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Bahrain Medical Bulletin
P O Box 32159
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Telephone: (+973) 239798
Facsimile: (+973) 277036
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Methods: Describe sampling procedure, design, equipments, methods of study, statistical analysis in sufficient details to allow reproduction by other workers.

Results: Present results in logic sequence. Avoid repetition between text and illustrations. Numbers should match with all sections of the paper. Use uniform unit of measurement.

Discussion: Provide implication and interpretation of findings and their limitations. Relate observations to relevant study and present status of knowledge. Do not repeat data from introduction or findings from the results section unless warranted. Avoid lengthy literature review. Unqualified statements must be supported by references. Link conclusions to goals of study. Affirm the "message" of the paper in the final paragraph.

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Editorial

Obesity in the Arab Gulf Countries

Abdulrahman O Musaiger, DrPH*

Thirty years ago the word obesity was not familiar to the people of the Arabian Gulf countries. Underweight, anaemia and infectious diseases were the predominant diseases at that time. However, the Arab Gulf countries, namely Bahrain, Kuwait, Oman, Qatar, Saudi Arabia and the United Arab Emirates have experienced marked changes in lifestyle, socioeconomic status and dietary habits during the past three decades. These changes have their impact on trends of diseases in the populations with development of non-communicable diseases, such as obesity, heart diseases, hypertension, diabetes and cancer.

The prevalence of obesity is rising steadily in the Arab Gulf countries, with a higher prevalence among women than men. Studies in the region showed that overweight and obesity are growing rapidly among school children and adolescents. This is an alarming situation as increased body fat among children may be a contributing factor for obesity in adulthood. Furthermore, it is well documented that obesity is a risk factor for certain chronic diseases, especially heart diseases, hypertension, diabetes and some forms of cancer.

The trend of increasing prevalence of obesity in the Arab Gulf countries suggests that current measures to prevent and control obesity are inadequate. Programme to prevent obesity in any community should base on epidemiologic studies in the region. This current issue of *Bahrain Medical Bulletin* provides useful information on obesity in the Arab Gulf countries. The issue was divided into four main sections: First section includes review papers on measuring obesity, the role of physical activity and diet in childhood obesity and a review on obesity in Saudi Arabia. Second section includes three original papers on obesity in Bahrain, Kuwait and Qatar; whereas the third section contains five short communications on attitudes of nursing students to obesity, obesity in students of Bahrain University, obesity in females students in the United Arab Emirates University, obesity among health workers in Bahrain and obesity among women in the United Arab Emirates. The fourth section provides very useful bibliography on all published papers and reports on obesity in the Arab Gulf countries.

We hope that this special issue on obesity in the Arab Gulf countries is a useful document for all those interested in studying obesity in this region.

* Director
Environmental & Biological Programme
Bahrain Centre for Studies & Research
State of Bahrain

Methods of Measuring Obesity, with Special Emphasis on Children and Adolescents

Anissa M. Al-Sindi, BSc. MSc*

Several methods were used to determine obesity. The aim of this paper was to highlight the main methods used to measure obesity, with special emphasis on children and adolescents. Anthropometric measurements are widely used and these include weight and height, relative weight, body mass index, skinfold thickness, waist and waist-hip circumference ratio. The visibility and accuracy of these methods were briefly discussed. The classification of obesity based on weight and height and body mass index (BMI) for children was highlighted. In this region and due to lack of facilities and trained people, simple methods such as BMI is recommended to be used, especially with the availability of international reference data for BMI.

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Obesity is now becoming a major clinical and public health concern contributing to increasing morbidity and mortality rates for several chronic diseases, and affecting both adult and child populations worldwide.

The specific causes of obesity are poorly understood, but a wide variety of environmental, socio-economic, familial as well as individual variables appear to influence its development. Obesity often occurs as a result of small shifts in the energy homeostasis, which over time lead to a gradual but sustained weight gain. The aim of this paper is to highlight the main methods used to measure obesity.

Adult vs. childhood obesity

In adults, obesity and overweight are often determined using the body mass index (BMI). Adults are classified as obese or overweight by a variety of cut-off values based on the mortality and morbidity associated with various levels of weight. It is well established that obesity is a risk factor for chronic diseases such as heart disease, hypertension, stroke, diabetes and some forms of cancer[1]. Recently the World Health Organisation has published non-gender specific BMI criteria for overweight and obesity in adults. A BMI value of 25-29.9 indicates overweight whereas a BMI value of 30 and over indicates obesity. The category of obesity is further classified into class I (BMI 30-34.9), class II (BMI 35-39.9) and class III (BMI ≥ 40)[2].

The waist circumference and the waist hip circumference ratio, which are measures of intra-abdominal fat, are often used to predict the health consequences of obesity in adults, as changes in these measurements tend to reflect changes in risk factors for cardiovascular diseases and other chronic illnesses.

Obesity in children and adolescents is difficult to quantify and until recently there has been little agreement on a common definition and a system of classification of obesity in the paediatric group. This is largely because of the increase in weight for height, sexual maturation and the changing body composition that characterizes child growth. Various methods have been used to assess adiposity in children including absolute weight, weight for height percentiles, percent of ideal body weight, body mass index and skinfold.

Measurements of body composition

Recent developments have led to the availability of several measurement techniques for assessing body composition including densitometry, dual energy absorptiometry (DEXA), tracer dilution techniques, neutron activation, ultrasound, magnetic resonance imaging (MRI), computerised tomography (CT) and bio-electric impedance analysis (BIA)[3]. Most of these techniques are complex, expensive and not practical for use in population studies and thus their use is restricted to research settings. A summary of these methods along with cost, ease of use, accuracy and effectiveness in assessing body fat is presented in Table 1.

Anthropometric Measurements

Anthropometric measurements are often used, particularly in epidemiologic studies, as indirect methods to

* Head of Life Sciences Department
College of Health Sciences
Ministry of Health
State of Bahrain.

Table 1. **Methods of estimating body fat and its distribution**

Method	Cost	Ease of Use	Measures Accuracy	Regional Fat
Height and weight	$	Easy	High	No
Skinfolds	$	Easy	Low	Yes
Circumferences	$	Easy	Moderate	Yes
Ultrasound	$$	Moderate	Moderate	Yes
Density Immersion	$	Moderate	High	No
Plethysmograph	$$$	Difficult	High	No
Heavy water				
Tritiated	$$	Moderate	High	No
Deuterium oxide	$$$	Moderate	High	No
Potassium isotope (^{40}K)	$$$$	Difficult	High	No
Total body electrical conductivity	$$$	Moderate	High	No
Bioelectric impedance	$$	Easy	High	No
Fat-soluble gas	$$	Difficult	High	No
Absorptiometry (dual-energy x-ray absorptiometry, dual-photon absorptiometry)	$$$	Easy	High	No
Computed tomography	$$$$	Difficult	High	Yes
Magnetic resonance imaging	$$$$	Difficult	High	Yes
Neutron activation	$$$$	Difficult	High	No

$ = low cost; $$ = moderate cost; $$$ = high cost; $$$$ = very high cost.
Source: Harsha & Bray[3]

estimate the size of fat mass. The most commonly used of these measurements are stature (height), weight and skinfold thickness measurements.

Weight and height

Weight and height are simple and direct measures of body size that are easy to obtain in a variety of settings using relatively inexpensive instruments. Weight is highly correlated with body fat, but it also correlates with height, which is poorly associated with body fat. Thus weight adjusted for height is more useful than weight alone as an indicator of overweight[4]. There are two types of weight /height ratios: relative weight and power type indices.

Relative weight

Relative weight or weight for height is a common measure of overweight in children. It expresses the weight of a given subject as a percentage of the average weight of people of the same height and requires the use of tables of expected weight for the child's height and sex[5].

Power type weight and height indices

In addition to the height and weight tables, several indices have been proposed that relate weight to the n power of height (wt/ht(n)), such as the ponderal index (ht/wt $-1/3$), Rohrer index (wt/ht^3), Benn's index (wt/htp) and the Quetelet index or the body mass index (wt/ht^2).

Body mass index (BMI)

The body mass index (BMI) is one of the most commonly used weight for height measures. It can be simply calculated by dividing the body weight in kilograms by the height in meters square (kg/m^2). BMI offers a reliable and valid measure of obesity both in adults[6] and in children and adolescents[7,8,9] and is often employed in large-scale nutritional and epidemiologic studies. Although more reliably quantifiable than skinfold thickness, BMI measurements may be affected by variability in body frame size. It has been suggested that, in children, factors such as growth and development may complicate the use of BMI[10]. More recently however, BMI has been recommended as the most acceptable measure of body fat in children and adolescents which is both valid and reproducible as well as being easy to use[11,12]. In normal children, BMI increases slightly with age, thus BMI percentiles, which are age specific, are used to define risk categories.

Skinfold thickness

Total body fat can be predicted from skinfold thickness at various anatomical sites of the body, both in children and adolescents[13]. The most common sites used to assess children and adolescence adiposity are the subscapular skinfold measurement, which determines truncal body fat and the triceps skinfold, which measures fat in the extremities. Several prediction equations for assessing fat mass from skinfold measurement have been developed and cross-validated with other techniques for measuring body fat[14,15]. The clinical validity of skinfold measurement is well established. Triceps skinfold correlates positively with arteriosclerosis index and systolic blood pressure, and negatively with high-density lipoprotein cholesterol[16].

Skinfold thickness measurement is simple and relatively inexpensive. However, there is growing concern regarding the comparability of the skinfold measurement across surveys and longitudinal studies, which monitor trends over time[17,18]. Reliability is often difficult to establish either for a single observer on the same subject or for different observers and it tends to decrease as body fat increases. In addition, the need to partially undress may not make this method culturally acceptable in some parts of the world. It may also lead to greater subject refusal and consequently bias[4].

Waist circumference and waist –hip circumference ratio

Waist–hip circumference ratio is a well-recognised measure of regional fat distribution in the body and is often used as a marker for intra-abdominal fat accumulation. In adults there are gender differences in accumulation of intra-abdominal fat, which appears to be independent of the total amount of body fat[19]. Males often show a central or android pattern of fat distribution, whereas in females, body fat tends to accumulate in the thighs and buttocks resulting in a peripheral or gynaecoid pattern of adiposity. In men and women an increased WHR (>1.0 for males and >0.8 for females) is associated with greater risk of chronic diseases such as hypertension, stroke and ischemic heart disease[2, 20] independent of total body fat[21]. In children and adolescents, excessive intra-abdominal fat accumulation is associated with cardiovascular risk factors. Caprio et al[22] have demonstrated a positive correlation between visceral fat mass and triglycerides and inverse relationship with high-density lipoprotein cholesterol in obese adolescent girls.

In adults both waist–hip ratio and waist circumference have been shown to be significantly associated with intra-abdominal fat[23]. Recent evidence suggests that waist circumference is the most preferred single anthropometric measurement for assessment of visceral adipose tissue[24,25]. Waist girth is easy to measure and correlates well with BMI, intra-abdominal fat mass and cardiovascular risk factors. Furthermore, reduction of waist circumference during weight loss in women has been shown to result in reduction in risks to cardiovascular diseases[26].

In children and adolescents however, no correlation has been established between these measurements and intra-abdominal adipose tissue[27,28]. Using MRI to assess peripheral and intra-abdominal adipose tissue in obese and non-obese 10-15-year-old children, Brambilla et al[29] showed that adiposity in children has a subcutaneous pattern and that there is no difference between sexes.

Individual trunk skinfold thicknesses and ratio of trunk to extremity skinfold thickness or circumference appear to be more important indicators of intra-abdominal adiposity in children and adolescents than waist-hip ratio. Fox et al[28] used MRI to examine abdominal fat deposition in a group of 11-year-old children. Results showed that in girls subscapular skinfold thickness and waist circumference correlate well with intra-abdominal fat ($r=0.8$, $r=0.76$ respectively). Brambilla et al[29] found that intra-abdominal fat in adolescents has a positive correlation with several trunk/ extremities such as waist/ arm and waist/thigh ratios and that in boys the subscapular/triceps skinfold ratio was the most important anthropometric measure of intra-abdominal fat($r=0.6$).

Classification of obesity in children and adolescents

Obesity in children and adolescents is difficult to classify based on outcome criteria similar to those used for adults. Although adiposity in youth has been shown to be associated with adult morbidity and mortality[30-32], available data are currently insufficient to support the development of a risk factor-based classification system for obesity in youth[4]. Thus a statistical approach is used in which obesity and overweight are defined relative to a selected percentile of a reference population based on age, sex and race-ethnicity[33]. These percentiles may be applied to a variety of anthropometric measures including skinfolds, weight for height and BMI.

Traditionally, obesity in children has been defined as a weight for height above the 90th percentile on the growth charts from the National Center of Health Statistics (NCHS), or weight in excess of 120 percent of the medi-

Table 2. **Recommended cut off-values of body mass index and skinfold thickness for adolescents**

Indicator	Anthropometric variable	Cut off values
Overweight	BMI for age	>85th percentile
Obese	BMI for age	>85th percentile of BMI
	TRSKF for age	>90th percentile of TRSKF
	SSKF for age	>90th percentile of SSKF

TRSKF= triceps skinfold, SSKF= subscapular skinfold
Source: adapted from WHO[11]

an weight for a given height. Super-obesity is defined as a weight for height above the 95th percentile and weight in excess of 140 percent of the median weight for a given height.

A recent workshop on childhood obesity convened by the International Obesity Task Force agreed to select BMI as an internationally acceptable index to assess adiposity in children and adolescents worldwide[12]. Cut-off points consistent with the internationally accepted cut-off points for adults' morbidity of 25-30 have been proposed. Overweight was defined as a BMI value above the 80th percentile while a value greater than the 95th percentile was indicative of obesity. More recently, Cole et al[34] have proposed age and sex specific cut off points for overweight and obesity in children which are linked to the adult obesity cut off points of 25 and 30 and based on pooled data from six large nationally representative surveys conducted in Brazil, Great Britain, Hong Kong, the Netherlands, Singapore and the United States.

The World Health Organisation expert committee, on the other hand, has recommended the use of weight for height tables for determining overweight in children and infants in populations[11]. A cut-off of > +2 Z score is considered to be indicative of overweight in children. In case of adolescents, the WHO expert committee has recommended the use of both the BMI for age and the skinfold for age as the best indicators for the assessment of obesity in this group. Overweight is defined as >85th percentile of BMI for age while cut-off >85th percentile of BMI for age plus a >90th percentile of triceps skinfold for age and a >90th percentile of subscapular skinfold for age would be indicative of adolescent obesity. Several countries have published BMI for age charts for their population as well as defined cut-off points for overweight and obesity. Table 2 shows indices and cut-off points used in different countries to define obesity in children. The WHO has suggested that in the absence of local reference data, the United States' BMI for age data, as published by Must et al[35] should be used.

CONCLUSION

There are several methods for measuring obesity in various ages and sexes. Each method has its advantages and disadvantages. However, the selection of these methods depends on many factors such as the cost, accuracy, ease of use, facilities and availability of trained personnel. In the Arab Gulf countries, most studies have used body mass index and skinfold thickness to determine overweight and obesity. These measurements are easy to obtain and some of them (body mass index) have a relatively good level of accuracy. Advanced sophis measurements may be difficult to use at this time, mainly due to the absence of facilities to carry out such measurements.

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Childhood Obesity: The Role of Physical Activity and Diet

Yannis Manios, PhD*
Colin Boreham, PhD**
Anthony Kafatos, MD***

The world-wide epidemic diffusion of obesity and the health and socio-economic implications of it has promoted extended research during the last decades on the aetiopathogenesis, treatment and prevention of this disease. The objective of the current paper is to review the existing literature on childhood obesity, focusing primarily on the role of physical activity, both in the pathogenesis and the treatment of the disease. Both the cross sectional and the prospective studies reviewed are quite consistent in demonstrating a relationship between obesity and physical activity in children. Furthermore the findings of the experimental studies are supportive to this relationship indicating that enhanced physical activity through structured exercise programmes, is an effective tool in treating childhood obesity. This tool can be even more effective if diet is also included as a component of the intervention.

However, the long-term benefits of such interventions are questionable and definitely not cost effective if they have to be implemented in large group of children. Understanding human behaviour and the role of family and school in the development of life habits, seems to be the key point in developing effective interventions with long term benefits. During the last two decades several school based programmes, with extended parental involvement, focusing both on developing healthy eating habits and increasing voluntarily physical activity, indicate a promising, effective approach without requiring substantial school time or new resources.

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The increased levels of adult inactivity, observed during the end of the century, seems to be highly related with the increased levels of obesity and chronic disease morbidity and mortality observed both in developed and developing world[1,2,3]. This relationship is also supported by research evidence showing a reduction in age standardized mortality rates in initially sedentary men who became more active[4,5].

Furthermore, it seams that both the behavioral parameters (diet and physical activity) and physiological parameter (obesity) leading to increased risk for chronic diseases have their roots in childhood[6,7]. Specifically, it has been reported that life long physical activity is more likely to be initiated in childhood and adolescence[8] and the physical activity levels in adulthood are positively correlated with those during childhood[8,9]. The purpose of the present paper is to review scientific evidence focusing primarily on the role of physical activity and diet on both the etiology and the prevention of childhood obesity.

Is children's physical activity/inactivity related to childhood obesity?

Although there are accumulating evidence about the importance of genetic factors and the role of leptin in the development of obesity the non-genetic factors still remains the primary determinants. Precisely, when the energy expenditure is constantly lower than the energy intake over a long-term period this is leading to the development of overweight and obesity.The main components of energy expenditure are the resting metabolic rate, the thermic effect in food and the thermic effect of physical activity. Resting metabolic rate constitutes 60-70%, the thermic effect of food approximately 10% and the remainder is due to physical activity[10]. While the former two components are relatively constant the thermic effect of physical activity is most variable, suggesting that the main factor determining the levels of energy expenditure are the levels of physical activity.

When physical activity is measured as energy expendi-

* Kellogg's Science and Nutrition Manager
** Professor of Sports and Exercise Science
University of Ulster
Northern Ireland.
***Professor & Director
Preventive Medicine and Nutrition Clinic
University of Crete.

ture then it is necessary to adjust activity energy expenditure for body weight. This is because heavier children spend more energy for a certain activity compare to the lean children. Consequently in order to avoid misleading interpretation of the findings this correction needs to take place. An extra problem then arises regarding the appropriate correction factor. Children tend to do several activities that vary in nature (running vs cycling) regarding how much of the body weight is supported externally. Furthermore, Prentice et al[11] suggested that the correct exponent is itself dependent on the relative mix of weight-dependent and non-weight dependent activities undertaken. Consequently an exponent closer to 1.0 might lead to over correction while an exponent closer to 0.5 might be more appropriate for sedentary lifestyle.

The different correction methods used in cross-sectional and prospective Double Labeled Water studies might be some of the reasons that these studies reached controversial findings and no clear conclusion can be reached[12-15]. Observational studies, although they are less objective, they might promote a more clear picture of children's physical activity. Cross-sectional and prospective studies can guide us to the development of certain hypothesis. However, causal relationship can only be supported by experimental studies. For this reason studies falling is these two categories will be presented separately in the following section.

Cross-sectional Studies

In a nationally representative cross-sectional survey in USA which took place between 1988 and 1994 on 8 to 16 year old children it was found that 20% of US children participated in 2 or lower bouts of vigorous physical activities per week. The rate was found to be higher for girls compared to boys (26% vs 17%). Overall 26% of the children were watching 4 or more hours of television per day while the highest rate was observed among non-Hispanic black children (24%). Both boys and girls who watch 4 or more hours of television per day had significantly greater body fat and body mass index compared to those who watched less than 2 hours per day[16].

In agreement with these findings are the results of the study conducted by Obarzanek et al[17] on 2379 black and white US children aged 9-10 years. Obarzanek et al, apart from hours of TV watching they also assessed daily physical activity with the use of 3 day activity diaries and dietary intake with the use of 3 day food records. With the use of multivariate – regression analysis they found that the variations observed in body mass index and sum of skinfold thickness can best be explained by hours of TV watching for both black and white girls and by the intake of saturated fat in black girls and intake of total fat in white girls.

Further more physical activity data was found to have a significant impact on the model explaining the variations obtained in the obesity indices only for black girls. Finally, it was found that black girls spent significantly more hours per week watching TV and video than white girls.

More or less in line with the above findings are the results of a study conducted on 712, 9-16 year old children from a low and middle income town in the Mexico City area[18]. They found that the mean time spent by children on TV watching (including video) was 4.1 ± 2.2 hours/day while the average time spent on moderate and vigorous physical activities were 1.8 ± 1.3 hours/day. Odds ratio of obesity were 12% higher for each hour of TV watching per day and 10% lower for each hour of moderate/vigorous physical activity per day.

In a small sample of 86 healthy 19 years old adolescents no differences were observed in body mass index between active and less active adolescents. However body composition (assessed based on an equation using arm circumference and tricep skinfold) was found to be significantly different favour of active adolescents compared to less active.Finally TV watching was found to be significantly and positively correlated to body mass index, tricep and subscapular skinfolds[19].

In the Belgian Luxemburg child study of 1028 children from the mainly rural area of the Province de Luxemburg in Belgium were examined. It was found that boys participated significantly more frequently in sport activities than girls did. A significant positive relationship between body mass index and time spent on TV watching daily was found (only) for boys, while participation in sports activities was found to be negatively related to subscapular skinfold. In girls no such relationships were found. Furthermore for both boys and girls it was found that father's education was directly associated with participation in sports, whereas the mother being a housewife showed a negative relationship to physical activity and positive to TV watching of their children[20].

In Thailand, in a study conducted by Mo-suwa and Geater[21], 2161 primary school children aged 6-13 were examined. According to weight for height measurement, the prevalence of obesity was found to be 14.1%. With the use of logistic regression, childhood obesity was

found to be significantly positive correlated with family income and negatively with family size. Furthermore the highest attributable factors for childhood obesity were found to be family history of obesity (34%), low exercise levels (12%) and an obese or overweight mother (10%).

In a study conducted in United Arab Emirates 566 female students from the Local University were examined. Students were classified as overweight when their weight was 110-120% of the reference weight for height and they were classified as obese when their weight exceeded 120% of the reference value. According to this criterion 10.8% of the students were classified as overweight and 30.6% as obese. Obesity was found to be associated with obesity during childhood, presence of obesity among one or both parents and food intake between meals. Limited physical activity and long afternoon napping were found to be important contributors to the development of obesity[22].

Similar findings were obtained from a younger population in the same country. 220 children aged 6-18 years were divided into two groups (obese and non-obese) according to the body mass index (>90th percentile of age-sex reference data). The logistic regression analysis showed that family history of obesity, diet, physical activity and mother's education were significant factors for the development of obesity. No relationship between socio-economic status and obesity was found[23].

The same methodological approach was also used in another study conducted in Kuwait on 460 obese and 460 normal weight controls. 6-13 year old children. The logistic regression analysis showed that childhood obesity is significantly related to family history of obesity. However, no such a relationship was found for physical activity and parental social class[24].

Comparisons between obese and non-obese children were also done in two recent studies. In Finland 129 obese children were compared with 142 normal weight controls. It was found that children's obesity was negatively associated with children's habitual physical activity and parent's obesity (body mass index ∅30 kg/m^2). Also parent inactivity was a strong positive predictor of children's inactivity[25].

In Japan a matched-pair comparison was performed between 427 obese (body mass index ∅18) and 854 control children. All children were 3 years old. It was found that parental overweight, children's overweight at birth, snacking irregularity and physical inactivity are influencing factors for the development of obesity at the age of three[26].

In an attempt to identify possible difference regarding cardiovascular disease risk factors between urban and rural areas of USA, 962 urban and 1151 rural third and fourth grade children were examined. It was found that although both body mass index and sum of skinfolds was significantly greater for rural children no differences were found between the two populations regarding physical activity[27].

No relationship between physical activity and body weight was also found in a study conducted on an ethnically diverse, low income, urban school children population aged 9-12 year old in Canada[28]. Similarly, neither physical activity nor high fat food intake were found to be related to childhood obesity in a study conducted on 8-10 years old USA children[29].

Prospective Studies

In a study conducted by Klesges et al[30], 146 children and their families were followed for 3 years. Children's average age at the beginning of the study was 4.4 years. It was found that increases in children's leisure physical activity were associated with decreases in subsequent weight gain. It was also found that although parents' BMI was related to children's BMI, this parameter accounted less compared to children's dietary intake and physical activity in determining changes in children's BMI.

Similar are the findings of the well-known "Framingham children's study". In a paper published by Lynn et al[31] the data obtained from 97 healthy children, aged 3-5 years at their entry of the study and re-examined at the 1st grade are presented. The data analysis showed that more active children (those with above-median activity levels) gained substantially less subcutaneous fat than did the less active children. When age, television viewing, energy intake, baseline triceps and parent's body mass indices were controlled for, it was found that the less active children at baseline were 3.8 times as likely as active children to have an increasing triceps slope during follow up.

In a study conducted by Eck et al[32], 92 children with one or two parents overweight and 95 children none of the parents being overweight were followed for one year. Average age for both groups at base line was 4.5 years of age and no differences regarding both weight, were observed for the two groups at baseline. At the follow up it was observed that the group of children with at least

one parent overweight gained more weight (P=0.05) while no significant differences were observed between the two groups regarding total energy intake or physical activity. However, the high risk group was found to consume a significantly higher percentage of energy from fat.

Both the cross-sectional and prospective studies reviewed above are quite consistent in demonstrating an association between childhood obesity and levels of physical activity. However, because of the difficulty of measuring physical activity due both the uncertainty of what is meant by physical activity and the lack of a valid, widely accepted tool for measuring it, few definitive conclusions are warranted. Perhaps the most reasonable conclusion is similar to one reached in a prospective study of 10 year weight changes in a national cohort of adults[33], that low physical activity leads to weight gain, while weight gain leads to further diminution of activity. This conclusion would imply that interventions which could either increase physical activity or decrease fatness would turn the cycle in the favourite direction. In the next section the experimental studies would be reviewed looking for more solid evidence to support the causal relationship between physical activity and obesity.

Experimental studies

Supportive evidence for the value of exercise early in life for the prevention or treatment of obesity comes from experimental studies on animals[34]. Although it would be reasonable to formulate a hypothesis based on the findings of the animal studies it would be also wise to keep in mind the complexity of human behaviours and external parameters influencing it. For this reason in this section we will proceed with a step-wise approach presenting findings of controlled exercise interventions to more complex multidisciplinary approaches.

In a study conducted by Gutin et al[35], on 79, white, black and Asian children (aged 7-11 years) with obesity were randomly assigned to two groups. The first group was engaged in a controlled physical training for four montwhilthe second group engaged in the physical training programme the second four months. The physical training programme offered in both groups, consisted of five 40 minutes sessions per week. Each session started with warm up and ended with cool down while the main part of the session consisted with at least 30 minutes aerobic activities at an indesity level of 70% of maximal heart rate. The findings of the study showed that both groups declined in percent body fat of an average 1.6% fat units during the training period. However the first group 4 months after the cessation of the training regained 1.3% of body fat[35]. Concluding, the finding of this study suggests that regular exercise without dietary intervention can improve the body composition profile of obese children. Furthermore it proves that obese children are capable of participating in a substantial amount of high intensity training over a long time period[36,37].

A slight different approach was used in a study conducted by Epstein et al[38] on 8-12 years old children from 61 families. It was found that interventions aiming to reduce sedentary lifestyle had higher, longer-term (after 1 year) beneficial effects on decreasing body fat compared to intervention focusing on reinforcing exercise. It was also found that the children participating in the mild form of intervention increased their liking for exercise and reduced their caloric intake compared to the children participating in the exercise-reinforcing group.

Although the short-term benefits of interventions focusing on exercise alone are clearly demonstrated in the above studies, the combination of dietary counseling plus exercise, is gaining more and more supporters world wide. The combination of exercise and dietary counseling has been followed in the studies reviewed bellow.

After 10 weeks of disciplinary intervention including guidance for dietary and exercise lifestyle changes on 59 obese children (mean age 2.8 ± 2.6) significant changes in total body fat mass but not in fat-free mass were observed[39]. No follow up was reported in this study.

Similar beneficial effects on a 10-week multidisciplinary intervention on 87, obese children (7-17 years) were reported in the study conducted by Sothern et al[40]. The intervention included a low calorie/high protein diet, moderate intensity progressive exercise programme and behaviour modification sessions. Significant favourable changes were observed in weight, body mass index, percent body fat and physical activity patterns both at the end of the intervention and in the one year follow up[41,42]. However no control group was used in the current study.

Supportive to the finding of the previous study are the findings of the study conducted by Johnson et al[43]. Similar multidisciplinary approach on obese children showed significant favourable changes on weight and their lipids profile right after the end of the 16 session intervention but also at the 5 year follow up compared to the control group.

More or less in line with the above studies are the find-

ings of Schwingshandl et al[44]. In this study 30 obese children were divided into two groups. In the first group a strength training programme and dietary counseling was applied where in the second group dietary counseling was applied alone. At the end of the intervention and at the one year follow up both groups improved significantly regarding body mass index. However the first group improved significantly compared to the second group regarding fat free mass.

A different approach has been tried in Thailand where 21 obese children aged 8-13 years joined a four weeks summer camp programme. Exercise, swimming, group therapy and dietary restrictions during the official hours were implemented throughout the programme. At the end of the programme all participants had lost about 5% of their initial weight[45]. However, no long-term follow up has been reported from this study and whether these changes in body weight remained over time is not clear.

The findings of the above studies are consistent demonstrating favourable changes in the obesity indices of the intervention groups. However, none of these studies had a long-term follow up and it still remains questionable whether these positive changes will remain after the end of the intervention period. Furthermore, the absence or very limited involvement of the family jeopardize furthermore the sustainability of these results. Understanding the role of the family in the development of life habits and obesity, will help us to see the potential role that family could play in treating the problem and helping children in developing life long healthy habits. However the important role that family plays in developing children's behaviours is generally recognized and is not a new theoretical concept[46]. The studies review bellow, have included families as part of their interventions.

In a very recent study conducted by Epstein et al[47], ninety families with obese 8-12 years old children participated in a comprehensive family-based behavioural weight control programme. These families were divided into four groups of intervention. All four interventions consisted of 6 months treatment period. Families received parent and child workbooks, which included introduction to weight control and self-monitoring the specific activity program, behaviour change techniques and maintenance of behaviour change. Periodically family members were weighted and they also attending 30-minute parent and child group meeting with individual therapist. The dietary intervention was the same for all four groups based on the Traffic Light Diet were foods are grouped in different colour groups according to their calories and nutrient content. The four interventions were varied only on the physical activity component of the intervention (emphasis on increasing physical activities vs decreasing sedentary activities) and treatment dose (low vs high). The families participating in the increase physical activity group were reinforced for increasing physical activities in addition to those engaged in at the onset of the programme. Those participating in the decreasing sedentary activities group were reinforced for reducing sedentary behaviours that compete with being active. During the two years follow up it was found a significant reduction in children's percent overweight and body fat and increase in aerobic fitness for all groups. Furthermore, obese participating parents showed a significant decrease in weight from base live to follow up. The finding of this study demonstrated that reducing sedentary behaviours through a family based weight control programme can be as effective as a well validated activity in obese children, giving more flexibility for the therapists who are treating obese children.

Davis and Christoffel[48], conducted one more study focusing on the dose response and the ideal age for applying an intervention on obese children. They divided 93 obese children (greater than 120% ideal body weight for height age) aged 1 to 10 years in four treatment groups defined by age (pre-school vs school age children) and frequency of visits in one year (two to three vs four or more). An individualised care plan including prescribed frequency and duration of exercise was applied for one year in all four groups. After one year of programme's application it was found that all groups improved significantly regarding ideal body weight for height. However, the greatest changes were observed in the group with the pre-school age children with the frequent visits.

Similar encouraging findings have also being obtained from other studies applying family based programmes for obese US children with 10 years follow up[49] and Chinese obese children with one year follow up[50].

The findings of the studies presented above seems to indicate the positive effect of exercise, dietary counseling and the involvement of family in the treatment of childhood obesity. However, the cost of all these studies, if they have to be implemented in real life, would be tremendous since counselors and therapists would have to follow individual children and families for a quite long time. The need to develop effective, easy to implement interventions with access to large group of children and with low cost, is raising. The ideal environment for such interventions seems to be the school and a large number of studies have already tested the effectiveness

and applicability of such interventions.

School based interventions

The available studies applying school based interventions in order to promote physical activity and treat or prevent childhood obesity, among other coronary heart disease risk factors, can be grouped into three groups. Those focusing entirely on the enhancement of physical activity through the re-organization of the Physical Education (PE) classes. Those that focusing both on diet and physical activity, in and out of school, with no or limited parental involvement. And those which were focusing both on diet and physical activity promotion with enhanced parental participation.

Studies focusing on Physical Education (PE) classes

During 70's a new concept, regarding PE classes, is developing in USA, Canada and Australia, linking PE with physical fitness and the long-term promotion of health. It was believed that the more physical activity children do during PE classes the more physically active they will become after school and consequently they will adopt and track this life style into adulthood which could have a preventative action against coronary heart diseases[51].

One of the first researches was executed in Canada and it is known as 'The Trois Rivieres Study'. Five hours of PE classes, focusing on the promotion of cardiovascular fitness and strength, were added in the curriculum of 500 pupils aged 10-12 years old for four consecutive years. During the follow up it was found that the intervention group performed significantly higher in a cardiorespiratory fitness test compared to the control group which was taking only one 40-minutes PE class per week. It was also found that the amount of time devoted to moderate to vigorous activities daily was higher for the intervention group compared to the control due to more PE classes. However, it was found that control group children spent more time in moderate to vigorous activities out of school compared to intervention group[52].

During the same time period another programme called 'Vigorous Exercise Programme' was applied in USA on 59 randomly selected school children aged 6-7 years old. These children participated in a 25 minutes well-structured aerobic exercise programme four times per week. At the end of the programme it was found that intervention group devoted significantly more time in activities elevating the heart rate above 160 bpm, both during PE classes and out of school, compared to the control group. However, no significant differences were found between groups in weight, height and skinfold thickness[53].

Similar was the structure of the 'Daily Physical Education' programme applied in Australia on 10 years old children for 14 weeks. Five hundred children were divided into three groups. The first two groups served as control groups and children participated in three 30-minutes PE classes per week, following the suggested curriculum from the Ministry of Education, or classes focusing mainly on the promotion of motor skills. The third group participated in a vigorous aerobic programme daily. At the end of the programme it was found that the group which participated daily in the aerobic exercise had a significant reduction in percent body fat and significant improvement in cardiorespiratory fitness compared to the control group[54].

Recently a programme with similar structure was applied in Thailand. An exercise programme, in addition to the one hour PE class per week, consisted by a 15 minutes walk in the morning and a 20 minutes aerobic dance session, three times per week for 29.6 weeks was applies on 292 second grade elementary school children. The control group participated only in the one hour PE class per week. At the end of the intervention period no differences between the two groups were found regarding body mass index[55].

Studies focusing on PE classes plus diet with no or limited parental involvement

One of the most recent and well-known programme is the 'Children and Adolescent Trial for Cardiovascular Health' (CATCH). This programme had three years duration and it was applied on third grade pupils. Certain changes regarding school lunch meals and PE classes were implemented in the intervention schools. The percentage of fat in the meals was reduced to 30% and the salt content of each meal was between 600-1000 mg, while at least 40% of the time during PE classes was devoted to moderate to vigorous physical activities. Intervention school children were also given a workbook where activities related to exercise, diet and smoking had to be completed at school or at home with parental involvement. At the end of the programme 2,366 intervention children and 1,653 control children were re-examined. It was found that although favourable significant changes were observed for the intervention group regarding both fat consumption and time devoted to moderate-vigorous physical activities, no differences were observed between groups regarding anthropomet-

ric indices[56-59].

Similar structure had the 'Cardiovascular Health in Children' implemented in North Carolina. In this programme parental involvement was even more limited compared to CATCH. The total duration of the programme was eight weeks while the intervention group was consisted by 588 third and fourth grade pupils while the control by 686 pupils. At the end of the programme the only significant differences found between the two groups were on health knowledge and level of physical activity[60].

Very similar structure with the previous programmes, but absolutely no parental involvement, was followed in a study conducted in Nebraska. The intervention had a total duration of two years while both intervention and control groups were consisted by children registered in third, fourth and fifth grades. At the end of the intervention period it was found that although intervention school lunches had significantly less fat and sodium and more fiber, according to the 24 hours dietary recall the only difference found between the two groups was for sodium. Physical activity during school hours was 6% greater for intervention group but out of school it was approximately 16% less compared to control group. Regarding body weight and body fat no differences were found between groups for both normal weight and obese children[61].

Most of the above studies managed to increase children's physical activity in the school setting. Further more some of them showed significant improvements in fitness. However, the short term benefits of all these studies regarding obesity indices or other cardiovascular risk factors are very limited or none. Furthermore it is questionable whether forms of interventions as those presented in the above studies can increase voluntarily physical activity out of school or even develop certain lifestyle habits that could track into adulthood and help individuals to minimize the risk for cardiovascular diseases. The findings of Shephard et al[52] and Donelly et al[61] seams to indicate the opposite.

Similarly to the interventions out of the school setting, the ineffectiveness of the above studies seems to indicate the crucial role that family and parents can play in such interventions. The studies reviewed bellow have extended in their school based interventions to the parents/family setting.

Studies focusing on PE classes plus diet with parental involvement

The need to understand human behaviour and the parameters influencing it was raised by more recent studies where parental participation was viewed as one of the main components of intervention. The first and most known programme of this kind was the 'Known Your Body' programme. The routes of this programme are back in 70's[62-64] and since then several versions of it has been applied in different regions of USA and other parts of the world.

Some of the most recent applications of the 'Know Your Body' programme in USA took place in New York, Houston and Michigan. In thNew York and Houston programme the intervention group consisted of 2973 primary school children first to fourth grades, while the control group consisted of 1209 children. The duration of the intervention was 2 fi years and it was consisted of activities that both children and parents had to do together at home, activities in the classroom, changes in the school lunch meals and promotion of leisure time physical activity. At the end of the intervention period significant favourable dietary changes for the intervention group versus the control group were observed. No differences between the two groups were found for the body mass index[65].

In the Michigan programme the intervention group consisted of 1200 pupils from all grades in four primary schools, while 500 pupils from four other schools served as the control group. After one year of intervention, significant favourable changes for the intervention group were found in dietary habits and levels of physical activity[66].

In Israel the 'Know Your Body' programme was used for two years on a cohort of 242 first grade school children (both Hebrew and Arabs) while 161 pupils served as the control group. At the re-examination significant favourable changes for the intervention group were found in body mass index, serum blood lipids and blood pressure[67].

Similar favourable changes were found in Norway after two years of programme's application on 828, 10-15 years old children[68] and in Greece when the programme was applied for one year on 95, 13-14 years old children[69].

More recently, in Greece, the main principles of the 'Know Your Body' programme were adapted in a 'Health and Nutrition Education' programme developed by the University of Crete. The programme had six years duration and it was applied to all children registered in first

grade in 1992 in two counties of Crete, while the children from a third county served as control group. A representative sample of 602 pupils from the intervention counties and 444 from the control were examined for evaluation purposes at baseline, at the three years follow up and at the end of the intervention period, when children were at sixth grade. Significant favourable changes for the intervention group were found for the dietary habit, leisure time physical activity, anthropometric and serum lipids indices at the three years follow up[70,71] and at the completion of the six years intervention[72].

CONCLUSIONS

Both the methodological approaches of dietary restrictions and significant weight losses, whenever observed in the studies reviewed should be viewed with skepticism. As Quinzi[73] stated that children and adolescents should not be placed on restrictive diets because adequate calories are needed for proper growth and development. However, dietary guidelines and family based behavioural management plus exercise seems to be the three major components for treating childhood obesity.

On the same line is the review paper by Epstein and Goldfield[74]. According to their review there is not enough research data to evaluate the effects of exercise alone on treating childhood obesity. However, there is a sufficient number of studies in order to make a quantitative analysis on the comparison of diet versus diet plus exercise programmes. They suggested that exercise add to the effect of diet counseling in the short-term treatment of childhood obesity, which is in agreement with our review findings. In addition the main findings of the current review paper indicate that the ideal environment for large-scale interventions is the school setting but with extended involvement of the family too. Furthermore when such interventions are combined with the PE classes allow more hours of intervention with the least possible interference for the remainder of the curriculum. Such interventions provide an important model for school based health promotion for primary prevention of obesity and chronic diseases without requiring substantial school time or new resources.

Recent studies have shown that the degree of children's participation in physical activities is very much related to the fun and enjoyment children get from their participation in the activity[75-77]. Furthermore, the enjoyment children get from their participation depends to a large extent on their perception of ability or self-mastery[75,78]. Children, who perceive that, have a low ability and feel unable to cope with the demands of the activity, are more likely to drop out[78]. For these reasons we might need to reconsider the objectives and the structure of the PE classes. PE classes should promote and encourage participation of all pupils of the intervention group and not just the few gifted ones[79]. It has been reported that training sessions of moderate intensity do not discourage the less gifted or the obese children, who actually are the ones that need most this type of intervention[80,81].

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Obesity in Saudi Arabia: A Review

Khalid A Madani, MPH, DSc*

This paper highlights the current situation of obesity in Saudi Arabia. The prevalence of obesity ranged from 14% in children less than 6 years to about 83% in adults. Women were more prone to be overweight or obese than men. Several factors were reported to be associated with obesity in this country such as age, sex, socio-economic status, employment, education, and parity. More studies are needed to determine cultural influences in developing obesity. Strategy to prevent obesity in Saudi Arabia should include encouragement of physical activity, reduce intake of high fat foods and behaviour modification.

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It is well documented that obesity is associated with several chronic illnesses. Therefore, the prevalence of obesity in a population can be considered as a rough indicator for health status. Obesity is not an uncommon finding, particularly in affluent societies. In Saudi Arabia, obesity is becoming one of the most important public health problems[1]. The available data clearly indicate a high prevalence of adult obesity particularly in women in the Kingdom.

This paper aims to summarize the current state of knowledge about the prevalence of obesity, its predisposing factors, and its management in Saudi Arabia. This information is required for planning intervention programmes in nutrition and to offer new directions for improving the health of the people of Saudi Arabia.

PREVALENCE OF OBESITY

The prevalence of obesity in Saudi Arabia, ranges from 14% in children to about 83% in adult[2,3]. This wide variation could be due to the differences in criteria used to define obesity and also to the differences in age, sex, and health status.

PRESCHOOL CHILDREN

The risk of childhood obesity and its continuation to adulthood is well established[4]. A survey carried out in the Kingdom[2] utilizing the National Centre for Health Statistics Standards revealed 14% childhood obesity among newborn to six years of age. The tracking of body mass and obesity from childhood through adulthood implies that the genetic, behavioural, and cultural factors involved in obesity operate early in life, can be identified in youth, and can be intervened upon[5]. The challenge for early identification and intervention has important public health implications.

SCHOOL CHILDREN AND ADOLESCENTS

Recently. Abahussain et al[6] assessed the nutritional status of 676 Saudi adolescent girls aged 12 to 19 years from Al-Khobar city, in the Eastern Province of Saudi Arabia. Using the body mass index (BMI) for determining the nutritional status of the girls. it was found that 11% of girls were underweight, 61% were normal and 28% were overweight or obese. These findings revealed that adolescent girls in Saudi Arabia face two contrasting nutrition situations, underweight and overweight. These findings indicate the need for intervention programmes to promote better nutrition among school children and adolescents in Saudi Arabia.

Preliminary results concerning the health and nutritional profile of adolescent girls in the Taif region of Saudi Arabia were gathered by Madani et al[7]. Weight, height, and dietary patterns were obtained from 540 adolescent girls aged 12 to 18 years. The body mass index of NHANESI was used as a reference for adolescence. The prevalence of underweight among these girls was 14.7% (<15th percentiles), and 16.3% were overweight or obese (>85th percentiles). However, the majority (69.0%) were in the normal weight range (15th – 85th percentiles). It was concluded that the dietary pattern of Saudi adolescents was similar to that of their counterparts in Western communities. This suggests a change in dietary habits toward those practiced in Western communities, and may explain in part the steady rise in diet-related chronic diseases in this country.

* Consultant Nutritionist,
Directorate of Health Affairs
Ministry of Health
Jeddah
Saudi Arabia

Al-Abbad[8] determined the prevalence of obesity and some of its associated risk factors using the same criteria to obesity as the previous study. Seven hundred students were randomly selected, aged 11-21 years, from 6 female intermediate and high schools in Al-Khobar city. The prevalence of underweight, normal, and overweight were 11.3%, 60.1%, and 28.6%, respectively. In view of the high prevalence of obesity, it was recommended that national preventive programmes for weight control and healthy life-style for all ages including children and adolescents should be established.

Al-Nuaim et al[9] determined the prevalence of overweight and obesity among 9,061 male school children aged 6-18 years old in Saudi Arabia. Children with evidence of chronic or acute diseases were excluded from the study. The percentage of expected BMI at the 50th percentile for each age group was computed. The 50th percentile of The National Center for Health Statistics/Center for Disease Control (NCHS/CDC) reference population was used as the expected standard population values. Childhood obesity was defined as children who weighed more than 120% of the expected median percentile of the reference population, and overweight as 110-120%. The results showed that the overall prevalence of overweight was 11.7% and obesity was 15.8%. The high prevalence of childhood obesity, when compared with the NCHS/CDC, calls for an early health education programme on the appropriate choice of diets for growth, health and longevity.

Recently, Al-Rashidi[10] studied 200 students of the Home Economics and Art Educational College in Jeddah, to determine the effect of social level and food habits on the spread of overweight and obesity. To determine the prevalence of overweight and obesity, BMI criteria was used. The results showed that 38.5% were of normal weight (BMI 20-25), 27.5% were lean (BMI less than 20), 16% were overweight (BMI 25-30) and 18% were obese (BMI more than 30).

ADULTS

El-Hazmi and Warsy[11] determined the prevalence of overweight (BMI=25-29.9) and obesity (BMI > 30) in a total of 14,660 adult Saudi males and females (>14 years of age) in different regions of the Kingdom. The prevalence of overweight in the total population was 27.23% and 25.20% in males and females, respectively, while the prevalence of obesity was 13.05% and 20.26% in males and females respectively. This high prevalence of obesity is a cause for concern, since obesity is associated with several complications which increase both morbidity and mortality.

Al-Shammari et al[12] determined the prevalence of obesity among, 1,580 Saudi male attendees at 15 health centers in urban and rural areas in the Riyadh region. The mean age was 33.6 ± 13.5 years and BMI was 26.9 ± 5.7. Only 36.6% of subjects were at their ideal weight (BMI < 25), while 34.8% were overweight (BMI 25-29.9). Among them, 26.9% were moderately obese (BMI 30-40) and 1.7% were morbidly obese (BMI > 40).

Ogbeide et al[13] determined the prevalence of obesity among a sample of 1.485 adult patients (48% males and 52% females) at the out-patient department of Al-Kharj Military Industry Corporation Hospital. Overweight was defined as BMI >25 and <30, while obesity was >30. The prevalence of overweight and obesity among the study sample was 31.5% and 40.5% for females and 40.2% and 21.0% for males, respectively. A high prevalence of obesity is observed, particularly in females. Outpatient departments and primary health care centers should include nutritionists on their teams to educate subjects on good nutritional habits and weight control.

Binhemd et al[14] studied the height and weight of 1,072 Saudis (477 men and 595 women), aged 18-74 years, to determine the prevalence of obesity in patients attending the primary health care center of King Fahad Hospital, Al-Khobar. Using a criterion of body mass index of greater than 25, 51.5% of the men, and 65.5% of the women were considered obese. More women than men were found to be obese. Similar findings were also reported by Al-Attas et al[15], indicating obesity was found more frequently in females than in males.

THE ELDERLY

Literature searchfailed to show any study designed to determine specifically the prevalence of overweight and obesity among the elderly in Saudi Arabia. However, Al-Nuaim[16] conducted a national epidemiological household survey to study chronic metabolic disease in Saudis, 6.873 (52%) male and 6.304 (48%) female subjects, aged fifteen years and above. The results of the survey indicated that the prevalence of overweight (BMI = 25 to 30) increased with age, reaching a maximum at the 6th decade for male and female subjects. The prevalence of obesity (BMI ≥ 30 to 40) also increased with age, reaching a maximum at the 5th decade for male and female subjects. The mean BMI for male and female over sixty years old were 25.9 and 26.8, respectively. The prevalence of overweight for males and females over sixty were 37% and 34%, respectively, while the prevalence of obesity for males and females over sixty were 23% and 30%, respectively.

FACTORS AFFECTING OBESITY

The available data indicate that the prevalence of adult obesity in the Kingdom is high, and affects women in particular[13-18], with a preponderance of abdominal obesity[19,20]. There are several factors contributing to the high incidence of obesity amongst women. Watching television and eating snacks are the main activities during their leisure time, especially when the majority of women are not employed. Excessive food intake is also responsible for obesity in the country[21]. The attitude towards obesity is another important factor[22]. The traditional, long, comfortable, and wide clothes worn by women prevents them from noticing the gradual gain in weight[22]. The modernization and affluence in Saudi Arabia over the last three decades has probably caused the problems of obesity in vulnerable persons to surface[23]. Some might even consider obesity as a sign of affluence[3].

For males, middle age, lower education and joblessness predicted a higher risk for obesity[12]. Patients living in rural areas had greater BMIs than those living in urban areas. Forty percent of overweight participants did not think they were overweight. The high prevalence of obesity and the lack of awareness among those afflicted emphasizes the need for community-based programmes for preventing and reducing obesity, since weight control is effective in ameliorating most of the disorders associated with obesity. Young parents who are at risk of developing obesity and who play a central role in perpetuating it in their offspring should be the target of obesity-prevention programmes[12].

In another study, Al-Nuaim et al.[24] conducted a community-based national epidemiological household survey to estimate the prevalence of overweight and to examine its association with the socio-demographic characteristics for 10,657 Saudi subjects aged 20 years and over. The mean age was 35.8 ± 14.27 and 50.8% of the sample were males. The overall prevalence of overweight was 31.2%; it was 33.1% for males and 29.4% for females. For obesity, the overall prevalence was 22.1% (males 17.8% and females 26.6%). The multiple logistic regression analysis showed that age, residential area, region, income, gender, and education are statistically significant predictors of obesity. The prevalence of obesity was higher in females than males, lower in subjects living in rural areas with traditional lifestyles than those in more urbanized environments, and increased with increasing age. The observed prevalence and pattern of overweight and obesity with age and gender is similar to those observed in the Arab community and some Western nations.

In a cross-sectional study[25] in the Gassim region of Saudi Arabia, 6,044 subjects (2,727 males and 3,317 females) had their BMI computed in the following age groups, namely, 0-5, 6-12, 13-49, 50-69 and 70+ years. In general, the trend for BMI was to increase with age in both genders, but the curve pattern showed some plateauing from about the age of 50, with a slight decline in later life. Females had significantly higher indices than males, this becoming quite prominent from the 10-14 year age group. This difference persisted irrespective of the types of age grouping or residential location. Overall means of BMI were 20.14 ± 5.98 vs 22.22 ± 7.21 for males and females, respectively. Subjects in the urban living environment had significantly higher indices than their rural counterparts.

Khwaja and Al-Sebai[26] conducted a study on a sample of 467 married non-pregnant Saudi female patients, using the cut-off point of >30 for the BMI as an indicator of obesity. The results showed that the overall prevalence of obesity was as high as 27%. Age, rather than parity, was a contributing factor to obesity. This appears more likely since the interval between pregnancies is usually short, and does not allow the female to lose the weight gained during pregnancy. This is particularly true in Saudi Arabia, where grand multiparity (the births of five or more viable infants) is a common occurrence[27,28].

Khashoggi et al[23] considered the factors affecting the rate of obesity among females whose ages ranged between 11 and 70 years in the Western Province of the Kingdom. The sample involved 950 females screened at primary health care centers and it was found that the prevalence of obesity was 64.3%, using BMI with a cut-off point of greater than or equal to 25 as an indicator of obesity. Multiple regression analysis indicated that five variables were significant predictors for obesity. These variables were age, marital status, number of servants, having children, and parity. Other factors were studied, including education and income, which were of no predictive value.

Al-Shagrawi et al[29] conducted a study to evaluate the factors affecting the prevalence of obesity among female Saudi college students. A sample of 460 female Saudi students, representing 21.2% of the total students, was selected using a systematic random procedure. The results showed that obesity was present among 20.9% of the students, using BMI equal to or greater than 25 as a criterion. There was a significant relationship between age, social status, daily dietary intakes of energy, fat and carbohydrate as independent variables, with obesity as a dependent variable. These researchers recommended

that more attention should be given to nutritional education for university students regarding the selection of a balanced diet.

Recently, Rasheed[30] evaluated the association between the body weight of young female adults with self-reported eating behaviour, weight control beliefs and practices related to dieting and exercise. A total of 77 female students from King Faisal University resided in the local hostel, all of whom participated in the study. The age of the women ranged from 17-25 years (mean age 20.7 years). Interestingly enough, the present study has shown weight-related beliefs and attitudes at the two ends of the spectrum – a tolerance of obesity at one end and an exaggerated concern for its occurrence at the other. Preference for the modern Western thin body image was clearly obvious in a subgroup of normal-weight females (37.5%), who expressed dissatisfaction with their weight status and wished to lose weight, as well as in nearly two-thirds (61.9%) of the underweight females who did not want to gain weight. Exercise is not part of a daily routine for women living in Saudi Arabia, a claim supported by the present study. Even among the obese of the studied population, exercise was not popular, and this was combined with a poor attitude and a low level of knowledge about exercise. In general, a negative attitude and lack of motivation for exercise largely prevailed among the study subjects. Unacceptable reasons, such as laziness or lack of time, showed that students were not inclined towards physical work-outs. Judicious use and budgeting of time for exercise should receive special attention in health awareness programmes. If young people are convinced of the benefits of exercise in terms of better physical fitness and consequently an improved ability to handle the stresses of daily chores, as well as physically and mentally demanding education programmes, it would be possible to change their lifestyle[30].

Al-Rashidi[10] showed that there was a relationship between social level and weight average. The results showed that weight was higher with higher social level, and it was statistically significant ($p<0.05$). There is a relationship between BMI and age. The older the students were the higher their BMI, and it was statistically significant ($p<0.05$).

Hamilton et al[3] quantify the prevalence of obesity in females in the infertility clinic at King Faisal Specialist Hospital in Riyadh. The results showed that the prevalence of overweight and obesity is alarmingly high among infertile Saudi females. Eighty percent of the females were either overweight or obese before the introduction of ovulation-inducing agents. The high incidence of obesity, as found in this infertile Saudi population, must urge workers in the health care sector to inform the public about these adverse effects and start implementation of preventive measures.

A case control study[31] was conducted to examine the theoretic differences for eating and exercise behaviour among obese and non-obese women from an urban health center in Saudi Arabia. Perceptions regarding actual and ideal body size were also determined. The obese were significantly more likely to eat under emotional conditions of stress and anger, in secrecy, and indulge in binge eating ($p<0.05$). Frequent snacking and regular drinking of soda drinks was also more common in this group compared to the controls ($p<0.05$). A weak association was observed for nibbling at food without being aware, and preference of sweet foods compared to savoury ones by the obese ($p<0.1$). A large group of the study population (75%) was either not exercising at all or doing so infrequently, a feature expected in the middle and lower social class group of women in this region. A sizeable proportion of women either overestimated (28.6%) or underestimated (28.9%) their actual body weight, with increasing education significantly related to overestimation of weight and vice-versa ($p<0.05$). A change in the concept of an ideal body image from the overweight female to that of the slim figure was also observed with advancing education[31].

MANAGEMENT OF OBESITY

Understanding the psychodynamics of obese patients and their families is a pre-requisite to successful treatment. It is suggested that health education related to an awareness of a healthy body size and appropriate eating and exercise behaviour should be given through primary health centers, other health facilities and schools. Perhaps behaviour modification with respect to food intake will be effective in the treatment of obesity, especially in Saudi Arabia.

A reasonable level of physical activity is recommended, not only to lose body fat[32], but also to improve circulation[33]. This can be done either at home or at physical fitness centers. Women in the Kingdom are not allowed to participate in outdoor exercise programmes, hence physical fitness centers have opened in order to cater for women's needs for physical activities and exercise. Surgical management of obesity has been introduced in Saudi Arabia for the treatment of patients with morbid obesity. In a surgical management study[34], the mean weight loss during one year was 39% in males and 33%

in females. In another study[35], excess weight loss of 87% for morbid obesity patients was achieved at 6 months postoperatively.

CONCLUSION

The nutritional problems in Saudi Arabia are mainly due to a change in food habits, illiteracy and ignorance, rather than a shortage of food supply or low income. Therefore, it is essential for all people to eat a balanced diet which will provide the dietary requirements of all nutrients. Perhaps behaviour modification with respect to food intake, will be effective in the treatment of obesity, especially in Saudi Arabia. Strenuous physical activity should be encouraged as a strategy directed towards weight reduction in the obese, as well as prevention of obesity in the Kingdom.

Studies are needed to determine the cultural influences in developing obesity. Knowledge of the social factors associated with obesity will help to identify high risk groups. Certainly, public health measures should focus on all members of society (i.e. in schools, via the printed media, TV, radio, etc..) to discuss the health hazards of being overweight.

Studies are also needed relating to the distinction between gynoid and android obesity[36]. The latter type may correlate with medical morbidity, whereas the gynoid type may not[37,38].

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ORIGINAL

Factors Related to Weight Status of the Adult Bahraini Population (A community-based Study)

Abdulrahman O. Musaiger, DrPH*
Mariam A. Al-Mannai, PhD**

Factors related to weight status of Bahraini adults were studied. A cross-sectional survey on 514 Bahraini adults aged 30-79 years was carried out using multistage sampling technique. Body mass index (BMI) was used as an indicator for measuring obesity. The subjects were classified into non-obese (BMI<25), overweight (BMI 25-29.9) and obese (BMI≥30). There was a significant difference in mean BMI between men and women in all factors studied. Younger people (30-49 years), with higher education, non-smokers, those with history of hypertension, and those who watched television daily had higher mean BMI. There was a significant difference between weight status and age ($p<0.005$), sex ($p<0.0001$), education ($p<0.04$), smoking ($p<0.0001$), hypertension ($p<0.002$), diabetes ($p<0.001$), and watching television ($p<0.04$). The results suggest that the health authority in the country should establish a programme to prevent and control obesity, taking into consideration several social, dietary and health factors.

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Several studies have been carried out in Bahrain to determine the prevalence of obesity in the population[1-3]. These studies found that obesity is highly prevalent among adolescents and adults, especially among women. As obesity is a risk factor for some chronic diseases[4], the need to prevent and control it has become an essential measure to prevent chronic non-communicable diseases in the country.

Any programme to prevent obesity would not be effective without understanding the factors that cause overweight and obesity among various age groups. Very few studies have addressed this aspect in Bahrain. Musaiger et al[5] studied socio-demographic and dietary factors associated with obesity among secondary school students (15-20 years) in Bahrain. The findings revealed that 15.6% of boys and 17.4% of girls were either overweight or obese. Family size, parents' education, and family history of obesity were significantly associated with obesity among boys, while family history was the only socio-economic factor statistically associated with obesity among girls. Another study on women attending physical fitness programmes in Bahrain showed that age, education, employment, marital status, family size and practising exercise have a statistically significant association with obesity, whereas ownership of cars, availability of housemaids, family history of obesity and meal patterns have no significant association[6].

The objective of this study was to investigate some factors that might be associated with the weight status of Bahraini adults aged 30-79 years, using a community-based survey.

METHODS

The study population consisted of Bahraini nationals aged 30-79 years. A proportional random sample of 520 households taken from a list of all households in Bahrain released by the Central Statistics Organization[7] was selected using the method for cluster sample surveys

* Director
Environmental and Biological Programme
Bahrain Center for Studies and Research
** College of Science
University of Bahrain
State of Bahrain

described by Bennett et al[8]. In brief, Bahrain is divided administratively into 11 geographical areas, a total of 337 blocks. A random sample of 52 blocks (15%) was selected using random tables. A probability random sample was obtained from lists of households in each of the selected blocks, and 10 households were chosen from each block, yielding a total sample of 520 households.

One person aged 30 to 79 years was selected from each household. This was done by selecting the first person available in the household aged 30 years or above. People were interviewed at home by trained female interviewers using a structured pre-tested questionnaire which included information on socio-demographic backgrounds, lifestyle patterns, and history of diabetes and hypertension. Educational levels of subjects were grouped into three categories, low education, which included illiterate and those who could read or write; middle education which included those who had primary and intermediate education, and high education, which included those who had secondary and university education. Marital status was divided into two groups; currently married and unmarried (including widowed and divorced). Smoking behaviour was classified into two categories, current smokers and current non-smokers (including ex-smokers). Six people were excluded due to incompleteness of some responses to questions, making the total sample of 514 people.

Weight was obtained using a scale with an accuracy of 0.1 Kg, while the height was obtained using a portable stadiometer with an accuracy of 0.1 cm. Body mass index (BMI) [weight (kg) / height (m)2] was used to determine obesity among the study population. The subjects were classified into two levels, non-obese, which included those who had BMI less than 25, and obese, which included those who had BMI equal to or more than 25 as described by Garrow[9].

Data were stored on a D-Base file and the SPSS software package was used for data management and analysis.

RESULTS

Means and standard deviations of BMI according to social and lifestyle factors of adult Bahrainis are shown in Table 1. There was a significant difference in mean BMI between men and women in all factors studied, and women had a higher mean BMI than men. This finding suggests that women were heavier than men. When the mean BMI was compared within each sex, a significant difference was found in mean BMI for men with age (P<0.0001), education (P<0.0002), smoking (P<0.0002) and watching television(P<0.0008). The mean BMI for currently married men was lower than that for unmarried men (26.3 and 27.8, respectively). However, this trend was not observed among women, as the mean BMI was almost equal in both groups (30.1 and 30.0, respectively). Among women the mean BMI was significantly differed with smoking (P<0.005) and history of hypertension (P<0.0002).

Table 1. **Social and lifestyle factors of Bahraini adults (30-79 years) by mean and standard deviation (SD) of body mass index**

Factors	Men		Women	
	No.	(Mean±SD)	No.	(Mean±SD)
Age (years)				
<50	125	27.3±4.7	121	30.2±6.9
≥50	173	25.6±4.3	95	29 8±6 1
Education				
Low*	221	25.2±4 1	183	29.7±6 3
High	77	27.3±4 7	33	31 1±7 3
Marital Status				
Currentlymarried	289	26 3±4.5	188	30 1±6 5
Currently unmarried	10	27 8±4.8	28	30 0±7 3
Smoking				
Non-smoker	164	27 0±4 3	66	30.7±6.5
Smoker	134	25.0±4.7	150	27 9±6.7
Historyot hypertension				
No	271	26.2±4 5	180	29.5±6.6
Yes	27	27.1±4 9	36	33.3±5.8
History of diabetes				
No	279	26.3±4 6	189	29.9±6 9
Yes	19	26.0±4 7	27	31.7±4 3
Watching television				
Rarely or occasionally	68	24 7±4 4	45	29 3±6.2
Daily	230	26.8±4.5	171	30 4±6 7

* Low education included low and middle education (see method section)

The relationship between the weight status of Bahraini adults and social, lifestyle and health factors is given in Table 2. Obesity was more prevalent among younger adults (<50 years), female, unmarried, non-smokers, hypertensive, diabetic and those who watched television daily. With the exception of marital status, the association between weight status and these factors was statistically significant. Overweight was more prevalent among high education subjects (44.4%), compared to low (29.8%) and middle education (34.2%) subjects. However, the proportion of obesity among the three education groups was almost the same. The association between education and weight status was statistically significant (p=0.040).

Table 2. **Social, health and lifestyle factors associated with weight status of adult Bahraini adults**

Factors	Non-obese		Overweight		Obese		P-value
	No.	%	No.	%	No.	%	
Age (years)							
<50	66	26.8	92	37.4	88	35.8	0.0055
≥50	108	40.1	82	30.5	78	29.4	
Sex							
Male	130	43.6	106	35.6	62	20.8	0.0001
Female	44	20.3	68	31.3	104	48.4	
Education							
Low	112	30.4	87	29.8	93	31.8	0.0400
Middle	36	31.6	39	34.2	39	34.2	
High	26	24.1	48	44.4	34	31.5	
Marital status							
Married	163	34.2	165	34.7	148	31.1	0.1184
Unmarried	11	28.9	9	23.7	18	47.4	
Smoking							
Non-smoker	113	30.0	127	33.8	136	36.2	0.0001
Smoker	61	44.2	47	34.1	30	21.7	
Hypertension							
No	163	36.1	154	34.2	134	29.7	0.001
Yes	11	17.5	20	31.7	32	50.8	
Diabetes							
No	165	35.2	159	34.0	144	30.8	0.0015
Yes	9	19.6	15	32.6	22	47.8	
Watching T.V							
Daily	127	31.4	138	34.1	140	34.5	0.0364
Rarely or occasionally	47	43.1	36	33.0	26	23.9	

DISCUSSION

Two important findings were obtained from this study. First, the weight status of adult Bahraini is highly associated with social, lifestyle and health factors, which indicates that the causes of obesity are multi-factorial. Second, women showed a higher BMI than men, with the result that obesity is more prevalent in adult females than males. The prevalence of overweight was slightly higher among men (35.5%) than women (31.3%). In contrast, women showed about double the proportion of obesity compared to men (48.4% and 21%). These data supported those reported in other Gulf countries, as obesity was determined by several factors and women were more prone to be obese than men[10,11].

Older people (≥50 years) showed a lower proportion of obesity than younger people (<50 years). The phenomena that obesity increased with age until the age of 50 or 60 years was demonstrated by other investigators in the Gulf region[11,12]. The age-related increase in obesity during young adulthood and middle age is not only a consequence of slowly accumulating excess of fat, it is also likely to be promoted by the fact that most people reduce the frequency, duration and intensity of physical activity very considerably as they age[13].

Interestingly, high education level had a higher percentage of overweight compared to other education groups. This result is in line with that found in the United Arab Emirates, as overweight and obesity were more prevalent among university educated than non-university educated men[14]. In contrast, Khashoggi et al[15] showed that obesity was lower among high education Saudi women followed by low and middle education, respectively. Education, is mostly linked with age, and probably in our study older people were also low educated, and this may explain the lower prevalence of obesity among the low education subjects.

A significant difference in obesity was observed between smokers and non-smokers, as the latter group were more susceptible to obesity. Studies on the relationship between smoking and obesity were inconclusive. However, a number of studies have shown that cigarette smokers weigh less than non-smokers and are less likely to be overweight than non-smokers. In a multiple regression analysis that adjusted for age, alcohol consumption and physical activity, both male and female smokers had a lower mean BMI than people who had never smoked[13].

Hypertension and diabetes were highly statistically associated with weight status in our subjects. The main cause of excess mortality among obese people is heart disease and hypertension. In women, obesity (following age and blood pressure) is the third most powerful predicator of heart disease. In epidemiologic studies the prevalence of diabetes increases with increasing severity as well as duration of obesity. However, diabetes is not directly the cause of most of the excess mortality among obese people. The metabolic defect underlying non-insulin diabetes mellitus is clearly the result of obesity, which itself predisposes to hypertension and heart disease[13].

Hours of watching television had a significant association with weight status (p=0.0364). The percentage of obesity among people who watched television daily (34.5%) was higher than those who rarely or occasionally watched television (23.9%), but the proportion of overweight was the same in both groups (34.1% and 33.0%, respectively). Studies on the association of television with obesity are not consistent[16,17]. Some researchers suggested that the food eaten during watching television may be a confounding factor for obesity, as most of these foods are high in fat and energy. Further investigations on the relationship between watching television and obesity are needed, especially in our region where the television plays an important role in leisure time activity in both children and adults.

CONCLUSION

The present study confirmed the findings of other studies in the region as well as in western countries, that obesity is highly prevalent in the community and is caused by several social and lifestyle factors. Dietary patterns, although not studied, is another contributing factor. These findings suggest that the health authority in the country should establish a programme to prevent and control obesity as it is one of the main factors linked with occurrence of chronic non-communicable diseases. To be effective, such a programme should take into consideration the socio-economic status, dietary habits, and cultural factors that are associated with obesity in the Bahraini community.

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Prevalence of Overweight and Obesity among Kuwaiti Children and Adolescents

Zamzam Al-Mousa, MPH* Parsanna Parkash, MSc*

The objective of this paper was to find out the prevalence of overweight and obesity in preschool and school children, as well as adolescents in Kuwait. Data were obtained from the national surveillance programme on anthropometric information of children, adolescents and adults. The sample included in this study was as follows: 15149 children aged 1-72 months, 10130 children aged 6-9 years, 10893 children aged 10-13 years and 10512 adolescents aged 14-17 years. Findings showed that the prevalence of obesity was higher among females at age groups 1-72 months and 14-17 years, while the prevalence was almost equal in other age groups. As compared with previous studies, the prevalence of obesity is increasing, and therefore a programme to prevent overweight and obesity should be established.

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Obesity is a major public health problem that plagues most countries. Obesity occurs in all socioeconomic strata. However, in most industrialized countries, obesity has been shown to be most common among the lower socioeconomic groups. In developing countries, it is common among emerging elite groups. Obesity has been shown to be a significant contributor to a number of adverse health conditions. Among these are diabetes mellitus, gall bladder disease, hypertension, respiratory disease, heart disease, and other health problems. The development of obesity involves an interaction between genetic, psychological, socioeconomic and cultural factors and is not only due to overeating[1,2].

Obesity can begin at any age. However, overweight and obesity at childhood and adolescent period may be a risk factor for adult obesity. This is generally life long and is associated with an increase in the number of fat cells. Some retrospective studies have suggested that there is a direct progression from a fat child to fat adult[3].

Obesity, as used in the medical sense, is a term for excessive body weight due to excessive body fat. Several measures are used to determine obesity. Body mass index (BMI), fat-fold thickness, and relative weight are the most commonly used indicators, to determine obesity. BMI is the ratio of body weight measured in kilograms divided by the square of height measured in meters. Fat-folds have been taken at a number of body sites. The most common sites and those for which better standards exist are measurements of the thickness of fat layers of the triceps and the subscapular area on the back of the shoulder. Relative weight (as a measure of obesity) is usually defined as being more than 120% of the United States Metropolitan weight-for-height standards. BMI has been shown to be highly correlated with percent body fat and seems to be highly predictive of increased risk of morbidity and mortality from various chronic diseases. Thus, BMI has become the most widely recommended and used indicator of overweight and obesity.

The purpose of this report was to find out the prevalence of overweight and obesity in Kuwaiti infants, children and adolescents.

METHODS

As part of the on-going surveillance efforts of the Nutrition Unit, at the Ministry of Health, Kuwait, anthropometric data were collected from healthy Kuwaiti children during their attendance at the preventive health centers for routine childhood vaccinations[4]. The children and adolescents were from different governorates classes. Weight and height data were also obtained from school age children attending primary, intermediate and secondary schools.

The Kuwait Nutrition Surveillance System was developed in collaboration with WHO consultants and uses WHO surveillance procedures and anthropometric cut-off points. The following data were collected for each enrolled subject: sex, birth date from the birth certificate or identification card, weight (recorded to the nearest 0.1 kg) using an electronic scale, and height (recorded to the nearest 0.1 cm) using a CDC measuring board [5].

Kuwaiti children were compared to the American reference population, which was disseminated by both the

* Nutrition Unit
Ministry of Health
Kuwait

USA National Center for Health Statistics (NCHS) and the Centers for Disease Control and Prevention (CDC). These reference values are also recommended by the World Health Organization (WHO)[6]. The criteria for a reference population are of critical importance. The sample size provides criteria related to the precision with which Z-scores was calculated. The sample size was as follows: 15149 children aged 0-72 months, 10130 children aged 6-9 years, 10893 children aged 10-13 years, and 10512 adolescents aged 14-17 years.

The Software Packages dBase IV, Anthrol 1, Anthro 2 and SPSS were used for the processing, calculation and statistical analysis of the data. The data were analyzed using the NCHS/CDC reference population and according to the recommendations of the WHO Expert Committee Report[7]. In children between the ages of 0-10 years, weight for height >2 SD is considered to be an indicator of obesity, thinness was calculated as <-2 SD, while normal children where those between -2 SD and +2 SD. Reporting of prevalence-based data are commonly done by using a cut-off value of (±2) standard deviations to improve the precision of defining malnutrition[6].

BMI is recommended as an anthropometric indicator for thinness and overweight during adolescence because weight-for-age index is considered uninformative or even misleading and weight-for-height index changes dramatically with age and with maturational status. Therefore, BMI-for-age is recommended as the best indicator for use in adolescence. The recommended cut-off values of reference data for adolescents are summarized below[7]:

Underweight:	BMI/Age.	<5th Percentile
Normal:	BMI/Age.	5-85th Percentile
Overweight:	BMI/Age.	≥85th Percentile
Obese:	BMI/Age.	≥95th Percentile

RESULTS AND DISCUSSION

Table 1 shows the prevalence of overweight among children below 6 years of age. The results of this study showed a similar pattern to those reported by Al-Isa[8] as girls had a higher prevalence of obesity than boys, as well as that reported by Afifi et al[9]. The highest proportion of obesity among males was noted at age 6-11 months (8.3%) while that in females at age 12-23 months (12.4%).

Table 1. **Prevalence of thinness, normal and overweight among Kuwaiti children aged less than 6 years based on weight for height Z-score data by sex**

Age (months)	Sex	Weight for Hight (Z-Score)					Sample size
		<-2 SD (Thinness) (%)	±2 SD (Normal) (%)	>2 SD (Over-weight and obese) (%)	Mean Z-Score	SD Z-Score	
0-5	M	0.4	93.6	6.0	0.55	0.95	1134
	F	0.4	92.9	6.7	0.59	0.94	1157
6-11	M	0.6	91.1	8.3	0.52	1.06	700
	F	0.9	89.6	9.6	0.59	1.05	690
12-23	M	1.2	91.4	7.4	0.40	1.11	1016
	F	1.0	86.7	12.4	0.53	1.22	945
24-35	M	2.1	95.2	2.7	0.04	0.97	1181
	F	2.4	93.8	3.8	0.11	1.01	1225
36-47	M	1.7	95.9	2.4	0.14	0.99	839
	F	0.7	94.9	4.4	0.03	1.06	858
48-59	M	1.5	95.8	2.6	0.09	0.98	1293
	F	1.2	93.3	5.5	0.15	1.07	1338
60-71	M	1.3	94.0	4.6	0.06	1.01	1422
	F	1.5	91.8	6.7	0.10	1.12	1351
Total	M	1.3	94.0	4.7	0.14	1.05	7585
	F	1.2	92.1	6.7	0.28	1.09	7564

Table 2. **Prevalence of thinness, normal and overweight among Kuwaiti children aged 6 to 9 years based on weight for height Z-score data by sex**

Age Groups in months	Sex	Weight for Hight (Z-Score)					Sample size
		<-2 SD (Thinness) (%)	±2 SD (Normal) (%)	>2 SD (Over-weight and obese) (%)	Mean Z-Score	SD Z-Score	
6-6.9	M	2.1	91.9	6.0	0.01	1.13	1419
	F	1.6	90.6	7.8	0.17	1.20	1244
7-7.9	M	1.7	92.9	5.4	0.03	1.10	1361
	F	1.2	90.1	8.7	0.24	1.28	1361
8-8.9	M	1.5	88.7	9.8	0.18	1.27	1409
	F	1.3	88.6	10.1	0.26	1.28	1243
9-9.9	M	1.7	86.4	11.9	0.30	1.38	1189
	F	1.5	89.8	8.7	0.19	1.28	904
Total	M	1.7	90.2	8.1	0.11	1.22	5378
	F	1.5	89.7	8.8	0.22	1.26	4752

Table 3. **Prevalence of underweight, normal and overweight among Kuwaiti children aged 10-14 years based on body mass index by sex**

Age (years)	Sex	Body Mass Index for Age					Sample size
		Under-weight (%)	Normal (%)	Over weight and obese (%)	BMI Mean	BMI S.D.	
10-10.9	M	7.5	56.5	36.0	18.70	3.69	1371
	F	8.3	56.4	35.3	18.98	3.95	1380
11-11.9	M	8.0	55.1	36.9	19.51	3.02	1456
	F	6.6	58.1	35.3	19.87	4.17	1471
12-12.9	M	7.2	54.7	38.1	20.50	4.42	1467
	F	4.6	57.9	37.5	21.14	4.49	1468
13-13.9	M	9.2	55.1	35.8	20.81	4.43	1155
	F	2.8	61.7	35.6	21.87	4.56	1125
Total	M	7.9	55.3	36.8	19.85	4.22	5449
	F	5.7	58.4	35.9	20.40	4.42	5444

The overall prevalence of obesity is relatively high; being 4.7% for males and 6.7% for females. The prevalence of low weight-for-height (≤2 SD) is less than expected, however, the prevalence of obesity (>2 SD) is greater than expected for almost all age groups. The prevalence of obesity is consistently higher in females than in males.

A study of the growth patterns of Kuwaiti pre-school children[8] showed that girls were taller than boys after the age of one year. The prevalence of obesity [Weight/Height >2 SD] was greater among females (3.8%) compared to males (2.7%).

Previous reports of Kuwaiti pre-school children between 0-5 years of age[10], showed that Kuwaiti children were shorter than American children according to NCHS/CDC references. Forty seven percent (47%) fell below the 30th percentile of the USA reference population. However, the weights of Kuwaiti children were

Table 4. **Prevalence of underweight, normal and overweight among Kuwaiti children aged 14-17 years based on body mass index by sex**

Age (years)	Sex	Body Mass Index for Age					Sample size
		Under-weight (%)	Normal (%)	Over weight and obese (%)	BMI Mean	BMI S.D.	
14-14.9	M	8.2	59.0	32.8	21.64	5.06	1128
	F	1.7	65.3	33.0	22.62	4.79	1143
15-15.9	M	9.5	62.9	27.6	21.56	4.86	1410
	F	3.1	64.1	32.8	22.90	5.02	1420
16-16.9	M	10.0	64.2	25.8	21.83	4.14	1485
	F	2.2	68.5	29.3	23.09	4.71	1452
17-17.9	M	10.1	65.0	24.9	22.22	4.54	1167
	F	2.4	68.1	29.5	23.37	4.75	1307
Total	M	9.5	62.9	27.6	21.80	4.72	5190
	F	2.4	66.5	31.1	23.01	4.83	5322

closer to their American counterparts. Overweight (110-<120% standard wt/ht) was prevalent among 13.7% and obesity (120+% standard wt/ht) among 5.2%[10].

Table 2 shows weight-for-height data for Kuwaiti children aged 6 to 9 years according to sex. The overall prevalence of obesity (weight/height >2 SD) was 8.1% for males and 8.8% for females. These percentages were higher than those observed among the Kuwaiti children below 6 years of age (4.7% for males and 6.7% for females). Females tended to have higher weight-for-height than males. However, at age 9-10 years, the prevalence of obesity in males exceeded that of females.

Table 3 shows body mass index for Kuwaiti children aged 10 to 13 years according to sex. The prevalence of overweight (>85th percentile of BMI for age) was similar for both sexes, being 36.8% among males and 35.9% among females. The average BMI for both males and females increased progressively from 10 to 13 years with females displayed slightly higher BMI at each age interval.

Table 4 shows body mass index for Kuwaiti children aged 14 to 17 years according to sex. The prevalence of overweight (≥85th percentile of BMI/age) was comparatively higher and was more among females (31.1%) than among males (27.6%). About one third of Kuwaiti children aged 14-17 were overweight. This is consistent with the observed overweight among Kuwaiti children from the age group 10-13 years. The mean body mass index continued to increase during 14-17 years, but was more apparent among females.

These data demonstrate that from first month to ninth year, the prevalence of obesity was higher in females than in males. However, for the 9-10 age interval until 14-15 age interval, males had higher BMI's and greater prevalence of overweight. After the age of 15-16 years, females exceeded the males in prevalence of overweight. The prevalence of thinness at age 14-17 years in males was as much as 3 to 4 times greater than that in females.

Overweight and obesity appear to be increasing among Kuwaiti males and females. The data of this study indicate a potentially significant future public health problem, since many overweight adolescents may become an obese adults. This means that they will be at high risk for several chronic diseases, including hypertension, diabetes mellitus, osteo-arthritis, coronary heart diseases, and others in adulthood stage.

The combination of high incomes, an abundant food supply, easy access to high calorie fast foods, and decreased physical activity may all be responsible for the increase in overweight and obesity in Kuwaiti children and adolescents. Whatever the explanation, the trend toward increasing overweight and obesity is clearly evident from these, and other data, collected by the Ministry of Health, in Kuwait over the last several years. It is highly recommended to establish a programme to prevent obesity among young, school children and adolescents.

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Social, Lifestyle and Health Factors Associated with Obesity among Out-patients in Qatar

Abdulrahman O Musaiger, DrPH*
Ahmed A. Al-Mulla, DrPH**
Mariam A. Al-Mannai, PhD***

This study aimed to investigate factors associated with obesity in patients attending out-patient clinics in Qatar. Patients aged 20 years and over who attended the out-patient clinics between 8 a.m. to 12p.m. for the period of one week were interviewed (457 patients). Of these patients only 346 had their weight and height recorded, and therefore were included in the study. There was no significant association between factors studied and obesity. However, using logistic regression, it was found that the risk of obesity was higher among older people (odd ratio, OR=1.56) female (OR=1.74), married (OR=1.20) and those who watched television more than two hours a day (OR=1.22). People with a history of hypertension and cardiovascular diseases were also more prone to be obese. The findings revealed that obesity is caused by interaction between social and lifestyle factors.

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Obesity is one of the most important risk factors for several chronic diseases such as cardiovascular diseases (CVD), diabetes, hypertension, arthritis and some types of cancer[1]. These diseases have become the main causes of death in Qatar and represent over 50% of total deaths[2]. Therefore, prevention and control of obesity is considered an important measure to control non-communicable chronic diseases in Qatar.

Studies on obesity in Qatar are very limited. Musaiger et al [3] have carried out a cross-sectional survey on 628 women aged 17-67 years who attended health centers in Doha, the capital of Qatar. They found that 62.6% of women were overweight or obese. Socio-economic factors such as age, marital status, education and age at marriage as well as chronic diseases such as hypertension and diabetes were significantly associated with obesity.

The present study aims to investigate the social, lifestyle and health factors that could be associated with obesity among patients attending the outpatient clinics in Qatar.

METHODS

The target group of this study was patients attending outpatient clinics attached to Hamad General Hospital in Doha, the only governmental hospital in Doha. All patients aged 20 years and over who attended the outpatient clinics between 8 a.m. and 12 p.m. for the period of one week were interviewed. The total sample was 457. However, only 346 patients (75.7%) were included in the study, due to absence of data on weight or height or both of them in the rest of the patients.

The patients were interviewed by health workers using a pre-tested questionnaire. Information on the socioeconomic background of patients, lifestyle patterns and occurrence of some chronic diseases was collected. Weight and height of patients were obtained based on self-reporting. The patients were asked to report their weight and height. Those who did not recall their weight or height were excluded from the study. Obesity was determined using the body mass index (BMI) which is defined as the weight in kilograms divided by height in square meters. Patients with BMI equal or above 25 were considered obese (overweight and obese), while those with BMI less than 25 were considered non-obese as described by Garrow[4].

Marital status was classified as currently unmarried and currently married. Employment status was grouped into unemployed (including housewife), and employed. Educational level was divided into low education, which included those who had education below secondary

* Director
Environmental and Biological Programme
Bahrain Center for Studies and Research
State of Bahrain
** Hamad General Hospital
Doha, Qatar
*** College of Sciences
University of Bahrain
State of Bahrain

Table 1. **Risk of socio-demographic factors for occurrence of obesity among patients attending outpatient clinics in Qatar**

Socio-demographic	Obese		Non-Obese		Odds Ratio	95% CI*
	No.	%	No.	%		
Age (Years)						
20 - 39	110	56.7	84	43.3	1.00**	
40+	95	62.5	57	37.5	1.27	0.81-2.01
Sex						
Male	137	56.4	106	43.6	1.00	
Female	68	66.0	35	34.0	1.50	0.91-2.50
Marital Status						
Currently single	35	58.3	25	41.7	1.00	
Currently married	170	59.4	116	40.6	1.05	0.57-1.91
Employment						
Unemployed	73	64.6	40	35.4	1.00	
Employed	132	56.6	101	43.4	0.72	0.44-1.17
Educational level						
Low education	101	58.0	73	42.0	1.00	
High education	104	60.5	68	39.5	1.11	0.70-1.74
Nationality						
Qatari	117	58.2	84	41.8	1.00	
Non-Qatari	88	60.7	57	39.3	1.11	0.70-1.75

* 95% Confidence Intervals.
** Reference value for Odds Ratio.

school level and high education, which included those who had secondary school level and above. Any person who consumed one or more cigarettes a day was considered as a current smoker, while non-smokers were those who did not smoke or former smokers. Occurrence of chronic diseases was obtained by asking the patients whether the doctor had told the patient if he/she had diseases.

Data were stored in a D-base file and analyzed using the SPSS software package. Crude odds ratio and 95% confidence intervals were calculated by using the Epi-Info software programme. Unconditional logistic regression analysis was used to calculate the odds ratio (OR) and their corresponding 95% confidence intervals (CI), while adjustments were made for the effects of factors in the model.

RESULTS

The relationship between obesity and socio-demographic factors is presented in Table 1. The proportion of obesity was higher among patients aged 40 years and over (62.5%) compared to patients aged 20-39 years (56.7%). About 66% of women were obese, while the percentage was 56.4% in men. In general, older subjects (odds ratio, OR=1.27), and female (OR=1.50) were more likely to be obese. However, there was no statistically significant association between socio-demographic factors and obesity in our sample.

There was no significant association between lifestyle patterns and obesity among patients studied. Nevertheless, the risk for obesity was higher among patients with hypertension (OR=1.51) and cardiovascular diseases (OR=1.25). Non-smokers were less likely to be obese than smokers (OR=0.84), as shown in Table 2.

The social and lifestyle factors associated with obesity among patients studied using logistic regression was given in Table 3. The risk for obesity was higher among patients over 39 years (adjusted OR=1.56, CI, 0.92-2.64), females (adjusted OR=1.74, CI, 0.91-3.32), married (adjusted OR=1.20, 0.64-2.18), higher education (adjusted OR=1.20, CI, 0.66-2.13) and those who watched television more than 2 hours a day (adjusted OR=1.22, CI, 0.60-2.46). However, the association was still statistically not significant in all factors studied.

Table 2. **Risk of lifestyle and health factors for occurrence of obesity among patients attending outpatient clinics in Qatar**

Factors	Obese		Non-Obese		Odds Ratio	95% CI*
	No.	%	No.	%		
Smoking						
Smoker	61	62.2	37	37.8	1.00**	
Non-smoker	144	58.1	104	41.9	0.84	0.50-1.39
Practising exercise						
No	111	59.7	75	40.3	1.00	
Yes	94	58.8	66	41.2	0.96	0.61-1.51
Daily hours of watching TV						
< 2 hrs	38	59.4	26	40.6	1.00	
2+ hrs	167	59.2	115	40.8	0.99	0.55-1.79
History of diabetes						
No	82	58.6	58	41.4	1.00	
Yes	123	59.7	83	40.3	1.05	0.66-1.66
Hstory of hypertension						
No	109	55.1	89	44.9	1.00	
Yes	96	64.9	52	35.1	1.51	0.96-2.39
History of cardiovascular disease						
No	142	57.7	104	42.3	1.00	
Yes	63	63.0	37	37.0	1.25	0.75-2.07

* 95% Confidence Intervals.
** Reference value for Odds Ratio.

DISCUSSION

This is the first study in the Arab Gulf countries, which depends on self-reporting of weight and height of the people rather than taking these measurements with a weighing scale and stadiometer. The accuracy of the self-reporting was not checked, but we strongly believe that most patients attending outpatient clinics are aware of their actual weights and heights as these are routinely taken in the clinics. This is especially true when a relatively high percentage of patients have one or more chronic diseases that link to weight status.

The findings of our study were compared to a previous study done by Musaiger et al[3] among women attending health centers in Qatar. Our data showed that 66% of women attending outpatient clinics were obese (based on BMI $\geq$ 25). This result is very similar to those reported by Musaiger et al[3], as they found that the prevalence of obesity in women aged 17-67 years was 62.9% using the same cut-off of BMI. This comparison could indicate that using the self-reporting of weight and height could be an appropriate method for measuring weight status among adults in this region, after some control.

In general 59% of patients attending outpatient clinics were overweight or obese. However, the risk was higher among women than men. This result is consistent with studies in the Arab Gulf countries[5,6]. The low physical activity of women compared to men and multiple pregnancies were considered among the main factors leading to increase the occurrence of obesity among females in this region. In Kuwait, Saleh et al[7] found that the proportion of obesity (based on body fat) increased as the parity increased.

At age 40 years and over, the prevalence of obesity is increased compared to those aged less than 40 years. Studies in the Arab Gulf countries showed that obesity increased with age until age 50 years, then the prevalence decreased gradually. Kordy and El-gamal[8] found that the mean BMI of adult Saudis increased with age, and reached its peak at age 54 years; afterwards the mean declined. Married, higher education and unemployed people showed a higher tendency to overweight or obesity compared to single, low education, and

Table 3. **Social and lifestyle factors associated with obesity among patients attending outpatient clinics in Qatar using logistic regression analysis**

Factors	Obese No.	Non-Obese No.	Adjusted odds ratio.	95% CI* %
Age (years)				
20 - 30	110	84	1.00**	
40 +	95	57	1.56	0.92-2.64
Sex				
Male	137	106	1.00	
Female	68	35	1.74	0.91-3.32
Marital status				
Single	35	25	1.00	
Married	170	116	1.20	0.64-2.18
Educational level				
Low	101	73	1.00	
High	104	68	1.20	0.66-2.13
Nationality				
Qatari	117	84	1.00	
Non-Qatari	88	57	0.94	0.58-1.49
Employment				
Unemployed	73	40	1.00	
Employed	132	101	0.90	0.51-1.57
Smoking				
Smoker	61	37	1.00	
Non-smoker	144	104	0.70	0.42-1.20
Practising exercise				
No	111	75	1.00	
Yes	94	66	0.99	0.64-1.56
Hours of watching TV/day				
< 2 hrs	38	26	1.00	
2+ hrs	167	115	1.22	0.60-2.46

* 95% Confidence Intervals.

** Reference value for Odds Ratio.

employed people. This is in line with other studies in Bahrain[9] and Saudi Arabia[10]. In Bahrain, for example, Musaiger and Al-Ansari[9] reported that married women have twice the risk of obesity of single women, while employed women have less risk of obesity than unemployed women. They attributed the reason for this to employed people being more exposed to society, and therefore more interested in taking care of their weight.

Contrary to some studies[11], the risk for obesity was higher among smokers than non-smokers, although the association was not statistically significant. This may be due to two reasons; first, many patients studied may quit smoking because they are advised by physicians to do so, especially as a relatively high percentage of patients had smoking-related chronic diseases (diabetes, hypertension and CVD). Second, the question on smoking did not include the number of cigarette smoked per day and ex-smokers, which would give a clear picture about smoking status in our subjects.

It is not surprising that walking did not show any association with obesity in this study. This is mainly due to the fact that people did not differentiate between walking in general and walking for the purpose of exercise. It is highly recommended for future studies that questions on exercise should be phrased in more detail and validated.

A tendency to overweight was observed among those who watched television for 2 hours or more a day. The association between viewing television and overweight was a subject of several investigations[12-14]. Mc Murray et al[12] found that watching television on non-school days was related to being overweight. However, when BMI analysis was adjusted for ethnicity and social status, there were no significant effects of television viewing on

BMI. The study by Crawford et al[13] suggested that the link between obesity and television viewing is complex, and that television viewing may not be the simple marker of sedentariness we may have hoped.

CONCLUSION

Although social and lifestyle factors did not show a significant association with obesity among patients attending out patient clinics, the risk for obesity was higher among women, older, unemployed and higher education people. These results are consistent with other studies in the region. The finding that the prevalence of obesity using self-reporting of weight and height is similar to that using actual measurements opens the door to study the validity of self-reporting method of weight and height to determine the obesity in adult people in the Arab Gulf countries. The self-reporting method is widely used in Western countries due to the accuracy of this method. In-depth studies on the prevalence of obesity in various age groups in Qatar, as well as on factors affecting obesity are urgently needed. The present study may provide useful data for such studies.

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Short Communication

Attitudes of Bahraini Nursing Students to Obesity

Nahed Abdulkhalek, DrPH*

A sample of 200 students in the College of Health Sciences in Bahrain were interviewed to determine their knowledge and attitudes towards obesity. In general, the nursing students have better knowledge and attitudes than secondary students. However, some unsound attitudes towards obesity exist, suggesting more nutrition education programme in the mass media to correct unsound beliefs related to obesity.

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Sound knowledge and attitudes toward health problems is an essential component for health curricula in medical and nursing schools. Studies in the Arabian Gulf states[1-3] showed that a large proportion of the community believes in unsound information regarding obesity and other chronic diseases. Therefore, one step to correct this unsound information is to include appropriate knowledge on health and diseases into the undergraduate curriculum. The objective of this study was to determine the knowledge and attitudes of Bahraini nursing students towards obesity.

METHODS

Nursing students in the College of Health Sciences in Bahrain were the target group of this study. The sample size comprised of 200 students with a mean age of 20.4±3.1 years. The students were asked to answer a specially designed questionnaire consisting of eight statements regarding obesity as reported by Musaiger[2]. The attitudes of students were measured using a three-point scale ranging from agree, do not know, to disagree. Data were entered in a D-base file and analysed using the EPI-INFO software programme[4].

RESULTS AND DISCUSSION

The attitudes of nursing students towards obesity are illustrated in Table 1. In general, nursing students have better knowledge and attitudes compared to secondary students in Bahrain[1], indicating that health curriculum in the College of Health Sciences may play a role in providing sound health and nutrition information. The highest percentage of agreement was observed in the statement "Sauna baths help in reducing the fat of the body" (33%), and the statement" plump women are more acceptable to men than non-plump women", (22.5%). These statements also received the highest proportion of "do not know", indicating that a relatively large percentage of nursing students needs further information to correct their attitudes to these statements.

Table 1. **Attitudes towards obesity by Bahraini nursing students**

Attitudes	Agree %	Disagree %	Do not know %
Drinking a lot of water causes obesity	12.0	78.5	9.5
Skipping breakfast helps in reducing weight	3.0	93.0	4.0
Constricting the abdomen with clothes after delivery helps in reducing the fat in the abdomen	17.0	38.5	44.5
Sauna baths help in reducing the fat of the body	33.0	24.0	43.0
Drinking grapefruit juice helps in dissolving the fat in the body	16.5	22.5	61.0
Plump women are more acceptable to men than non-plump women	22.5	37.5	40.0
Tight clothes help in reducing weight	4.5	81.5	14.0
The best method to reduce weight is eating one meal a day	3.5	92.5	4.0

* College of Health Sciences
Ministry of Health, Bahrain.

However, a high proportion of students studied disagreed with many unsound statements, especially those related to the drinking of water and obesity, skipping breakfast and eating one meal a day to reduce weight.

The belief that plump women are more acceptable to men still exists in Bahrain. This finding confirmed that by Musaiger in women in Oman[5] and in female university students in the United Arab Emirates[2]. This unsound belief may encourage some girls to keep their extra weight, which can lead to more accumulation of body fat in future. Mass media should play an important role in correcting unsound beliefs and attitudes toward obesity. Curricula in schools and colleges should contain adequate information to correct the wrong health and nutrition beliefs that are widely spread in the community.

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Short Communication

Body Weight of University Students in Bahrain

Mona Al-Ansari, PhD*
Mariam Al Mannai, PhD**
Abdulrahman O. Musaiger, DrPH***

To estimate the percentage of overweight and obesity of university students in Bahrain, a sample of 238 males and 406 females were obtained. The findings showed that 17.6% and 18.5% of males and females respectively were overweight. The proportion of obesity was 11.8% in males and 7.6% in females. Physical activity should be encouraged in this group to prevent obesity.

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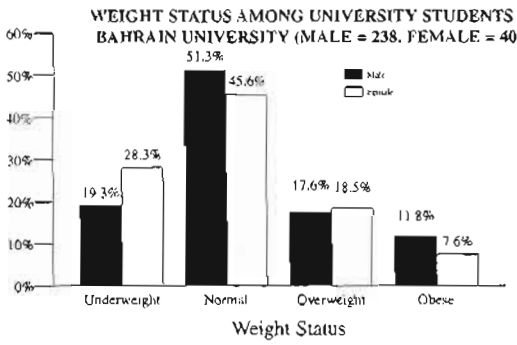
Researches on body weight in Bahrain are limited to children, adolescents and adults[1,2,3], and none of these researches study the body weight of university students. In the United Arab Emirates (UAE), Musaiger and Radwan[4] found that university females have the problem, of both underweight and overweight. In Kuwait, Al-Isa[5] showed that the prevalence of overweight and obesity in university females was 27.2% and 7.2%, respectively. The aim of this paper was to determine the body weight of the university students in Bahrain.

METHODS

This study depended on self-participation of students of Bahrain University at Al-Sakhir campus. The total numbers of students who volunteered to participate were 238 males and 406 females. Their ages ranged from 17 to 38 years, with a mean age of 20.5 years. The students were asked to fill in a questionnaire containing questions on attitudes to and practices of obesity. Weight was measured using a portable scale, and height was measured using a special tape with an accuracy of 0.1 cm. The Body Mass Index (BMI) was calculated to determine the body weight of the students. The body weight was classified into four groups, underweight, normal, overweight and obese, corresponding to BMI <20, 20-24.9, 25-29.9 and ≥30, respectively.

RESULTS AND DISCUSSION

The distribution of students according to their body weight and sex is illustrated in Figure 1. Females had a higher percentage of underweight (28.7%) than males (19.3%). However, the percentage of obesity was higher among males (11.1%) than females (7.6%). The prevalence of underweight and overweight in university females in this study was close to that reported by Musaiger and Radwan in the UAE[4]. The proportion of obesity among female Bahraini university students was similar to that of their counterparts in Kuwait (7.6% and 7.2%, respectively). Nevertheless, the Kuwaiti females had a higher proportion of overweight (27.2%) than the Bahraini females (18.5%).



The data of this study confirmed that of other studies in the region, as both underweight and overweight exist in adolescents and young adults. Promotion of physical activity and reduced intake of food rich in fat are important elements to reduce overweight and obesity in university students. For underweight students, sound nutrition and proper food intake should be encouraged. It is recommended that more studies should be carried out on the causes of underweight and overweight in young people in the country.

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* College of Education
** College of Science
University of Bahrain
*** Director
Environmental & Biological programme
Bahrain Centre for studies & Research
State of Bahrain

Short Communication

Obesity in female students in the United Arab Emirates University

Rana A Al-Mukhtar, BSc*
Abdulrahman O Musaiger, DrpH**

A study on 200 female university students was carried out to determine their weight status. Using body mass index (BMI), 24% and 7.5% of students were overweight and obese, respectively. There was no significant association between BMI and age of students.

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The prevalence of obesity is increasing rapidly in the United Arab Emirates (UAE) especially among females. Musaiger and Radwan[1] found that there are many social and dietary factors associated with obesity in female university students in the UAE. Studies[2,3] showed that overweight and obesity are related to morbidity and mortality due to some diseases. The present paper aims to investigate the prevalence of overweight and obesity among female students of the United Arab Emirates University (UAE University).

METHODS

The female students were obtained from female hostels related to the UAE University in Al-Ain, UAE. There are four hostels for females in Al-Ain, and two of them were selected. Only 200 females participated in this study. Weight was taken using a portable weighing scale with an accuracy of 0.1 Kg. Height was taken using a portable stadiometer with an accuracy of 0.1 cm. Body mass index (BMI) was used to calculate the weight status of the females as follows: underweight (BMI<20), acceptable (BMI 20-24.9), overweight (BMI 25-29.9) and obese (BMI≥30) as reported by Garrow[4].

RESULTS AND DISCUSSION

The ages of the students ranged from 18 to 24 years, with a mean age of 19.8±1.5 years. Of the students 77 (38.5%) were under the age of 20 years and the rest (61.5%) were aged 20 years and above. The weight status of the female students based on BMI according to their age is given in Table 1. Of the students, 20% were underweight and 31.5% were overweight or obese. This finding is very close to that reported by Musaiger and Radwan[1], as they found that 20% and 28.8% of female students in UAE University were underweight and obese, respectively. The proportion of overweight was higher among students aged less than 20 years (27.3%) compared to students aged 20 years and above (21.9%), but there was no statistically significant association between the age of the female students and nutritional status.

Table 1. Nutritional status of female students in the UAE University, Al-Ain by their ages

Nutritional Status	<20 years		20+ years		Total	
	No.	%	No.	%	No.	%
Underweight (BMI<20)	15	19.5	25	20.3	40	20.0
Acceptable weight (BMI 20-24.9)	36	46.7	61	49.6	97	48.5
Overweight (BMI 25-29.9)	21	27.3	27	21.9	48	24.0
Obese (BMI≥30)	5	6.5	10	8.2	15	7.5
Total	77	100.0	123	100.0	200	100.0

* Faculty of Agricultural Sciences
UAE University, Al-Ain
United Arab Emirates
** Director
Environmental & Biological programme
Bahrain Center for studies & Research
State of Bahrain

As reported in other studies in the region[1-5], there are two problems related to weight status existing among female university students; underweight and overweight. Consequently, programmes to promote healthy weight in the community should take into consideration both underweight and overweight. Further studies are recommended to assess the main causes of unacceptable weight among children and adults in the UAE.

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Short Communication

Obesity among Medical Practitioners and Medical Students in Bahrain

Khawla M Al-Madani, BSc, MSc. *

Data on weight and height (based on self-reporting) were obtained from 158 medical practitioners and 53 medical students in 1999. Overweight and obesity was more observed in medical practitioners (44.3%) than medical students (22.6%).

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The growing increase of obesity, among either adults or adolescents in Bahrain, creates a great incentive to study the prevalence and factors affecting this health problem in the community. Studies in the Arab Gulf countries, including Bahrain, have focused on the prevalence of obesity among children, adolescents and adults[1-3]. However, none of these studies have investigated the prevalence of obesity among health professionals. The aim of this short report is to ascertain the proportion of overweight and obesity among medical practitioners and medical students in Bahrain.

METHODS

Data of this paper are based on a cross-sectional survey to study nutrition knowledge, attitudes and practices of medical practitioners and medical students in Bahrain. Self-completion questionnaires were distributed to 300 medical practitioners and 100 medical students registered with the Ministry of Health and the Arabian Gulf University (AGU), respectively. The questionnaire included questions related to nutrition knowledge, attitudes and practices, and the subjects were asked to record their weight and height. The present study only reports the weight status of the subjects studied, based on body mass index [weight (Kg)/height (meter)^2]. Of the total sample, 171 and 66 of medical practitioners and medical students respectively, returned the questionnaires, and among those, 158 and 53 respectively, recorded their weight and height,.

Weight status was classified into 3 categories, underweight (BMI<20), normal (BMI 20-24.9) and overweight and obese (BMI≥25) as reported by Garrow[4].

RESULTS AND DISCUSSION

The mean age of medical practitioners was 33.4±7.7 years, while that of medical students was 20.9±1.9 years. About 46% of medical practitioners were male, corresponding to 40.9% of medical students.

Due to the small sample size, male and female data were combined. However, there was no statistically signifi-

Table 1. **Nutrition status of medical practitioners and medical students in Bahrain (based on body mass index, BMI)**

Nutrition status	Medical practitioners		Medical students	
	No.	%	No.	%
Underweight (BMI<20)	13	8.2	17	32.1
Normal (BMI 20-24.9)	75	47.5	24	45.3
Overweight/obese (BMI≥25)	70	44.3	12	22.6
Total	158	100.0	53	100.0

X^2=20.71 P<0.0001

* Dietitian
Salmaniya Medical Complex
Ministry of Health
State of Bahrain.

cant difference in obesity between males and females, in both medical practitioners and medical students. The proportion of weight status of medical practitioners and medical students is presented in Table 1. The percentage of underweight was higher among medical students (32.1%) compared to medical practitioners (8.2%). In contrast, overweight and obesity were more prevalent among medical practitioners than medical students. The difference in weight status between the two groups was highly statistically significant ($p<0.0001$).

This is the first report on obesity among medical workers in Bahrain, and perhaps in the Arab Gulf countries. The relatively high proportion of underweight among medical students is unexpected, as these students should have adequate information on balanced diets. There is no study on the nutrition content of curricula in medical schools. In Bahrain however, Musaiger[5] reported that nutrition was not given enough attention in nursing and medical schools in the country. This will negatively affect the knowledge and attitudes of the graduate students to sound food habits.

The high percentage of overweight and obesity among medical practitioners questions the healthy lifestyle of these subjects. Medical professionals, especially those who deal directly with patients, should set a good example of a healthy figure. Medical advice cannot be effective in changing behaviour if health professionals do not act as health models who will encourage their patients to behave like them. Therefore, it is recommended that health workers should practice a healthy lifestyle and use it in their medical practice. More studies on the lifestyle of health workers are recommended to compare it with the lifestyle of the general population.

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Short Communication

Nutritional Status of Emirati Women in Al-Ain City, United Arab Emirates

Abdulrahman O Musaiger, DrPH*
Nada Abu-Aladeeb, BSc**
Hussain Qazaq, MSc**

The aim of this study was to determine the proportion of obesity among national Emirati women who were attending out-patient clinics in Al-Ain City, United Arab Emirates. Of women studied, 9.2%, 29.8% and 38.4% respectively were underweight, overweight and obese. The findings of this study are consistent with other studies in UAE, that obesity is a problem of concern among women.

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Measuring of nutritional status is one of the important steps to understanding the health situation of the people. Anthropometric measurements are widely used to determine the nutritional status, with weight and height the most common measures used. The National Nutrition Survey in the United Arab Emirates (UAE)[1] showed that 3.9% of Emirati women were underweight, 33.8% overweight and 38.4% obese, based on body mass index. El-Mugamer et al[2] found that 27.4% of women of Bedouin origin in the UAE were obese. The present paper aims to find out the proportion of underweight and overweight among Emirati women in Al-Ain City, UAE.

METHODS

Data of this study were obtained from women attending the out-patient clinics in Tawam Hospital, the main and the university hospital in Al-Ain City. Women who attended the out-patient clinics during the periods 8 a.m. to 12 p.m. and 2 p.m. to 5 p.m. for one week were the target group in this study. Only Emirati women and those who agreed to participate in the study were included. Non-response was not reported.

Women were interviewed by nutritionists using a questionnaire containing information on several aspects of health and nutrition. Weight was obtained using Seca scales with an accuracy of 0.1 kg. Height was obtained to the nearest 0.1 cm using a stadiometer attached to the scale. For the purpose of this short report, only data on weight and height were included. The nutritional status of the women was determined using Body Mass Index

Table 1. **Nutritional Status of Emirati women in Al-Ain City by their ages**

Nutritional Status	*Age (years)*						*Total*	
	20-29		*30-39*		*40+*			
	%	No.	%	No.	%	No.	%	No.
Underweight	28	17.1	3	3.0	1	1.2	32	9.2
Normal	55	33.5	10	10.0	14	16.5	79	22.6
Overweight	40	24.4	39	39.0	25	29.4	104	29.8
Obese	41	25.0	48	48.0	45	52.9	134	38.4
Total	164	100.00	100	100.0	85	100.0	349	100.0

* Director
Environmental & Biological Programme
Bahrain Center for Studies & Research
State of Bahrain
** Nutrition Department
Al-Ain Medical District
Al-Ain, United Arab Emirates

[weight (kg)/Height (cm)^2]. Women were classified according to nutritional status into four groups underweight (BMI<20), normal (BMI 20-24.9), overweight (BMI 25-29.9) and obese (BMI≥30)[3].

RESULTS AND DISCUSSION

The classification of Emirati women according to nutritional status and age is presented in Table 1. The percentage of underweight declined steeply between the ages of 20 and 40 years. At age 20-29 years, the percentage of underweight was 17.1% and declined to 3% at age 30-39 years. At the same time, the proportion of obesity increased markedly during the same period, and continued to increase slowly after age 40 years. The percentage of obesity was 25% at age 20-29 years, and increased to 48% and 52.8% at ages 30-39 and ≥40 years, respectively. The association between the nutritional status and age of women was highly statistically significant ($p<0.0001$).

The high increase in obesity with age, especially at age 30-39 years can be attributed to multiple- pregnancies, inactivity and high intake of foods rich in calories. Studies in the region demonstrated that the risk of obesity increased with age until age 50 years and then declined gradually[4,5]. Parity was also reported as a risk factor for obesity among women in the Gulf [6].

The findings of this study supported that of El-Mugamer[2] and Musaiger[1] in the UAE, as well as studies in other Arab Gulf countries[5,6], as obesity is highly prevalent among women. More emphasis, therefore, should be put on health prevention programme to include activities to overcome obesity in this region.

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Environmental & Biological Programme
Bahrain Centre for Studies & Research
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WHO Regional Office for the Eastern Mediterranean, Alexandria: Egypt. 1989:49.

Bahrain Medical Bulletin

Scientific Research Competition for 2001

The Bahrain Medical Bulletin will organise the first Scientific Research Competition for the year 2001.

Rules and Regulations:

1. Event is open to all health professionals practising in Bahrain.
2. Research should have been carried out in Bahrain and completed within the last 2 years and should be relevant to health issues in Bahrain
3. Papers can be submitted in English or Arabic.
4. The paper should not have been previously submitted, accepted or published either locally or internationally.
5. Research work conducted preferably by a team of minimum 2 and maximum 6 will be considered.
6. Deadline for submission is the end of June 2001.
7. Winners will be announced by the end of September 2001.
8. The award winning papers will be the sole property of the Bahrain Medical Bulletin and will be published in the bulletin.

Instructions for Submission:
Each applicant must submit the following:

1. A completed application form with BD 15/- non -refundable should be submitted to Bahrain Medical Bulletin.
2. Each paper submitted should include:
   2.1 A diskette containing the paper.(windows 95,98.2000 format)
   2.2.A hard copy print-out of the manuscript and two sets of illustrations.

Papers should be written in BMB format (refer to "instruction to authors" in BMB)

Failure to submit all the material listed above may result in disqualification of the paper.

3. All material should be submitted to:

The Chairman
Bahrain Medical Bulletin Scientific Research Committee
P. O. Box 32159
Manama –Bahrain

Awards
All papers are eligible for the following awards:

1. **The Bahrain Medical Bulletin Award – 1st Prize**
2. **The Bahrain Medical Bulletin Award - 2nd Prize**

Applications form can be obtained from the Bahrain Medical Bulletin office:

P.O. Box 32159
Manama- Bahrain
Tel : +973 239 798
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مجلة البحرين الطبية
التعريف والأهداف

مجلة البحرين الطبية هي مجلة دورية علمية هدفها تطور وتقدم العلوم الطبية البيولوجية والأكلينكية والصحية وتقوم بإصدارها هيئة تحرير مستقلة ، تنشر المجلة مقالات باللغتين العربية والإنجليزية .

تشمل مجالات النشرة بالمجلة مقالات البحوث الأصلية ، المراجعات ، تقارير الحالات ، المقتطفات القصيرة ، رسائل للمحرر ، الاختبارات الطبية ، الافتتاحيات ، الآراء والأخبار ، مراجعات الكتب والدوريات ، التقارير العامة ، أخبار المؤتمرات والاجتماعات ، مقالات التعليم الطبي ، تقارير صحية ، تاريخ الطب والآراء الشخصية .

تخضع جميع الأعمال المقدمة للنشر في مجلة البحرين الطبية إلى المراجعة من قبل المحررين ومن محكمين مختصين ، يرسل إشعار استلام الأعمال المقدمة إلى المؤلف الرئيسي . تكون هذه المقالات من ممتلكات المجلة في حالة الموافقة على نشرها . يقوم محرر المجلة بقراءة المقالات المعدة للطبع . تخضع جميع الأعمال المقدمة للنشر بما في ذلك الإعلانات إلى القواعد الأخلاقية للمهنة .

يقرر المحررون والمحكمون قبول أي مقال إلى أي من مجالات النشر بمجلة البحرين الطبية ويبلغ المؤلفين بهذا القرار قبيل النشر .

ينظر في الأعمال المقدمة للنشر في مجلة البحرين الطبية على أساس أنها مقدمة للمجلة فقط وألا تكون قد نشرت أو قيد النشر في مجلة أخرى وألا تكون قد نشرت من قبل . وأن تكون المواد المقدمة للنشر متفق عليها من جميع المؤلفين ، لا يعتبر التلخيص المنشور مسبقاً للمقالات الكاملة المقدمة للمجلة نشراً مزدوجاً .

تشجع مجلة البحرين الطبية الأبحاث العلمية عن طريق تنظيم دورات وورش عمل أساليب البحث وما يمت لها بصلة مثل طرق الكتابة وأعمال التحرير وللمجلة هيئة استشارية للبحوث لمساعدة الباحثين في أبحاثهم . كما وتواصل المجلة دورها الاجتماعي عن طريق إقامة المحاضرات الدورية للمواضيع التي تهم الرأي العام .

مجلـــة البحريـــن الطبيـــة

تصدر مجلة البحرين الطبية كل ثلاث شهور في مارس ، يونيو ، سبتمبر وديسمبر . وهي مدرجة في الفهرس الطبي لمنظمة الصحة العالمية لمنطقة شرق المتوسط ، اكستر امد في المملكة المتحدة وأنظمة الإيداع العالمية بفرنسا.

الاشتراك في المجلة ثمانية دنانير بحرينية (٢٠ دولاراً أمريكياً) سنوياً ، والمجلة لا توفر إصدارات مجانية للمطبوعات المنشورة بها ويجوز طلب أعداد إضافية من المجلة .
يمكن الحصول على رسوم الإعلانات من مكتب تحرير المجلة .
توزع المجلة لجميع مناطق العالم وبالأخص منطقة الخليج العربي والشرق الأوسط .

ترسل جميع المراسلات وطلبات الاشتراك والإعلانات إلى :

مكتب التحرير :
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دولة البحرين

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فاكس : ٢٧٧٠٣٦ (٩٧٣+)
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