 years in seven Arab countries (Djibouti, Egypt,

Jordan, Libya Morocco, Oman, and the UAE) did not engage in a sufficient amount of daily physical activity [19].

This is associated with many risk factors later on in life including increased risk of having cardiovascular diseases and type 2 Diabetes Mellitus. Prevalence rates for type 2 diabetes mellitus and cardiovascular diseases in the Arab Gulf are between 25 and 35% for the adult population, whilst evidence of the metabolic syndrome is emerging in children and adolescents [7]. According to the World Health Organization, a healthy diet and physical exercise are the two main factors in the prevention of chronic diseases such as hypertension or diabetes [40]. It is important to introduce strategies that will help to reverse this trend, one of which is to improve the knowledge and awareness of children and adolescents about healthy eating through delivering health education sessions and implementing standards for school canteens whereby unhealthy food items are restricted or banned.

As adolescence is a time of developmental plasticity in which lifelong habits can become established, lifestyle interventions during this period may have a significant influence on lifelong health. Specifically, the promotion of sensible eating and physical activity during adolescence may modify an adolescent's risk of adult obesity [2, 21]. Therefore, mandatory health education sessions delivered by school nurses or doctors have been recently introduced into the public school curriculum in the UAE. A new guide for school canteen has also been certified by the Abu Dhabi Food Control Authority and the Ministry of Education (MoE) which has been implemented in all public Schools from September 2011. These changes should have resulted in improving school pupils' food and drink choices and habits both in and out of school.

The aim of this study was to obtain information about pupils' dietary habits both when at school and more widely throughout the day after the introduction of the mandatory food policy. Results obtained from this study will increase our understanding on what children and adolescents diet is composed of, and their association with this increased prevalence of obesity within this particular age group. Results will also confirm if changes in the school canteen and health education sessions contributed to improvement in pupils food and drink choices. Results will also benefit policy makers as feedback from children on the new canteen will be obtained.

2. Methodology

This was a descriptive cross sectional study of 1,500 randomly selected (convenience sampling) adolescents attending secondary government schools in Dubai; UAE.

	Emirati		Non-Emirati		Total	
	n	%	n	%	n	%
Male	455	49.7	84	78.5	539	52.7
Female	460	50.3	23	21.5	483	47.3
Total	915	100	107	100	1022	100

Table 1: Sample Characteristics.

The study protocol obtained Ethical Approval from Zayed University Research Ethics Committee (ZU12-013-F), and was also approved by the UAE Ministry of Education. The Ministry of Education in turn informed all 17 governmental secondary schools in Dubai, both male and female, that they have been selected to take part in this study. One classroom section was then randomly selected from each of the grades 6, 7, 8 and 9. Parents of these students were then informed about the study, and verbal assent was obtained from students. The sample was drawn from different educational grades and geographical areas of Dubai to ensure that the target population is representative. Both national and non-national adolescents were included.

A short, self-completed questionnaire was designed by a nutrition specialist and reviewed by a committee at the Ministry of Education to check applicability of the questions. The questionnaire was then piloted and tested in order to check that questions read well and reflected what was being asked and the final version of the questionnaire was modified based on the feedback received by the students. Selected trained school staff administered the questionnaire to students. The students were assembled in their classrooms and the objectives of the study as well as the questionnaire were explained to the students. The questionnaire was structured and collected information relating to students' food and drink choices and preferences; how often they consume breakfast, milk or yogurt, fruits and vegetables, fast food items, and sugar sweetened beverages. Information relating to students' eating behaviors in school was collected and included questions on: how often they use the canteen versus bringing food from home, how much money they spend, what items they purchase from school or bring from home, their views on the new canteen policy etc.). In addition, information relating to students' physical activities and sedentary behaviors were collected. All students' responses were confidential; their names and contact details were not provided.

The data in the questionnaire were entered into an excel sheet and statistical analysis was carried out using the Statistical Package for the Social Sciences (SPSS). Chi-square statistics were used to determine the presence of associations between variables, and the level of significance was set at $p < 0.05$.

3. Results

3.1. Sample Characteristics

A total of 1,033 students completed the questionnaire, of which 11 did not provide information about their nationality and were excluded from the analysis. Hence the final sample included a total of 1,022 students aged between 12 and 16 years. Table 1 shows characteristics of the sample, separated by gender and nationality. A total of 539 students were boys, and 483 were girls. 915 (89%) of those were Emirati nationals and 107 (11%) were non-Emirati. There were no significant differences in ages between gender ($p = 0.1$) or nationality ($p = 0.3$).There was a significant association ($p < 0.001$) between gender and nationality with males more likely to be Emirati. To minimize any effect of confounding by nationality of gender, all subsequent results show frequencies and percentages based these four groups.

Table 2 shows the dietary and lifestyle patterns of the sample, separated by nationality (Emirati versus non-Emirati). Table 3 further separates response by gender and nationality.

3.2. Dietary Habits

In relation to dietary habits, non-Emirati pupils tend to have a healthier approach to breakfast in terms of the frequency with which it is eaten, compared with Emirati pupils, with 17% of Emirati respondents reporting never eating the meal. Fewer than half (41%) of this group reported eating it every day, compared with 63% of non-Emirati pupils. Boys from both nationalities were more likely never to eat breakfast compared to girls.

Non-Emirati pupils appear to eat more healthily than their Emirati counterparts, with 23% saying that they never eat fast food, compared with 8% of Emirati pupils. Similar proportions in both groups (61% Emirati and 59% non-Emirati) eat this type of food in moderation (on one to three days per week). Frequency of consumption of fast food was reported to be higher in boys from both nationalities compared to girls.

Both Emirati and non-Emirati pupils tend to have similar habits with respect to drinking sweetened or energy drinks, with approximately one third overall (31%) reporting consuming them every day, particularly Emirati males (36%) and non-Emirati females (43%) . Overall, only 12% of students reported they never drink these types of drinks.

When students were asked to report the frequency of drinking milk or yogurt, 17% of Emirati and 26% of non-Emirati students said they never consumed it, with females from both nationalities more likely not to consume it compared to males ($p < 0.001$).

	Total		Emirati		Non-Emirati	
Frequency/week	**N**	**%**	**n**	**%**	**n**	**%**
Eating breakfast						
Every day	442	43.5	376	41.3	66	62.9
3 to 5 days	145	14.3	132	14.5	13	12.4
1 to 3 days	269	26.5	252	27.7	17	16.2
Never	160	15.7	151	16.6	9	8.6
Buying food at school						
Every day	682	66.8	626	68.5	56	52.3
3 to 5 days	123	12.0	111	12.1	12	11.2
1 to 3 days	166	16.3	136	14.9	30	28.0
Never	50	4.9	41	4.5	9	8.4
Taking food from home						
Everyday	93	9.3	59	6.6	34	33.3
1 to 3 days	189	18.9	170	19.0	19	18.6
Never	716	71.7	667	74.4	49	48.0
Eating fast food						
Every day	118	11.8	109	12.1	9	8.6
3 to 5 days	185	18.4	175	19.5	10	9.5
1 to 3 days	609	60.7	547	60.8	62	59.0
Never	92	9.2	68	7.6	24	22.9
Drinking sugar sweetened or energy drinks						
Every day	319	31.4	293	32.2	26	25.0
3 to 5 days	186	18.3	168	18.4	18	17.3
1 to 3 days	385	37.9	339	37.2	46	44.2
Never	125	12.3	111	12.2	14	13.5
Drinking milk or yogurt						
Every day	306	30.2	277	30.5	29	27.6
3 to 5 days	190	18.8	172	18.9	18	17.1

Table 2: Lifestyle and dietary habits of students by nationality.

In response to the frequency of fruit consumption, only about one quarter of students (24%) reported that they ate it at least 3 days per week, and 15% of students

	Total		Emirati		Non-Emirati	
1 to 3 days	333	32.9	302	33.3	31	29.5
Never	184	18.2	157	17.3	27	25.7
Eating fruits						
None	153	15.1	138	15.2	15	14.3
1 to 2 days	619	61.0	560	61.5	59	56.2
3 or more	243	23.9	212	23.3	31	29.5
Frequency/week	**N**	**%**	**n**	**%**	**n**	**%**
Playing sports/Exercising						
Every day	372	36.7	324	35.6	48	45.7
3 to 5 days	180	17.8	161	17.7	19	18.1
1 to 3 days	367	36.2	338	37.2	29	27.6
Never	95	9.4	86	9.5	9	8.6
Screen time						
1 hour or less	195	19.2	172	18.9	23	21.9
2 hours	226	22.3	197	21.6	29	27.6
3 hours	193	19.0	169	18.6	24	22.9
4 hours or more	401	39.5	372	40.9	29	27.6

Table 2: Table continued.

reported never eating it. There were no differences between nationalities, however girls from both groups were less likely to consume fruits compared to boys.

3.3. Activity and Sedentary Behaviors

Students were then asked to provide typical daily time spent on physical activity and screen time. No significant differences in physical activity patterns were observed between Emirati and non-Emirati students. However, Emirati boys were significantly more likely than Emirati girls to report doing some form of exercise on a daily basis (52% versus 19%; $p < 0.001$). There were no differences in activity levels between genders in non-Emiratis. The opposite pattern is true for the amount of time spent watching TV or taking part in some other form of sedentary activity, with females of both nationalities spending more time than males engaged in such behavior. Overall, almost 60% of students spent more than guidelines of a maximum of 2 hours screen time per day [6]; more Emiratis compared to non-Emiratis not meeting the guideline (60% versus 50% respectively).

	Emirati						Non-Emirati					
	Total		Males		Females		Total		Males		Females	
Frequency/week	n	%	n	%	n	%	n	%	n	%	n	%
Eating breakfast												
Every day	376	41.3	221	48.8	155	33.8	66	62.9	54	65.1	12	54.5
3 to 5 days	132	14.5	69	15.2	63	13.8	13	12.4	10	12.0	3	13.6
1 to 3 days	252	27.7	99	21.9	153	33.4	17	16.2	13	15.7	4	18.2
Never	151	16.6	64	14.1	87	19.0	9	8.6	6	7.2	3	13.6
Buying food at school												
Every day	626	68.5	338	74.4	288	62.6	56	52.3	49	58.3	7	30.4
3 to 5 days	111	12.1	45	9.9	66	14.3	12	11.2	8	9.5	4	17.4
1 to 3 days	136	14.9	55	12.1	81	17.6	30	28.0	21	25.0	9	39.1
Never	41	4.5	16	3.5	25	5.4	9	8.4	6	7.1	3	13.0
Taking food from home												
Everyday	59	6.6	32	7.1	27	6.0	34	33.3	27	32.9	7	35.0
1 to 3 days	170	19.0	70	15.6	100	22.4	19	18.6	15	18.3	4	20.0
Never	667	74.4	347	77.3	320	71.6	49	48.0	40	48.8	9	45.0
Eating fast food												
Every day	109	12.1	52	11.6	57	12.6	9	8.6	6	7.2	3	13.6
3 to 5 days	175	19.5	89	19.9	86	19.0	10	9.5	4	4.8	6	27.3
1 to 3 days	547	60.8	267	59.7	280	61.9	62	59.0	55	66.3	7	31.8
Never	68	7.6	39	8.7	29	6.4	24	22.9	18	21.7	6	27.3
Drinking sugar sweetened or energy drinks												
Every day	293	32.2	163	36.1	130	28.3	26	25.0	17	20.5	9	42.9
3 to 5 days	168	18.4	90	19.9	78	17.0	18	17.3	16	19.3	2	9.5
1 to 3 days	339	37.2	154	34.1	185	40.3	46	44.2	39	47.0	7	33.3
Never	111	12.2	45	10.0	66	14.4	14	13.5	11	13.3	3	14.3
Drinking milk or yogurt												
Every day	277	30.5	156	34.5	121	26.5	29	27.6	25	30.1	4	18.2
3 to 5 days	172	18.9	102	22.6	70	15.4	18	17.1	16	19.3	2	9.1
1 to 3 days	302	33.3	144	31.9	158	34.6	31	29.5	24	28.9	7	31.8

Table 3: Lifestyle and dietary habits of Emirati students by gender.

	Emirati						Non-Emirati					
	Total		Males		Females		Total		Males		Females	
Never	157	17.3	50	11.1	107	23.5	27	25.7	18	21.7	9	40.9
Eating fruits												
None	138	15.2	63	13.9	75	16.4	15	14.3	8	9.6	7	31.8
1 to 2 days	560	61.5	269	59.4	291	63.7	59	56.2	47	56.6	12	54.5
3 or more	212	23.3	121	26.7	91	19.9	31	29.5	28	33.7	3	13.6
Frequency/week	n	%	n	%	n	%	n	%	n	%	n	%
Playing sports/Exercising												
Every day	324	35.6	236	52.3	88	19.2	48	45.7	46	55.4	2	9.1
3 to 5 days	161	17.7	89	19.7	72	15.7	19	18.1	13	15.7	6	27.3
1 to 3 days	338	37.2	105	23.3	233	50.9	29	27.6	21	25.3	8	36.4
Never	86	9.5	21	4.7	65	14.2	9	8.6	3	3.6	6	27.3
Screen time												
1 hour or less	172	18.9	110	24.3	62	13.5	23	21.9	22	26.5	1	4.5
2 hours	197	21.6	113	25.0	84	18.3	29	27.6	21	25.3	8	36.4
3 hours	169	18.6	86	19.0	83	18.1	24	22.9	20	24.1	4	18.2
4 hours or more	372	40.9	143	31.6	229	50.0	29	27.6	20	24.1	9	40.9

Table 3: Table continued.

3.4. Food Choices and Views

Emirati students, particularly boys, were significantly more likely than non-Emiratis to buy food at school on a daily basis (69% compared with 52% for pupils overall). When asked how much pupils spend on food at school, Emirati pupils significantly have greater spending power than non-Emirati pupils with 51% compared with 21% spending at least 6 AED everyday ($p < 0.001$) .

Non-Emirati students were far more likely than Emirati pupils to report taking food from home on at least one day per week (52% compared with 26%). For those who said that they took food to school from home and gave information about items, the most popular was sandwiches, particularly so for non-Emirati pupils (73% compared with 32% of Emirati pupils; $p < 0.001$). Chocolate was more likely to be taken to school by Emirati compared with non-Emirati students (29% compared with 14%; $p < 0.05$) and in both nationality groups this item was more popular amongst females than males.

When students were asked whether they felt that the school canteen had changed, non-Emirati pupils (both males and females) were significantly less likely than Emirati

pupils to consider that there had been any recent changes to the school canteen (50% versus 63%; $p < 0.001$). Although similar proportions of both nationalities considered that any changes seen were for the worse (28%), a third of Emirati pupils (34%) thought that changes was an improvement in the school canteen. Emirati pupils were more likely than non-Emiratis to report that the school offers a range of healthy choices, although the proportion offering this response in both groups is low (28% versus 15% respectively). Over half (53%) of the non-Emirati group considered that a range of healthy foods was not offered, with similar proportions in both groups (17% and 18%) saying that they did not care about the issue.

Students were also given the opportunity to comment on any issues related to food and health, particularly in relation to the school canteen and school food. A total of 342 students who provided comments were generally divided between those who would like a greater variety of less healthy foods (such as carbonated, sweetened drinks and fried foods) to be provided and those who would like to food to be healthier. Some students commented that they would like to see fast food chains and sugar sweetened beverages sold in their schools. Other more interesting comments included provision of free breakfast at schools, provision of full lunch at school, an anti-obesity program in the school, more physical education lessons.

4. Discussion

The current study provides an update on dietary and lifestyle behaviors among adolescents in Dubai, especially after the introduction of the school Canteen policy and health education sessions in schools. Governmental schools in Dubai mainly include Emirati students, and are segregated. Results indicate some variation in dietary habits and lifestyle between genders and nationality. However, it is worth noting that comparing nationalities in this study should be viewed with some caution due to the difference in sample size between the Emirati and non-Emirati populations.

Unhealthy eating habits has become very common among young adolescents. Skipping breakfast, decreased consumption of fruits and dairy and increased consumption of fast food and sweetened or energy drinks has been reported in many studies, both in the West, Eastern Mediterranean region and the Gulf [4, 9, 12, 18, 31, 38]. This type of diet is strongly associated with the incidence of obesity and other chronic diseases such as type 2 diabetes and hypertension [40]. Results of this study is in line of what has been reported elsewhere; non-Emiratis tend to have healthier dietary practices compared to Emiratis. With the exception of energy drinks consumption, females are more likely to have unhealthier dietary habits compared to males. Almost one third

of Emirati females never consume dairy. This is especially an issue with the increased prevalence of Vitamin D deficiency in the Gulf region despite the area's sunny climate [33], females are at increased risk of getting osteoporosis and not reaching their full potential bone growth.

The presence of sedentary behavior among adolescent students in this study was found to be very high. The American Academy of Pediatrics recommends that screen time not to exceed 2 hours per day for this age group [6]. Only 40% of the sample met these recommendations; with females more likely to be engaged in sedentary behavior compared to males. The prevalence rate of screen time appears to be higher than what has been reported in many other countries in Europe [24, 37] but similar to what has been reported in Canada [25] and Saudi Arabia [4]. Females were more likely to spend more screen time compared to males which was supported by previous studies [4, 20, 24, 25]. This is of great concern, as the practice of consuming meals, which tends to be high in salt, fat and sugar, whilst watching television has become very popular among adolescents in the UAE, especially amongst the girls [30]. This may be due to cultural differences in Gulf countries, whereby adolescent males have more of an opportunity to go out and be more active compared with adolescent females. It was however not possible to draw any conclusions on the association between lifestyle habits with weight status as this was not collected in this study.

Almost two thirds of our population reported buying food at school every day. This was more common among the Emirati males. Reasons for the differences in frequency of buying food from school should be investigated and addressed; it might be, for example, that the food choice is more acceptable to particular groups of students in which case the food offered should be modified to appeal to a greater range of cultures. Almost half the sample reported noticing changes to the school canteen with just over two thirds saying it was an improvement to what was offered prior the introduction of the school canteen policy. The interpretation of questions relating to whether they thought food offered was healthy or not should be interpreted with caution, as students' perceptions of what they consider is healthy or unhealthy might not be true. This was observed where some students commented that they would like to see more 'healthy' items in the canteen such as fast food and high sugary drinks. Other comments included wanting to see more variety (reported by almost 36% of students) and more local/Emirati (reported by 22%) foods being offered in their school canteens. This information can be used by the authorities or schools to help achieve more appealing canteens to their students.

5. Conclusion

Although a lot of efforts by the governmental authorities have been made to try changing students dietary and lifestyle habits, it seems that students are still practicing unhealthy habits and lifestyles, and the perceptions of many students remain unchanged. One reason may be that the mode of delivery of the health education sessions is not interactive or interesting to students. Research has recently shown that students tend to be more engaged and more likely to listen and make changes when information is delivered to them using non-traditional teaching methods such as games, activities etc. [39]. Another possible reason is that the school canteen items sold are not appealing to students or are not presented in the age appropriate way. For example, young children are more likely to consume fruits or vegetables when presented to them cut rather than whole. Hence, the Ministry of Education has recently signed an agreement with a number of approved food suppliers to ensure that all food and drink items provided in schools meet the school canteen food and drink standards and are presented to students in a more appealing and appropriate manner. Furthermore, the Ministry of Health is now working on adopting the life-skills approach in the delivery of health education sessions to students, through providing training to school health educators on how to deliver health education using a skills-based approach. A follow-up study assessing both overweight and obesity levels of students in addition to their dietary and lifestyle habits would be key once these changes are effectively implemented in schools. This will help assess the effectiveness of those strategies or school health policies in changing levels of obesity and habits among school students.

6. Acknowledgments

Funded by Zayed University; UAE

References

[1] B. Abalkhail and S. Shawky, "Prevalence of daily breakfast intake, iron deficiency anaemia and awareness of being anaemic among Saudi school students," *International Journal of Food Sciences and Nutrition*, vol. 53, no. 6, pp. 519–528, 2002.

[2] A. S. Alberga, R. J. Sigal, G. Goldfield, D. Prud' homme, and G. P. Kenny, "Overweight and obese teenagers: why is adolescence a critical period?" *Pediatric Obesity*, vol. 7, no. 4, pp. 261–273, 2012.

[3] A. R. Al-Haifi, M. A. Al-Fayez, B. I. Al-Athari et al., "Relative contribution of physical activity, sedentary behaviors, and dietary habits to the prevalence of obesity among Kuwaiti adolescents," *Food and Nutrition Bulletin*, vol. 34, no. 1, pp. 6–13, 2013.

[4] H. M. Al-Hazzaa, N. A. Abahussain, H. I. Al-Sobayel, D. M. Qahwaji, and A. O. Musaiger, "Physical activity, sedentary behaviors and dietary habits among Saudi adolescents relative to age, gender and region," *International Journal of Behavioral Nutrition and Physical Activity*, vol. 8, article 140, 2011.

[5] H. Al Sabbah, C. Vereecken, P. Kolsteren, Z. Abdeen, and L. Maes, "Food habits and physical activity patterns among Palestinian adolescents: Findings from the national study of Palestinian schoolchildren (HBSC-WBG2004)," *Public Health Nutrition*, vol. 10, no. 7, pp. 739–746, 2007.

[6] V. C. Strasburger and M. J. Hogan, "Children, adolescents, and the media," *Pediatrics*, vol. 132, no. 5, pp. 958–961, 2013.

[7] P. Amuna and F. B. Zotor, "Epidemiological and nutrition transition in developing countries: impact on human health and development," *Proceedings of the Nutrition Society*, vol. 67, no. 1, pp. 82–90, 2008.

[8] H. N. Bashour, "Survey of dietary habits of in-school adolescents in Damascus, Syrian Arab Republic," *Eastern Mediterranean Health Journal*, vol. 10, no. 6, pp. 853–862, 2004.

[9] A. A. Bin Zaal, A. O. Musaiger, and R. D'Souza, "Dietary habits associated with obesity among adolescents in Dubai, United Arab Emirates," *Nutrición Hospitalaria*, vol. 24, no. 4, pp. 437–444, 2009.

[10] K. Boutelle, D. Neumark-Sztainer, M. Story, and M. Resnick, "Weight control behaviors among obese, overweight, and nonoverweight adolescents," *Journal of Pediatric Psychology*, vol. 27, no. 6, pp. 531–540, 2002.

[11] C. M. Brown, A. G. Dulloo, and J.-P. Montani, "Sugary drinks in the pathogenesis of obesity and cardiovascular diseases," *International Journal of Obesity*, vol. 32, no. 6, pp. S28–S34, 2008.

[12] Center of Disease Control and Prevention (CDC), Epi-info www.cdc.gov/epiinfo/ (access: 2012.07.15).

[13] K. S. Collison, M. Z. Zaidi, S. N. Subhani, K. Al-Rubeaan, M. Shoukri, and F. A. Al-Mohanna, "Sugar-sweetened carbonated beverage consumption correlates with BMI, waist circumference, and poor dietary choices in school children," *BMC Public Health*, vol. 10, article 234, 2010.

[14] S. Croezen, T. L. S. Visscher, N. C. W. ter Bogt, M. L. Veling, and A. Haveman-Nies, "Skipping breakfast, alcohol consumption and physical inactivity as risk factors for overweight and obesity in adolescents: Results of the E-MOVO project," *European Journal of Clinical Nutrition*, vol. 63, no. 3, pp. 405–412, 2009.

[15] S. R. Daniels, M. S. Jacobson, B. W. McCrindle, R. H. Eckel, and B. M. Sanner, "American heart association childhood obesity: Research summit," *Circulation*, vol. 119, no. 15, pp. 2114–2123, 2009.

[16] W. H. Dietz, "Health consequences of obesity in youth: childhood predictors of adult disease," *Pediatrics*, vol. 101, no. 3, pp. 518–525, 1998.

[17] M. M. Ferreira and M. C. Torgal, "Tobacco and Alcohol Consumption among Adolescents," *Revista Latino-Americana de Enfermagem*, vol. 18, no. 2, pp. 255–261, 2010.

[18] N. Gharib and P. Rasheed, "Energy and macronutrient intake and dietary pattern among school children in Bahrain: A cross-sectional study," *Nutrition Journal*, vol. 10, no. 1, article no. 62, 2011.

[19] R. Guthold, M. J. Cowan, C. S. Autenrieth, L. Kann, and L. M. Riley, "Physical Activity and Sedentary Behavior Among Schoolchildren: A 34-Country Comparison," *Journal of Pediatrics*, vol. 157, no. 1, pp. 43–e1, 2010.

[20] P. Hamar, S. Biddle, I. Soós, B. Takács, and A. Huszár, "The prevalence of sedentary behaviours and physical activity in Hungarian youth," *European Journal of Public Health*, vol. 20, no. 1, pp. 85–90, 2010.

[21] A. P. Hills, L. B. Andersen, and N. M. Byrne, "Physical activity and obesity in children," *British Journal of Sports Medicine*, vol. 45, no. 11, pp. 866–870, 2011.

[22] J. O. Hill and J. C. Peters, "Environmental contributions to the obesity epidemic," *Science*, vol. 280, no. 5368, pp. 1371–1374, 1998.

[23] J. P. Koplan, C. T. Liverman, and V. A. Kraak, *Preventing Childhood Obesity: Health in the Balance*, National Academy of Sciences, Washington, D.C, 2004.

[24] C. A. Loucaides, R. Jago, and M. Theophanous, "Physical activity and sedentary behaviours in Greek-Cypriot children and adolescents: A cross-sectional study," *International Journal of Behavioral Nutrition and Physical Activity*, vol. 8, article no. 90, 2011.

[25] A. E. Mark, W. F. Boyce, and I. Janssen, "Television viewing, computer use and total screen time in Canadian youth," *Paediatrics & Child Health*, vol. 11, no. 9, pp. 595–599, 2006.

[26] N. Mikki, H. F. Abdul-Rahim, Z. Shi, and G. Holmboe-Ottesen, "Dietary habits of Palestinian adolescents and associated sociodemographic characteristics in

Ramallah, Nablus and Hebron governorates," *Public Health Nutrition*, vol. 13, no. 9, pp. 1419–1429, 2010.

[27] *Fact Sheet. United Arab Emirates*, Ministry of Health. Global School-based Student Health Survey United Arab Emirates, 2010.

[28] A. O. Musaiger and H. M. Al-Hazzaa, "Prevalence and risk factors associated with nutrition-related noncommunicable diseases in the Eastern Mediterranean region," *Journal of General Internal Medicine*, vol. 5, pp. 199–217, 2012.

[29] A. O. Musaiger, M. Al-Mannai, R. Tayyem et al., "Prevalence of overweight and obesity among adolescents in seven Arab Countries: A cross-cultural study," *Journal of Obesity*, vol. 2012, Article ID 981390, 2012.

[30] A. O. Musaiger and W. B. Gregory, "Profile of body composition of school children (6-18y) in Bahrain," *International Journal of Obesity*, vol. 24, no. 9, pp. 1093–1096, 2000.

[31] H. Qotba and A. N. Al-Isa, "Anthropometric measuremnets and dietary habits of schoolchildren in Qatar," *International Journal of Food Sciences and Nutrition*, vol. 58, no. 1, pp. 1–5, 2007.

[32] G. C. Rampersaud, M. A. Pereira, B. L. Girard, J. Adams, and J. D. Metzl, "Breakfast habits, nutritional status, body weight, and academic performance in children and adolescents," *Journal of the Academy of Nutrition and Dietetics*, vol. 105, no. 5, pp. 743–760, 2005.

[33] H. F. Saadi, N. Nagelkerke, S. Benedict et al., "Predictors and relationships of serum 25 hydroxyvitamin D concentration with bone turnover markers, bone mineral density, and vitamin D receptor genotype in Emirati women," *Bone*, vol. 39, no. 5, pp. 1136–1143, 2006.

[34] M. Sánchez, Evaluación del estado de salud bucodental y surelación con estilos de vida saludables en la provincia de Salamanca. Tese de doutoramento. Salamanca: Universidad de Salamanca, 2008; 194.

[35] M. B. Schwartz and R. Puhl, "Childhood obesity: A societal problem to solve," *Obesity Reviews*, vol. 4, no. 1, pp. 57–71, 2003.

[36] R. S. Strauss and H. A. Pollack, "Social marginalization of overweight children," *JAMA Pediatrics*, vol. 157, no. 8, pp. 746–752, 2003.

[37] T. Tammelin, U. Ekelund, J. Remes, and S. Näyhä, "Physical activity and sedentary behaviors among finnish youth," *Medicine & Science in Sports & Exercise*, vol. 39, no. 7, pp. 1067–1074, 2007.

[38] S. A. Washi and M. B. Ageib, "Poor diet quality and food habits are related to impaired nutritional status in 13- to 18-year-old adolescents in Jeddah," *Nutrition Research*, vol. 30, no. 8, pp. 527–534, 2010.

[39] World Health Organization, Information Series on School Health. Document 9. 2003.

[40] World Health Organization, Diet, Nutrition and the Prevention of Chronic Diseases. Technical Report Series 916. Geneva, Switzerland, 2002.

Family Food Environment and Child Eating Behavior in a Private School of Abu Dhabi

Al Amoodi Sara Ahmed Abdulla Saeed

Department of Natural Sciences and Public Health, Zayed University, Abu Dhabi, UAE

Corresponding Author: Al Amoodi Sara Ahmed Abdulla Saeed; email:Amoudis@live.com

Abstract

Aim: Dietary habits developed during childhood and continued through adulthood. Children's eating behaviours should be monitorining to avoid possible nutritional deficiencies which have been found to be strongly related to the development of future disease such as obesity, diabetes type 2 and others. The main aim of this study is to explore the relationship between family food environment and the eating behavior during dinnertime among children aged 4 to 6 years old in Abu Dhabi. A cross-sectional study was carried out that examined the relationship between family food environment and child's eating behaviour around dinnertime.

Methods: 61 families participated in the study with their children aged 4-6 years old from a private school. They completed a questionnaire that included questions about demographics, eating behaviour and food environment.

Results: 82% of the mothers were reported to be responsible for feeding the children. Most of the families had dinner together three or more times a week. Half of the children got a high score in the child's eating behaviour scale, indicating that they had positive eating behaviour. The results also showed that children of highly educated mothers were more likely to have positive eating behaviour, compared to children of mothers with lower education ($p < .05$). There was a significant positive correlation between modelling of eating and child eating behaviour (Pearson's r = .56, p < .01), and a significant negative correlation between pressure to eat and child eating behaviour (Pearson's r = -.35, p < .01).

Conclusion: This study is in line with other studies showing that aspects in the family food environment have an influence on eating behaviour of children. Educating parents on food environment and its impact on child behaviour is crucial in order to make them able to develop feeding strategies most likely to benefit children's' health.

Keywords: Family, Food environment, Children, Eating behavior

1. Introduction

Monitoring children's eating behavior and factors influencing food consumption are critical. Some dietary habits developed during childhood continue with people through adulthood [2]. Several unhealthy dietary behaviors leading to nutritional deficiency

and dietary excess are strongly related to the development of serious health conditions [22]. Excess dietary intake can cause obesity, which increases the risk of "coronary heart disease, diabetes, gallbladder disease, some types of cancer, and osteoarthritis of the weight-bearing joints" [22]. According to Magarey et al. [2], people who suffer from obesity during their childhood are more likely to be obese when they become adults [14]. In the United Arab Emirates, it is estimated that the proportion of children who are overweight is 12.1%, while 21.5% of children are at risk of being overweight [22]. This problem is found to be related to the increase in unhealthy dietary behaviors [22].

Children's dietary behaviors and attitudes are shaped by a complex combination of factors [24]. In the first years of childhood, infants are fed when they are hungry. However, when children reach the age of three or four years old, eating behavior becomes a response to "environmental cues about food intake" and is not driven only by deprivation [14]. Recent reviews have shown that individual, as well as environmental influences are potential factors that affect dietary behavior among children and adolescents [24]. Individual factors include "physiological factors, psychological factors, food preferences, perception of healthy eating, knowledge and attitude" [24]. Economic, social, physical and interpersonal influences are features of environmental/collective factors that contribute in determining dietary habits [24]. Family is one of the environmental factors that plays a significant role in structuring child's diet [19]. According to Woodruff and Hanning [1], the family environment consists of four main interrelated influences, which are demographics, parenting style, behavior modeling and the shared environment. The shared environment includes food availability, family rules and media exposure [24].

Research has shown that family is a critical context for determining dietary habits. It has been estimated that children consume "two-thirds of the foods" at home [16]. Children eating practices, such as "attitudes toward food and children's assessment of satiety" are strongly influenced by the family [14]. These practices may later affect child's weight [14]. Mealtime is one aspect of the family environment [19]. Several health and social benefits are associated with increased frequency of family meals. When family meal style is about placing platters on the table, and everyone serves him/herself, this can help children to be responsible for choosing their food and regulate their energy intake depending on their innate abilities (Mogharreban & Nahilian-Nelms, 2002). Family meal is a time for connectedness and encouragement of health-related behavior [18]. Conversation about healthy eating and nutrition topics is associated with having family dinner; this increases nutritional knowledge among children (Gillespie & Achterberg, 2000). Positive association has been suggested between the frequency of eating family meals and healthy eating (Neumark-Sztainer, 2003).

During the mealtime, parents use some direct and indirect feeding attempts to control their children eating behaviors [9]. These feeding strategies could influence children's weight status and eating behavior, but they can also be a reaction to parental concern about the weight status. Parents rely on certain feeding methods depending on the child characteristics [5]. Many researchers have studied direct strategies focusing on parents feeding restriction and pressure to eat. In a study conducted by Farrow and Blissett [1], it was found that the use of pressure and restriction with child feeding at age 1-2 years old have predicted lower child weight. This could be attributed to the fact that child's food intake at this young age is controlled by the caregiver, and there is lack of independent eating and access to food [5]. Parents reported "more pressure to eat with children who weigh less or who are more negative at mealtimes" [5]. A study conducted by Campbell, Crawford, and Ball [3] showed a positive relationship between the use of pressure to eat and increased consumption of energy-dense food. This information supports the findings in other studies that there is a positive correlation between pressure to eat and both fat intake and weight gain [4]. However, if the child is overweight, pressure to eat is not used by parents in order to control the child's weight. For example, in an observational study, restrictive feeding strategies were used with overweight children more than with those with normal body weight [11].

According to [21], mothers restrict their children's food intake as a response to their concern with child becoming overweight. The results from this cross-sectional study had some support from longitudinal study by (Spruijt-Metz et al., 2006) that showed that "maternal concern about child weight was associated with lower increase in fat mass 3 years later" [21]. It is also suggested that there is a possibility that mothers use restriction with high food-responsive children because they are concerned with their children's consumption of unhealthy food [20]. Pressuring children to eat is used with children who are more responsive to satiety and less responsive to food, slower eater, food fussier, and enjoyed food less [5, 20]. When children are restricted from some food, they become attractive increasing children's responsiveness of food and "leading to overconsumption when they become freely available" [20].

Indirect control attempts include monitoring the child's eating behavior and modeling of healthy eating [9]. A recent study demonstrated that slower weight gain has been linked to monitoring feeding practices [1]. Modeling feeding strategies were found to be positively associated with healthy eating and lower picky eating behavior [8]. Gregory et al. [9] found a positive association between modeling of healthy eating reinforced by the experience of pleasant feelings and trying new foods.

T.V. exposure during mealtime impacts children's eating. It could be that T.V. viewing causes distraction that inhibit children from eating [3]. However, increased T.V. exposure time had been associated with higher energy intake [3]. Fitzpatrick, Edmunds,

and Dennison [1] had shown that children who watched T.V. during meals consumed less vegetables and fruits. Therefore, the main aim of this study is to explore the relationship between family food environment and the eating behavior around dinnertime among children aged 4 to 6 years old in the Abu Dhabi.

2. Methodology

This study was a cross sectional in nature, as data was collected from the participants once. Quantitative method was used with primary source of data collection which was a questionnaire. It studied the relationship between the home food environment and child's eating behavior around dinnertime. Family food environment data consisted of demographics and some feeding strategies, such as, modeling of eating, pressure to eat, use of reward, and child independence in eating. These were asked in the questionnaire completed by the participants. The study was approved by the ethical committee of Zayed University and all participants signed a consent form. In addition, permission form the head of the school was obtained prior to the study.

The study includes children form 61 families as a convenient sample form one private school in the city of Abu Dhabi. Families of children attending classes of kindergarten 1 and kindergarten 2 were recruited to participate in the study. The questionnaire was distributed to 150 students from each of the 15 kindergarten classes, 10 participants were selected randomly.

Some of the questions utilized in the questionnaires were extracted from other researcher [3], while rest were constructed specifically for this study. All the questions that were utilized in the study were translated to Arabic, and were distributed in both Arabic and English languages. Since, 4-6 years old children are too young to answer the survey's questions, parents were sent a consent form, the questionnaire, and a reply envelope. Two weeks from the distribution, the envelopes were collected from the school. Out of the 150 families with four to six years old children attending this school, 40.7% responded. Only families that consented to be part of the study were eligible for participation.

Child's care-giver completed the questionnaire that consisted of three parts. The first part asked questions about demographic information. The second part contained questions regarding food environment and child eating behavior when the child is having the dinner with the family. The last part asked about information regarding food environment and child eating behavior when the child is eating the evening meal separately. Demographic questions included information about care-giver age, education, relationship with the child in the study, nationality and marital status, perception of own weight status as well as child weight status. Questions about the

number of children under 18 years old and adults above 18 years old were included. Participants were asked some questions on the home food environment. A question on the frequency of the child having dinner with his/her family was included in the questionnaire. Response options ranged from less than once a week to 7 times a week and were collapsed into "less than once a week," "1-2 times," " 3-4 times", "5-6 times", and "7 times". The pressure to eat subscale included 3 questions, which were "If my child says 'I'm not hungry, I try to get him/her to eat anyway", " My child should always eat all the food on his/her plate in dinner" and "I have to make sure that my child eats enough dinner". A score of 12 to 15 points is high and suggested using pressure to eat. Modelling of eating subscale included 3 questions, such as "I am satisfied with how often my family eats the evening meal together" , and "it is difficult to have the evening meal together". A score of 12 to 15 points is high and suggests use of pressure to eat. The use of reward was defined as rewarding the child with interesting things when the child finishes the food or behaves in a good way around the dinner. Use of reward was assessed by using 4 statements, such as "if my child finishes the food, he/she will be rewarded with sweets, watching T.V.,..etc)". A score of 16 to 20 points is high and suggests using reward. Independence of eating was investigated using 4 questions about child independence in eating, and selecting type and quantity of food. The questions assess whether the child is responsible for feeding himself and choosing the type and quantity of food that he/she eat. A score of 7 to 8 points means that a child is independent in eating. Detailed questions about all these different features are provided in the complete questionnaire that is attached. (see appendices) To assess child's eating behavior, a number of questions that covered some eating behavior areas were included. Positive eating behavior is defined as: child enjoys dinner, does not have signs of picky eating behavior and food neophobia, and has good behavior around dinner table. Parents were asked to report their level of agreement to some statements. The scale had 8 items, and scores of 24 points and above are high indicating a better and positive eating behavior.

2.1. Statistics

Statistical analysis was conducted using SPSS software version 18. In order to examine the relationship between some demographic indicators, such as education level and employment status of the child care provider and child eating behavior, *t* test was used. Correlation was conducted to investigate whether there was a correlation between the family food environment elements and child eating behavior. Reliability (internal consistency) was tested for the used scales. $P< 0.05$ was considered statistically significant.

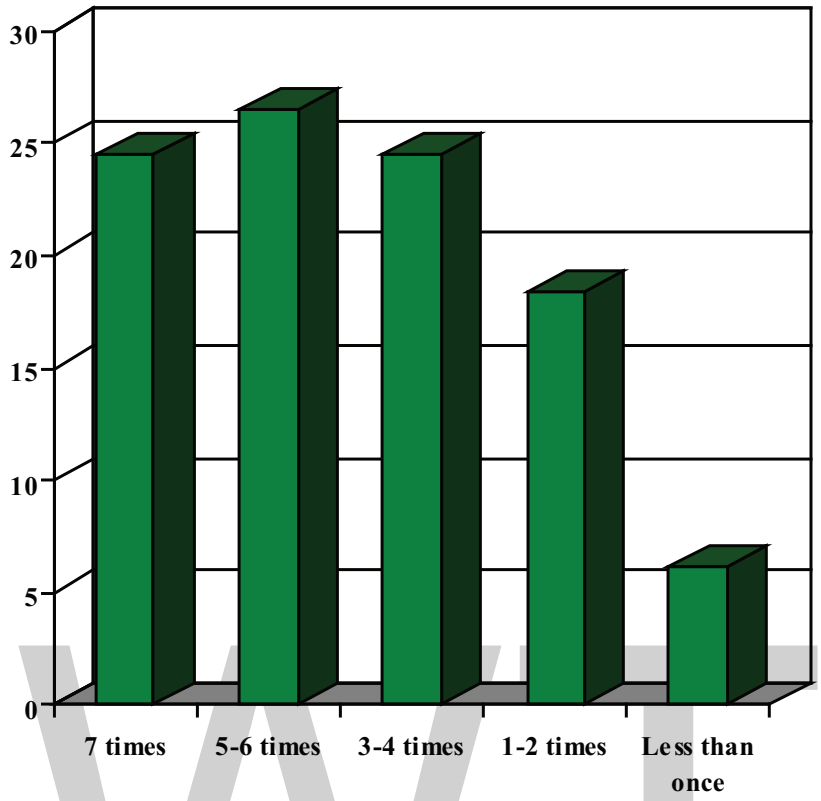

Figure 1: Number of dinners together (child and family) per week.

3. Results

Participants were 61 children, and their primary care providers were 82% mothers, 10% fathers and 7% relatives. Children who were fed by their fathers and other relatives were excluded from the study because of their small percentage in the sample. Data from one case that did not provide enough information in the questionnaire was also deleted. These exclusions reduced the number of cases from 61 to 49.

The age of majority of the mothers (65%) was between 26 to 35 years, while 20% of the them were above 36 years, and 14% were between 20 to 25 years old. The vast majority of the sample (92%) were Emirati, where as the rest were distributed thinly across other regions . Over half of all mothers (53%) were tertiary educated (higher education), and 47% had completed high school or Technical or trade school certificate/ apprenticeship (lower education). Fifty-three percent of mothers were not working, while forty-seven had an employment.

Most of the families had dinner together three times or more a week. Figure 1 presents the percentages of the number of times that the child ate with his/her family at dinner time. Around 69% of mothers found it difficult to have dinner together as a family. Nearly all of the mothers (96%) decided the menu for the family dinner. More than half (51%) of the mothers were responsible for cooking and preparing the meal,

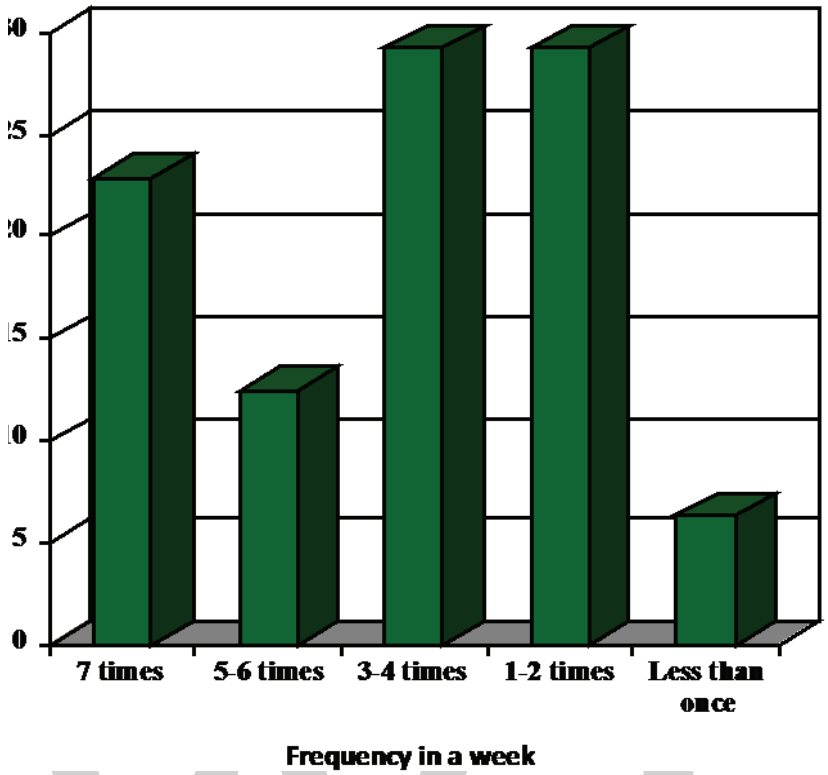

Figure 2: T.V. exposure among children during dinner per week.

while 49% of mothers reported that cooking was their domestic workers (maid or cook) responsibility. A small percentage of children (27%) helped in dinner preparation, while the rest (73%) helped once or less than a month. The proportion of children who enjoyed dinner more than usual when helping in preparation was 64%, whereas 33% enjoyed the meal as usual. The majority of mothers (73%) said that they planned for the dinner in advance. Dinner was considered a pleasant time for 78% of the families, where 82% of the families agreed that dinner was a time for family connectedness and communication. Ninety-two percent of the mothers had not shown support to statement that "the dinner is a time for disagreements", and if disagreements occurred, 78% would happen less than once a month. During dinner time, most mothers reported switching on television. Figure 2 shows child's T.V exposure during dinner in week.

The mean score of child eating behavior was 22.81 (*SD* = 3.84), with 50% scoring 24 points and above. Mothers were using different feeding strategies. Half of the children got a high score in the child's eating behaviour scale, indicating that they had positive eating behaviour. Reliability (internal consistency) was tested for feeding strategies and child eating behavior, and it ranged between .59 - .76 (Table 1).

Modeling of eating and child eating behavior were significantly positively correlated, Pearson's $r = .56$, $p < .01$. There was a significant negative correlation between pressure to eat and child eating behavior, Pearson's $r = -.35$, $p < .01$. There was a

Scale Name	No. of items	Internal consistency Cronbach's Alpha	Mean ± SD	Percentage of application
Modelling of eating	3	.76	11.04 ± 2.13	61%
Pressure to eat	3	.59	13.16 ± 3.07	49%
Use of reward	4	.76	14.08 ± 3.05	31%
Independence of eating	4	.64	6.10 ± 1.22	45%
Child eating behavior	8	.73	22.81 ± 3.84	50%

Table 1: Mean scores, SD, internal consistency scores, and percentage of mothers applying different feeding strategies in 4 to 6 years old children (n = 41).

no significant correlation between use of reward and child eating behavior as well as between independence in eating and eating behavior.

4. Discussion

The aim of the current study was to explore the home food environment and eating behavior among children who are between four to six years old in families living in the United Arab Emirates. In this sample, half of the children ate the evening meal five times or more a week with their families. The other half of the children had their dinner four times or less a week with their families. This shows that some children cannot have dinner more frequently with their families, and a reason for that could be that family members have different schedules. When the family is having dinner together, this meal is shown to be a pleasant time that connects family members together. One of the benefits of family connectedness is that it helps in promoting "health-related behavior and positive self-esteem" [18]. The results of this study showed that most of the mothers plan for the evening meal, and some of them cook for their families. The findings from this study revealed that a lot of children are exposed to television around dinnertime. This is a serious problem because of the epidemic of obesity in the U.A.E [22]. TV exposure is a major contributor to "obesity-promoting dietary outcomes" [3]. A study had shown that T.V. viewing during meals was negatively associated consumption of fruits and vegetables [3]. High T.V. exposure was also linked to an increased energy intake [3]. However, T.V. viewing can cause distraction that stops children from eating [3].

It was hypothesized that mother's employment would negatively impact child's eating behavior. It was also hypothesized that positive eating behavior would increase when mothers had higher level of education. An unexpected finding was that mother's occupation did not affect child's eating behavior in our study. This could be related to

both working and non-working mothers' ability to plan for the dinner. In the U.A.E, employement hours for some jobs that women have do not extend to the evening, which helps mothers to prepare for the meal and offer pleasant time for the children as non-working mothers do. The results of this study revealed that there was a positive association between maternal education and child eating behavior. The reason for this could also be that education may enhance knowledge about the importance of nutrition in health. Possibly, education fosters awareness amongst mothers about the health risks associated with child weight. It is also conceivable that mothers with higher education have an improved problem-solving skills supporting a parental style with high responsiveness to the child's needs, "high demandingness, and autonomy granting" [17].

The study findings suggesst that using pressure as a feeding strategy is negatively associated with positive child eating behavior during the meal. These results were supported by the study of Webber, Cooke, Hill, and Wardle, [20], which examined different feeding strategies and child's eating behavior. They found that forcing children to eat was negatively associated with enjoyment of food and positively associated with food fussiness, which were characteristics of negative eating behavior [20]. Another study had also revealed that pressuring decreased acceptance of new food by children [8]. The development of "common food dislikes can be traced back to children's experiences of being pressured to eat", which suggested that this practice was connected to the "development of food dislikes and rejections" [20]. Eventually, this could also lead to the loss of interest in the meal. One interpretation for the use of this strategy could be that the perceived child weight by the parents could play a role on constructing the type of feeding practice with the child. Parents tend most likely to apply pressure strategy with children that they perceive to be underweight [2]. This may not be beneficial to the child as it might interfere with the child's capacity to regulate his/her energy intake, compromising the ability to respond to internal cues. Another perspective to this issue is that parental feeding strategies were influenced by their children appetitive traits. Research conducted by Farrow, Galloway, and Fraser [1] showed that children with more negative behavior were pressured by their parents to eat. Another qualitative study had reported that mothers modified their feeding practices depending on their children's eating behavior [20]. These examples suggest that the relationship between pressuring and eating behavior could be bi-directional.

The present study demonstrated that modeling was linked to positive eating behavior, which was consistent with the finding that "modelling have a clear influence on how children both think and behave around food" [2]. Eating meal together provides an opportunity for parents to be models for their children "when paired with enthusiastic comments" [12]. Mealtime can also be regarded as learning experience for children

by watching others [12]. Children's eating behavior could also reflect their parents' eating behavior. Evidence had shown that there were "similarities between parents' and children's food acceptance and preferences, intake, and willingness to try new foods" [14].

Use of rewards and prohibiting interesting things to the children were not associated with eating behavior in this sample. This could be attributed to that the different influence that reward could have depending on the context or the situation in which this strategy is applied [2]. Therefore, positive or negative consequences may result. For instance, if the child was rewarded by eating a food in a "coercive or negative context" the conveyed message could be that it is the "consequences of eating badly" thus, he/she start to dislike that food. However, using reward in a positive context, such as positive consequences of eating and indication of child's achievement, could improve consumption and liking of food [10].

The independence in eating was not correlated with eating behavior of children. This finding was nearly consistent with another study conducted by Branen, Fletcher and Myer (1997). In their study, they found that consumption pattern of children, who were allowed to select their food, did not differ from when children were served preselected food [15].

The major strength of this study was that it allowed us to explore the home food environment and child eating behavior in the UAE, since Emirati participants comprised 92% of the sample. This study had some shortcomings too. Time constraint was one of them that lead to a small sample size. Secondly, the children in this study were young (4 to 6 years old), which would not allow the results to be generalized to older ages. Another limitation was that all of the data were reported by mothers and might not be accurate, so observational studies were suggested, but this proposal may not guarantee the possibility of normal interactions between child and parents. Another limitation of the study is the inability to analyze and compare the environment and eating behavior when the child eats alone to the environment and eating behavior when the child eats with the family because of the missing data.

5. Conclusion

This study was in line with other research showing that aspects in the family food environment have an influence on eating behavior of children. It focused on feeding strategies and child's eating behavior around dinner time. Educating parents on food environment and its impact on child's behavior is crucial in order to enable them to develop feeding strategies most likely to benefit children's health. Informing the Ministry of Health and Ministry of Education of the results of this study is important

in achieving this. One suggestion would be offering some sessions on this topic for parents in schools during parents and teachers meetings.

6. Acknowledgements

We would like to thank Ms. Amal Shaheed, the principal of the Private School, for allowing us to conduct the study in her school. We would also thank Dr. Malin Garemo for supervising the study, Dr. Fatima Al Anouti and Dr. Justin for their help in the analysis of the data, Amani Al Kathiri, Eman Al Amoudi and Saeed Al Amoudi for reviewing the Arabic version of the questionnaire.

References

[1] J. Blissett and E. Haycraft, "Are parenting style and controlling feeding practices related?" *Appetite*, vol. 50, no. 2-3, pp. 477–485, 2008.

[2] R. Brown and J. Ogden, "Children's eating attitudes and behaviour: A study of the modelling and control theories of parental influence," *Health Education Research*, vol. 19, no. 3, pp. 261–271, 2004.

[3] K. J. Campbell, D. A. Crawford, and K. Ball, "Family food environment and dietary behaviors likely to promote fatness in 5-6 year-old children," *International Journal of Obesity*, vol. 30, no. 8, pp. 1272–1280, 2006.

[4] H. R. Clark, E. Goyder, P. Bissell, L. Blank, and J. Peters, "How do parents' child-feeding behaviours influence child weight? Implications for childhood obesity policy," *Journal of Public Health*, vol. 29, no. 2, pp. 132–141, 2007.

[5] C. V. Farrow and J. Blissett, "Controlling feeding practices: Cause or consequence of early child weight?" *Pediatrics*, vol. 121, no. 1, pp. e164–e169, 2008.

[6] C. V. Farrow, A. T. Galloway, and K. Fraser, "Sibling eating behaviours and differential child feeding practices reported by parents," *Appetite*, vol. 52, no. 2, pp. 307–312, 2009.

[7] E. FitzPatrick, L. S. Edmunds, and B. A. Dennison, "Positive Effects of Family Dinner Are Undone by Television Viewing," *Journal of the Academy of Nutrition and Dietetics*, vol. 107, no. 4, pp. 666–671, 2007.

[8] A. T. Galloway, L. Fiorito, L. A. Francis, and L. L. Birch, "Finish your soup: counterproductive effects of pressuring children to eat on intake and affect," *Appetite*, vol. 46, pp. 318–323, 2006.

[9] J. E. Gregory, S. J. Paxton, and A. M. Brozovic, "Maternal feeding practices, child eating behaviour and body mass index in preschool-aged children: A prospective

analysis," *International Journal of Behavioral Nutrition and Physical Activity*, vol. 7, article no. 55, 2010.

[10] C. F. Lowe, P. J. Horne, K. Tapper, M. Bowdery, and C. Egerton, "Effects of a peer modelling and rewards-based intervention ot increase fruit vegetable consumption in children," *European Journal of Clinical Nutrition*, vol. 58, no. 3, pp. 510–522, 2004.

[11] E. Moens, C. Braet, and B. Soetens, "Observation of family functioning at mealtime: A comparison between families of children with and without overweight," *Journal of Pediatric Psychology*, vol. 32, no. 1, pp. 52–63, 2007.

[12] S. N. Moore, K. Tapper, and S. Murphy, "Feeding strategies used by mothers of 3-5-year-old children," *Appetite*, vol. 49, no. 3, pp. 704–707, 2007.

[13] J. K. Orrell-Valente, L. G. Hill, W. A. Brechwald, K. A. Dodge, G. S. Pettit, and J. E. Bates, ""Just three more bites": An observational analysis of parents' socialization of children's eating at mealtime," *Appetite*, vol. 48, no. 1, pp. 37–45, 2007.

[14] H. Patrick and T. A. Nicklas, "A review of family and social determinants of children's eating patterns and diet quality," *Journal of the American College of Nutrition*, vol. 24, no. 2, pp. 83–92, 2005.

[15] C. Robertson, *Safety, nutrition and health in early education*, Wadsworth Publishing, New York, 4th edition, 2009.

[16] R. R. Rosenkranz and D. A. Dzewaltowski, "Model of the home food environment pertaining to childhood obesity," *Nutrition Reviews*, vol. 66, no. 3, pp. 123–140, 2008.

[17] J. Saxton, S. Carnell, C. H. M. van Jaarsveld, and J. Wardle, "Maternal Education Is Associated with Feeding Style," *Journal of the Academy of Nutrition and Dietetics*, vol. 109, no. 5, pp. 894–898, 2009.

[18] M. Marquis and B. Shatenstein, "Food choice motives and the importance of family meals among immigrant mothers," *Canadian Journal of Dietetic Practice and Research*, vol. 66, no. 2, pp. 77–82, 2005.

[19] J. Utter, R. Scragg, D. Schaaf, and C. Ni Mhurchu, "Relationships between frequency of family meals, BMI and nutritional aspects of the home food environment among New Zealand adolescents," *International Journal of Behavioral Nutrition and Physical Activity*, vol. 5, article no. 50, 2008.

[20] L. Webber, L. Cooke, C. Hill, and J. Wardle, "Associations between children's appetitive traits and maternal feeding practices," *Journal of the Academy of Nutrition and Dietetics*, vol. 110, no. 11, pp. 1718–1722, 2010.

[21] L. Webber, C. Hill, L. Cooke, S. Carnell, and J. Wardle, "Associations between child weight and maternal feeding styles are mediated by maternal perceptions and concerns," *European Journal of Clinical Nutrition*, vol. 64, no. 3, pp. 259–265, 2010.

[22] WHO, United Arab Emirates Global School-based Student Health Survey. Geneva 2005; Retrieved October 13, 2009, from

http://www.who.int/chp/gshs/2005_United_Arab_Emirates_GSHS_Country_Report.pdf.

[23] WHO, Risks to oral health and intervention. Geneva n.d.; Retrieved March 17, 2009, from http://www.who.int/oral_health/action/risks/en/index.html.

[24] S. J. Woodruff and R. M. Hanning, "A Review of family meal influence on adolescents' dietary intake," *Canadian Journal of Dietetic Practice and Research*, vol. 69, no. 1, pp. 14–22, 2008.

Permissions