

Obesity Trends in School Children of Madinah Al Munawwarrah-A Cross-Sectional Study

Atta ur Rehman Khan* and Meshal Al Malki

Clinical Nutrition Department, Prince Muhammad Bin Abdulaziz Hospital, Madinah

King Abdullah International Medical Research Center, KAIMRC

King Saud Bin Abdulaziz University for Health Sciences, KSAU-HS

Ministry of National Guard Health Affairs, Saudi Arabia

*Corresponding author: Atta ur Rehman Khan, Clinical Nutrition Department, Saudi Arabia, Email: RehmanAu@NGHA.MED.SA



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ABSTRACT

Background: Obesity is one of the three gravest threats to human health, but no study has been conducted in the 2nd holiest city of Muslims Al Madinah Al Munawwarrah located on western part of Saudi Arabia.

Objectives: This study aimed to evaluate the prevalence of overweight and obesity in school children.

Methods: Participants were healthy schoolboys and girls aged 05-18 years. It was a cross-sectional stratified study. Total sample size was 6000 consisting of 3000 boys and 3000 girls. Twenty (20) schools were selected with random stratification with the help of Ministry of education. Data were collected between April - December 2017. Height and weight of children were measured to calculate percentiles for BMI-for-age and -sex according to the 2000 Centers for Disease Control and Prevention (CDC) growth charts. Overweight and obesity was defined as BMI-for-age/sex \geq 85th and \geq 95th percentile respectively.

Results: The overall prevalence of obesity was 14.7% (n=588). Obesity Prevalence in boys was 16% (n=347) and in girls was 14% (n=241). The overall prevalence of overweight was 15.4% (n=616). The Prevalence in boys was 16% (n=366) and in girls was 14% (n=250).

Conclusions: Overweight and obesity in school children in Al Madinah Al Munawwarh is as high as global prevalence is. Intervention and prevention programs should focus on primary school students. Ministry of education and Ministry of health have a key role. Dietitians and public health Workers can play an effective to control obesity.

Introduction

Obesity is one of the three gravest threats to human health and survival beside undernutrition and climate change [1]. One of the major consensus achieved by health researchers and medical experts at the beginning of the 21st century is all about obesity as a medical condition, a chronic and relapsing disease [2]. Obesity now is one of the largest contributors of poor health in the world. There has been an unabated rise in obesity prevalence in all countries in the past four decades, and no country has succeeded in reversing its obesity epidemic [3]. Despite large allocation of resources to prevent and treat obesity, it continues to rise across the continents,

borders, races and ages consistently. The recent prevalence is higher than ever in history [4]. The recent reports confirm the fastest rise in children with obesity by tenfold over the past four decades [5]. In 2014, around 41 million children under 5 years of age were reported with overweight or obesity world over [6]. The risk for adulthood non-communicable diseases is increased by childhood obesity. These so called non-communicable diseases in adults are reported to cause 71% of the world's deaths [7].

In Saudi Arabia, previous reports on the prevalence of overweight and obesity were limited to a single city male school

child such as prevalence of obesity was 22 % in Riyadh, 15 % in Jeddah, 23 % in eastern province, 17% in Al Khobar [8-10]. At the national level, only one representative study has been done in Saudi Arabia to date with a large sample size of 19317 healthy children and adolescents from 5 to 18 years of age. The prevalence of overweight, obesity and severe obesity in all age groups was 23.1%, 9.3% and 2%, respectively, with boys having a significantly higher prevalence of obesity (10.1% vs 8.4%; $P < .001$) and severe obesity (2.3% vs 1.6%; $P < .001$) than girls. The study showed that the girls had a significantly higher prevalence of overweight (23.8% vs 22.4%; $P = .014$). The 2005 Saudi reference data set was used to determine the prevalence of obesity with the criteria set in 2007 WHO reference [11]. The recent obesity epidemic is not entirely due to major changes in society. There is a very strong genetic predisposition to obesity as contrary to the commonly discussed lifestyle changes.

When studied, the identical twins are very similar in weight. If they have obesity, they generally both have obesity, and if they are thin, they are generally both thin [12]. It is now confirmed that genetic influences have an important role in determining human fatness in adults, whereas the family environment alone has no apparent effect [13]. Therefore, epigenetic mechanisms may explain recent increases in obesity [14]. Many more review, rodents and human studies have highlighted and explained the epigenetics mechanism behind the increased prevalence of obesity in the past 4-5 decades [15-21]. Obesity emerges from a lethal combination of exposure of the child to an obesogenic environment (unhealthy environment) [22] and inadequate behavioral and biological responses to that environment. There are number of health complications having both physical and psychological dimensions through childhood, adolescence and into adulthood. Obesity itself is a direct cause of morbidities in childhood including gastrointestinal, musculoskeletal and orthopedic complications, sleep apnea, and the accelerated onset of cardiovascular disease and type-2 diabetes, as well as the comorbidities of the latter two non communicable diseases [23]. At the same time, obesity in childhood can cause behavioral and emotional difficulties, such as depression, and can also lead to stigmatization and poor socialization and reduce educational attainment. [24-25]. Childhood obesity is a strong predictor of adult obesity, which has well known health and economic consequences, both for the individual and society as a whole [26-27]. Recently, longitudinal studies suggest that reduction in BMI in adulthood can reduce the risk of morbidity and mortality [28].

Despite the prevalence of the obesity at a faster pace in the kingdom, one hardly finds any regular National Nutrition survey such as National Health and Nutrition Examination survey (NHANES) in USA. As a result, there is also missing pediatric health and Nutrition data base that can be used to formulate policy on how to curb the Obesity and associated comorbidities in the kingdom. However, single city reports showing frequently that the children in Saudi Arabia are suffering from the menace of Obesity. The studies

conducted in the kingdom, consistently reveal the upward trends in obesity in both genders. Many small nutrition surveys and studies have been done in eastern, central and southern region but no study was carried out in western region and the Holy city of Al Madinah Al Munawwarah till to date. Therefore, based on various reports and keeping in view the sedentary lifestyle, unhealthy dietary habits and compromised health status of children, this study aimed to investigate prevalence of obesity and overweight in school going children in the 2nd Muslim holiest city of Madinah Al Munawwarah. We now report our study methods and results.

Methods

Study Design

It was a Cross-sectional Study. A pre structured self-administered questionnaire was used to collect the data on demographics, anthropometrics, dietary and physical lifestyle of the children. An informed consent was filled either by parent or guardian or school administration. Dietary intake was recorded by Food Frequency Questionnaire (FFQ) which will be published elsewhere.

Setting

Government schools in Madinah Research staff from Prince Muhammad Bin Abdulaziz Hospital -National Guard Health Affairs, Clinical Nutrition department carried out data collection, entry and analysis in the 2nd Holy Most city in the Muslim world Al Madinah Al Munawwarah west of Kingdom of Saudi Arabia. Ministry of Education in Madinah Al Munawwarah collaborated in completion of the project. The data collection was done between April - December 2017.

a) Ethical Approval The study was approved by Institutional review Board of King Abdullah International Medical Research Centre and King Saud Bin Abdulaziz university, Ministry of National Guard Health Affairs.

Sampling technique, inclusion and Exclusion criteria:

Sampling was done by random selection of schools and classes. Whereby all city schools in Madinah were stratified based on areas into four strata based on directions (east, west, north and south). An estimated population of the school children in Madinah is in the range of 50-60 thousand in all 100 plus schools. Probability stratified sampling was done to reach to a size of 6000 students with confidence Interval of 95%. Approximately 50% boys and 50% girls. This was around 10-15 % of the total students in Madinah city. Inclusion Criteria was the healthy schoolboys and girls aged 05-18 years whereas any student with diagnosed medical problem such as Diabetes Mellitus Type I was excluded. Sampling was done with random stratification of schools and then randomly selection of classes in stratified schools. Total sample size was 6000, which further divided into 3000 boys and 3000 girls (10% of overall population of school students). Twenty (20) schools were selected randomly out of total 110 schools with the help of Ministry of education.

Outcome Measures

Primary measures were Body Mass Index and which was calculated as Kg/m², which was also used as a measure of obesity because it correlates well with adiposity [29]. Anthropological measures of weight and height were taken following the interview. All subjects were measured when they were barefoot and wear only light clothes. Weight was measured by standardized calibrated scales to the nearest 0.1 kg and height was taken to the nearest 0.1 cm using the standardized wall-mounted height boards with a sliding head piece. Children’s height and weight were used to calculate percentiles for BMI-for-age and -sex according to the 2000 Centers for Disease Control and Prevention (CDC) growth charts, Overweight/ obesity was defined as BMI-for-age >85th percentile of the 2000 sex-specific CDC growth charts; obesity was defined as >95th percentile [30].

Statistical Analysis

Data was coded and analyzed using JMP SAS Statistical Package. Descriptive statistics was used to determine mean and standard deviations for Age, Weight, Height and Body Mass Index of all sample and sub-groups based on age categories. Frequencies were calculated for students who were overweight and obese. All the analysis was done as first combined and then separately for male and female students.

Results

A total number of 3987 school children responded on self-administered questionnaire which was initially distributed to 6000 children.3000 were girls and 3000 were boys. The response rate was recorded as 67%. Out of total 3987 children, 2222 (56%) were boys and 1765 (44%) were girls who responded with fully or partially filled questionnaire. All above means and standard deviations are in

the (Table 1). The demographics showed that the overall mean age for the whole sample was 14 years (SD ± 2.54). Mean age for boys was 14.4 years (SD ± 2.27) and girls was 13.88 years (SD± 2.81). The overall mean age (both boys and girls included) in Category- I (5-8 years) was 7.71(SD ± 0.63), category-II (9-13 years) was 11.82 (SD ± 1.31) and Category-III (14-18 years) was 15.68 (SD ± 1.35). The overall mean weight was 50.3 (SD ± 17.6).

Mean weight for boys was 52.53 (SD ± 18.26) kg. Mean weight for girls was 47.54 (SD ± 16.48) kg. In boys the mean weight in Category- I (5-8 years) was 26.05 (SD ± 6.08), category-II (9-13 years) was 40.7 (SD ± 13.2) and Category-III (14-18 years) was 57.9 (SD ± 17.45).In girls the mean weight in Category- I (5-8 years) was 22.9 (SD ± 5.7), category-II (9-13 years) was 42.08 (SD ± 14.08) and Category-III (14-18 years) was 53.46 (SD ± 14.99).The overall height was 1.54 (SD ± 0.12) meters. Mean height for boys was 1.57 (SD ± 0.13) meters. Mean height for girls was 1.50 (SD ± 0.11) meters. For boys the mean height in Category- I (5-8 years) was 1.26 (SD ± 0.04), category-II (9-13 years) was 1.45 (SD ± 0.09) and Category-III (14-18 years) was 1.63 (SD ± 0.09).For girls the mean height in Category- I (5-8 years) was 1.23 (SD ± 0.06), category-II (9-13 years) was 1.46 (SD ± 0.10) and Category-III (14-18 years) was 1.55 (SD ± 0.06) (Table 1). Body Mass Index (2000 Centre for Disease Control -CDC reference) [30]. The overall mean Body Mass Index (BMI) was 20.7 (SD ± 5.84) KG/M². Mean Body Mass Index (BMI) for boys was 20.78 (SD ± 6.03) KG/M² and mean Body Mass Index (BMI) for girls was 20.64 (SD ± 5.5) KG/M².In boys the mean BMI in Category- I (5-8 years) was 16.08 (SD ± 2.75), category-II (9-13 years) was 18.95(SD ± 4.56) and Category-III (14-18 years) was 21.62 (SD ± 6.38).For girls the mean BMI in Category- I (5-8 years) was 14.94 (SD ± 2.59), category-II (9-13 years) was 19.25 (SD ± 4.86) and Category-III (14-18 years) was 22.10 (SD ± 5.65).All above means and standard deviations are in the (Table 1a).

Table 1: Overall School Children Demographics in the Holy city of Madinah Al Munawarah.

Variables	Overall					
	Girls (n= 1765)		Boys (n= 2222)		Both sexes (n= 3987)	
	Mean	SD	Mean	SD	Mean	SD
Age (years)	14	2.54	14.4	2.27	13.88	2.81
Weight(kg)	50.3	17.6	52.53	18.26	47.54	16.48
Height(M)	1.54	0.12	1.57	0.13	1.50	0.11
Body mass index (BMI)	20.7	5.84	20.78	6.03	20.64	5.5

Table 1(a): Age categories and School Children Demographics in the Holy city of Madinah Al Munawarah.

Variable	5 - 8 years				9 - 13 years				14 - 18 years			
	Boys (n= 32)		Girls (n= 110)		Boys (n= 636)		Girls (n=624)		Boys (n= 1554)		Girls (n= 1031)	
	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD
Age (Years)	8.06	0.80	7.60	0.54	11.82	1.29	11.83	1.33	15.60	1.31	15.80	1.40
Weight(kg)	26.05	6.08	22.9	5.7	40.7	13.2	42.08	14.08	57.9	17.45	53.46	14.99
Height(M)	1.26	0.04	1.23	0.06	1.45	0.09	1.46	0.10	1.63	0.09	1.55	0.06
Body Mass Index (BMI)	16.08	2.75	14.94	2.59	18.95	4.56	19.25	4.86	21.62	6.38	22.10	5.65

a) Prevalence of Obesity (BMI > 95th Percentile)

In this study the overall prevalence of obesity was 14.7% (n= 588). Boys with obesity were 16% (n=347) and in girls was 14% (n=241). In boys the obesity prevalence in Category- I (5-8 years)

was 9 % (n=3), category-II (9-13 years) was 14% (n= 86) and Category-III (14-18 years) was 17% (n=258).For girls the obesity prevalence in Category- I (5-8 years) was 6% (n=7), category-II (9-13 years) was 14% (n=85) and Category-III (14-18 years) was also 14% (n=149) (Table 2).

Table 2: Trends in school children with overweight and Obesity in the Holy city Al Madinah Al Munawwarah.

Variable	Overall						5 - 8 years				9 - 13 years				14 - 18 years			
	Both		Boys		Girls		Boys		Girls		Boys		Girls		Boys		Girls	
	N	%	N	%	N	%	N	%	N	%	N	%	N	%	N	%	N	%
Obesity	14	241	16	347	14.7	588	6	7	9	3	14	85	14	86	14	149	17	258
¬Over weight	14	250	16	366	15.4	616	9	10	13	4	14	88	18	117	15	152	16	245

b) Prevalence of Overweight (BMI >85th Percentiles)

The overall trends in overweight was also similar to obesity as 15.4 % (n= 616). The boys with obesity were 16% (n=366) and the girls with obesity were 14% (n=250).Overweight trends in boys in Category- I (5-8 years) was 13 % (n=4), category-II (9-13 years) was 18% (n= 117) and Category-III (14-18 years) was 16% (n=245).Overweight trends in girls in Category- I (5-8 years) was 9% (n=10), category-II (9-13 years) was 14% (n=88) and Category-III (14-18 years) was 15 % (n=152) (Table 2).

are similar to the global trends recorded in the findings of WHO reports as global trends show the prevalence of childhood (aged 5-19 y) overweight and obesity has increased rapidly from as low as 4% in 1975 to 18% in 2016. This increase has been reported equally among both boys and girls: in 2016 18% of girls and 19% of boys were overweight. While just under 1% of children and adolescents aged 5-19 were obese in 1975, more 124 million children and adolescents (6% of girls and 8% of boys) were obese in 2016. 35. The prevalence of childhood obesity in Kingdom of Saudi Arabia (KSA) is 17.4 % reported by WHO in 2016.In 1975 the prevalence was just 1 %, in 2000 it rose to 9.8 % and 2010 to 14.3.The prevalence of childhood (5-19 y) obesity in other Gulf countries like Kuwait on top with 22.9%, Qatar 19.5%, Egypt 17.6%, Bahrain 17.2%, UAE 17.3%.Globally Cook island 32.2 % ,Niue 29% , Marshal island 26.6 and USA 21.4%. 35 Locally, Saudi Arabian childhood obesity data is scarce during this decade. Local data searches yield no encouraging results. Internationally through major search engines PubMed, google scholar, Cochrane we hardly found 2-3 national data sets in studies. These data sets however are old enough to be questioned for its applicability now in 2019. It is now beyond doubt that obesity and overweight is fast rising in Madinah as in the other region of the kingdom. As reported earlier [36] in the only national study on prevalence of childhood obesity in Saudi Arabia. The prevalence of overweight, obesity and severe obesity in all age groups was 23.1%, 9.3% and 2%, respectively, with boys having a significantly higher prevalence of obesity (10.1% vs 8.4%; P<.001) and severe obesity (2.3% vs 1.6%; P<.001) than girls. However, girls had a significantly higher prevalence of overweight (23.8% vs 22.4%; P=.014).11 The prevalence of overweight, obesity, and severe obesity in adolescents from 13 to 18 years of age was 26.6%, 10.6% and 2.4%, respectively. In the same it was reported that a significantly lower prevalence of overweight (23.9% vs 20.4%; P<.001) and obesity (9.5% vs 5.7%; P<.001) when the CDC reference was used. The same pattern prevails here in Madinah as we found around 15% prevalence of obesity and a little above 15% overweight in school children. Total combine percentage of overweight and obese exceeds 30%, which is quite alarming. In Saudi Arabia. The CDC reference underestimates the prevalence of overweight and obesity [11].

Discussion

Obesity and overweight know no borders and cuts across all age groups, genders, ethnic and all social-economic classes. Therefore, we are now a faced with a bigger problem as globesity because of global epidemic occurring in both developed and developing countries [31]. confirmed in 1997 by World Health Organization as a worldwide phenomenon [32]. A higher body weight is associated with an increased incidence of a number of medical conditions, including type 2 diabetes mellitus, insulin resistance, cardiovascular disease, stroke, some types of cancer, and nonalcoholic fatty liver disease [33]. Obesity in childhood and adolescence represents a serious health problem because it tends to continue into adulthood [34]. The present study is the first of its kind in the school children of Madinah at all levels of schooling such as primary, elementary and secondary. In this study the overall prevalence of obesity in school children was 14.7%. The obesity Prevalence in boys was higher than girls 16% vs 14%. In boys the highest prevalence was recorded Category-III (14-18 years) as 17%.Prevalence was decreased as we move down to the lesser age students (14% in 9-13 years and 9% in 5-8 years).At the same time the highest prevalence of obesity in girls was same as 14% in both age groups of 9-13 and 14-18 years. The similar pattern exists for the prevalence of overweight in boys and girls as observed in present study (16% vs 14%). This pattern of increase in overweight prevalence is similar to obesity prevalence in our study as both increase with the age in both boys and girls' students. This is similar to the both International and national childhood trends [35].

International comparisons can be made with our research findings. Our findings on obesity trends in Madinah school children

These results show that the combined obesity and overweight (32%) in Madinah ranks 3rd highest in the kingdom as per current available published results in many other studies [37,38]. The Eastern province being 1st in the ranking list with 42% prevalence and Al Riyadh being 2nd in the list with combined prevalence of Overweight and obesity of 37.5% and now Madinah 3rd with a prevalence of 32%. This can be placed as every 1 out of 3 teenagers in this city is overweight or obese. This should ring an alarm bell for the Ministry of health and other policy makers responsible for the children health in Madinah.

Study Strengths

As far as strengths are concerned, this is the first time we have laid the foundation of scientific health data base of children with present results on health status of our children in the 2nd holiest city of Muslims after Makkah in the whole world. The best timing to take action is now if we want to win a fight against obesity in this holy city. The implications are clearly evident for the Ministry of Education as well. This will be a baseline data for future researches to start with other health objectives in children of this holy city. This can also act a health quality improvement benchmark as well as a first ever available reference standard. These results can be instrumental to gauge the future changes in prevalence of obesity and overweight at local level. Thus, can be used as a yardstick to foresee the projections of the non-communicable diseases in Madinah in next 5-10 years.

Study Limitations

We have got few limitations to share in our study. First, the response rate of completion of questionnaire with food frequencies and anthropometrics was 66%. This is slightly higher than expected. The 34% non-responsiveness in our study data might create a sample bias and ultimately in prevalence results in both directions. Secondly, we used the CDC 2000 reference standard for BMI which underestimates the prevalence when compared with WHO standards 2007. This might make it difficult to compare with studies done by using IOTF or WHO cut offs. As future ideas, it can be suggested, Saudi Arabia needs to establish a national governmental database on overweight and obesity for children through 10 years National Health and Nutrition Examination survey such as conducted in the US. Future research also needs to study home environment as well as look at how nutrition and physical activity is promoted in the school environment in Saudi Arabia. How good are schools in demonstrating best practices to curb the menace of obesity? How can one apply these best practices to schools at national level? These are important potential research questions to be answered in the near future.

Conclusion

We can conclude from our study that obesity in children is at alarming levels in Madinah and thus the risk of non-communicable diseases is likely to rise in this city in near future at a drastic pace. This state of health of school children of Madinah likely to incur huge

cost for treatment of obesity related diseases. Concerted efforts are required at war footings jointly by Ministry of Health (MOH), Ministry of Education (MOE) in collaboration with other relevant governmental agencies and Nutrition healthcare professional bodies in order to tackle the obesogenic environment in the Holy city of Madinah Al Munawwarrah. This is the high time to adopt A whole- of-Government and whole-of-society approach to tackle the obesogenic environment otherwise no other approach will be able to halt obesity.

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