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Obesity and Other Cardiovascular Risk Factors in Egyptian University Students: Magnitude of the Problem

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Abstract

Background: Cardiovascular risk factors can lead to excessive morbidity and mortality from cardiovascular events. Metabolic syndrome in young adults is considered a predictor of increased cardiovascular risk in adulthood. Obesity in specific is rising among adolescents and young adults worldwide including populations living in developing countries. The aim of this study was to evaluate the prevalence of obesity and other cardiovascular risk factors in a group of university students representing large sector of young adults in Egypt.

Methods: This is a cross-sectional observational study on 2895 students from 10 public universities in 10 Egyptian governorates that represent different geographic areas in Egypt. Students were recruited for self-administered questionnaire, anthropometric and blood pressure measurements as well as laboratory analyses for random blood sugar and total cholesterol level.

Results: The majority of students were non-smokers, and the minority performed regular physical exercise. Obesity was encountered in 10.7% of participants, while abdominal obesity was shown in 43.4%. Abdominal obesity was more prevalent in South Upper Egypt female students. 2% of students were shown to be hypertensive and 15% were pre-hypertensive.

Conclusion: Pre-hypertension and Obesity, particularly the abdominal type was prevalent in Egyptian adolescents and young adults.

Keywords: Cardiovascular risk factors; Obesity; Egyptian young adults

Introduction

Worldwide, cardiovascular disease is estimated to be the leading cause of death and disability [1]. Most of cardiovascular disease events nowadays are taking place in low and middle income countries with 80% of the burden occurring in these countries [2]. The INTERHEART study [3] showed striking variation in the age of first presentation of acute myocardial infarction in various regions of the world, with the youngest patients in the region of the Middle East (median age 51 years). The highest proportion of cases with first acute myocardial infarction at age 40 years or younger was in men from Middle East also (12.6%).

The development of major cardiovascular risk factors at an early age is closely related to clustering of risk factors and health behaviour [4]. Hypertension, dyslipidemia, glucose intolerance and overweight are usually tolerated at a younger age [5], however, overtime these conditions especially if associated with poor dietary habits, smoking or physical inactivity; can lead to excessive morbidity and mortality from cardiovascular disease later in adulthood [6]. Exposure to these risk factors early in life was shown to induce permanent changes in the arterial tree that eventually leads to development of atherosclerosis [7-9]

In Egypt, since 1990, the cardiovascular related mortality was increased over three folds; to be responsible for over 40% of deaths compared with 12% reported two decades earlier [10]. The Egyptian National Hypertension Project (NHP) [11,12] was conducted between year 1991 and 1993 in six Egyptian governorates to define the prevalence of cardiovascular risk factors in adult Egyptians. The project documented an extremely high prevalence and prominent clustering of cardiovascular risk factors in adult men and women particularly obesity.

Very little is known about the prevalence and trends of cardiovascular risk factors among adolescents and young adults in Egypt. This study was conducted to determine the prevalence of measurable (blood pressure, obesity indices, serum cholesterol and random blood sugar) and behavioral (physical activity, smoking and dietary habits) among group of Egyptian university students below age 25 years with a specific focus on the pattern of obesity and its relation to different geographical areas in Egypt.

Methods

Design

This is a cross-sectional observational study on 2895 students from 10 public universities in 10 Egyptian governorates that represent different geographic areas, and urban and suburban areas. One

university represented the capital region (Cairo University), and 3 represented the Nile Delta (Banha, Zagazig and Monufia). Coastal regions were represented by Alexandria and Suez Canal Universities. Two universities represented North Upper Egypt (Beni Suef and Minya) and another 2 represented South Upper Egypt (Asyut and Sohag). Private universities were not included in this survey because it was thought that it would tend to include students with higher socioeconomic background. Students from faculty of Medicine, Oral Medicine, Physical Medicine, Pharmacy and Nursing were not included in this survey.

One month earlier, different university students in the 10 governorates were clearly announced about details of this study by posters and flyers. At the day of recruitment, the first 2 to 3 hundred students presented to the local working group office were included in the sampling frame.

Written informed consent was obtained from all participants, and the study protocol was approved by the ethical committee of our institution.

The student questionnaire consisted of precoded answers on demographic characteristics including, age and gender, presence of hypertension or diabetes (with or without treatment), use of tobacco (cigarettes), physical activity and dietary habits. Participants reported any tobacco use as "tobacco use-ever" and no use as "tobacco use-never". Data on frequency of participation in physical activity were collected. Participants were asked to report the number of days per week they perform different types of exercise (≥4 days/week, 2-3 days/week or once/week). Periods of exercise were expressed as ≥ 30 minutes or <30 minutes. Consumption of vegetables and fruits was expressed as the number of servings per day (>6 servings/day, 3-6 servings/day or <3 servings/day). One serving of vegetables or fruits was defined as small plate of cooked vegetables, small plate of salad or one piece of fresh vegetables and fruits. Students with treated hypertension or diabetes were not excluded and were marked as having the risk factor.

Anthropometric measurements

Height was measured to the nearest millimeter using portable height scales with shoes removed. Weight was measured to the nearest 0.1 Kg using portable bathroom scales with student shoes and heavy clothing removed. Height and weight measurements were used to calculate body mass index (BMI) according to the formula: BMI = weight (kg)/height (m^2). Overweight was defined as BMI 25-29.9 and obesity as BMI ≥ 30 Kg/ m^2. Waist circumference was measured at the midpoint between the bottom of the rib-cage and the top of the lateral border of iliac crest during minimal respiration. Waist-to-height ratio (WHtR) was then calculated and abdominal obesity was defined as WHtR ≥ 0.5 [13].

Blood pressure (BP) was measured after 5 minutes rest, in the sitting position from the right arm using standard mercury sphygmomanometers. The appearance of Kortocoff sounds was taken as systolic BP and the Kortokoff fifth phase (the disappearance of sounds) was recorded as the diastolic BP. Two measurements were made for all participants at 2 minutes intervals with the average of the 2 measurements used in data analysis. Participants were defined as having hypertension if they had BP >140/90 mmHg or were taking anti-hypertension medication. Pre-hypertension was defined as BP ≤ 140 /90 - ≥ 130/85 mmHg.

Blood samples and biochemical analysis

Random blood glucose was measured for all participants by quick test (finger stick). For total cholesterol, a non-fasting sample was taken using well calibrated digital machines (CardioCheck professional analyzer). Measurement of total cholesterol levels were done for students of only 4 universities (Cairo, Beni Suef, Suez Canal and Monufia).

Statistical analysis

For sample size calculation, we use Raosoft calculator [14]. We choose confidence level of 99% and a margin of error 4.04 %, so our sample size would not be less than 399 participants. To represent differences in the pattern of obesity, performance of physical exercise and dieting habits among different geographical areas in Egypt, we considered the 5 main regional areas; the capital area, the Delta region, Coast, North Upper Egypt and South Upper Egypt for comparison. For the descriptive purposes, categorical data were presented as absolute frequencies and percentages. Pearson Chi-square test was used to compare categorical data. All statistical analyses were performed with SPSS 14.0.1 program (SPSS, Chicago, IL).

Results

After reviewing the data sheets, participants with complete and valid data were only 1838 students (mean age 19.5 ± 2.0 years), with female gender preponderance (64.3%). Students with known hypertension were 17 (0.92%) and those with known type 2 diabetes were 4 (0.22%). As shown in the below Table 1 most students (> 90%) were belonged to "tobacco use-never" group. About 15% had regular exercise ≥4 days/week, however, most students when performing exercise, and they made it for ≥30 minutes. 90% of students had ≤6 daily servings of vegetables and fruits.

Questionnaire Data of all Participants	Number of students (%)
Male gender	656 (35.7)
Smoking	
Tobacco use-ever	116 (6.3)
Tobacco use-never	1722 (93.7)
Physical exercise	
>4 days/week	288 (15.7)
2-4 days/week	523 (28.5)
Once/week	1026 (55.8)
Period of exercise ≥ 30 minutes	1348 (73.3)
Period of exercise <30 minutes	490 (26.7)
Dietary habits	
>6 servings of vegetables and fruits/day	190 (10.4)
3-6 servings of vegetables and fruits/day	916 (49.8)
<3 servings of vegetables and fruits/day	732 (39.8)

Table 1: Questionnaire data of all participants

Table 2 shows the valid data for BP and anthropometric measurements. 2% of students were shown to have BP>140/90 mmHg. However, 15% were considered pre-hypertensives. According to BMI, obesity and overweight were shown in 10.7% and 27.9% of students respectively. On the other hand, abdominal obesity (WHtR ≥0.5) was encountered in 43.9%.

Anthropometric Data	Number of students (%)
Blood pressure	
> 140 /90 mmHg	38 (2.1)
≤ 140 /90 - ≥130/85 mmHg	278 (15.1)
< 130/80 mmHg	1522 (82.8)
BMI	
Normal (< 25 kg/m^2)	1129 (61.4)
Overweight (25 – 29.9 kg/m^2)	512 (27.9)
Obese (≥30 kg /m^2)	197 (10.7)
WHtR	
< 0.5	1040 (56.6)
≥0.5	798 (43.9)
*BMI body mass index; WHtR waist-to-height ratio	

Table 2: Valid data of blood pressure and anthropometric measurements.

As shown in Figures 1 and 2, students from Cairo and Coastal regions were the least to perform regular exercise. However, those students together with Delta students reported the highest prevalence of consumption of vegetables and fruits as 3-6 servings/day.

Table 3 shows the pattern of obesity in different geographical areas in Egypt. Overweight and obesity were shown to be more prevalent in Cairo and Delta. However, abdominal obesity (WHtR ≥0.5) was shown to be more prevalent in Cairo and South Upper Egypt.

	BMI			WHtR	
	Normal	Overweight	Obese	No abdominal obesity	Addominal obesity
Cairo	108 (62.1)	47 (27.0)	19 (10.9)	77 (44.3)	97 (55.7)
Delta	227 (50.9)	157 (35.2)	62 (13.9)	226 (50.7)	220 (49.3)
Coast	334 (65.4)	127 (24.9)	50 (9.8)	266 (52.1)	245 (47.9)
NUE	340 (63.6)	2143 (26.7)	52 (9.7)	387 (72.3)	148 (27.7)
SUE	120 (69.8)	38 (22.1)	14 (8.1)	84 (48.8)	88 (51.2)
BMI, body mass index; WHtR, waist-to-height ratio; NUE, North Upper Egypt; SUE, South Upper Egypt					

Table 3: Patterns of obesity in different geographical areas in Egypt.

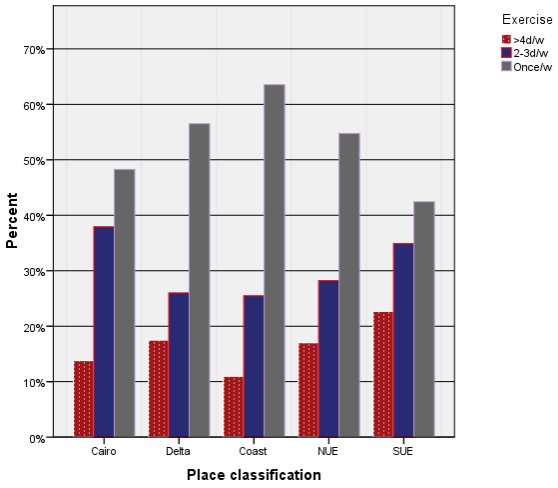

Figure 1: Frequency of physical exercise performed by students in different geographical areas in Egypt.

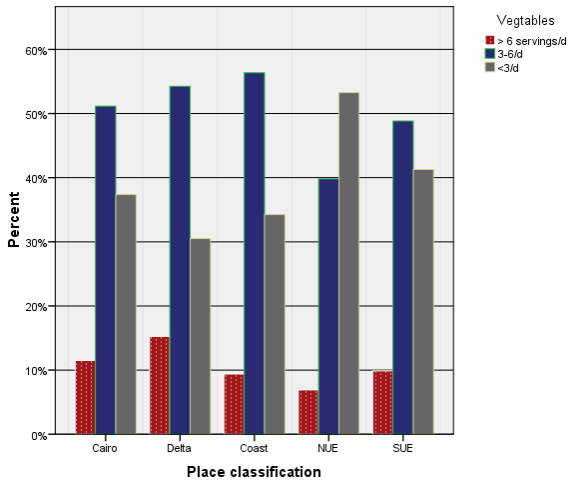

Figure 2: Daily servings of vegetables and fruits consumed by students in different geographical areas in Egypt

Table 4 shows the gender distribution of abdominal obesity in different geographical areas. Abdominal obesity was shown in 33.8% of male students and in 48.8% of female students. Male students from Cairo and South Upper Egypt had the highest and lowest prevalence of abdominal obesity respectively. On the other hand, female students from South Upper Egypt and North Upper Egypt had the highest and lowest prevalence of abdominal obesity respectively.

Random blood glucose measurements were taken for all students. Levels ≥200 mg/dl was met in only 32 (0.4%) participants. Out of 630 blood samples studied for total cholesterol, only 55 (8.3%) showed results ≥200 mg/dl.

	Male students (n = 657)		Female students (n = 1181)	
	No abdominal obesity	Abdominal obesity	No abdominal obesity	Abdominal obesity
Cairo	35 (44.3)	44 (55.7)	42 (44.2)	53 (55.8)
Delta	76 (70.4)	32 (29.6)	150 (44.4)	188 (55.6)
Coast	50 (53.8)	43 (46.2)	216 (51.7)	202 (48.3)
NUE	201 (69.8)	87 (30.2)	186 (75.3)	61 (24.7)
SUE	73 (82.0)	16 (18.0)	11 (13.3)	72 (86.7)
NUE North Upper Egypt; SUE South Upper Egypt				

Table 4: Gender distribution of abdominal obesity in different geographical areas in Egypt.

Discussion

In this survey, questionnaire data revealed that >90% of participants were non-smokers, 55% perform physical exercise once weekly for at least 30 minutes, and only 10% consumed >6 daily servings of vegetables and fruits. BP and laboratory measurements showed that >82% of students were normotensives and only 0.4% and 8.3% had elevated RBS and total cholesterol ≥200 mg% respectively.

A previous report on Egyptian adolescents (766 participants) showed that 80% were non-smokers [15]. However, the Egyptian NHP in 1993 showed 43% of studied adult populations were smokers [12]. Taken into account, the possible underreporting of smoking among adolescents and young adults, the most logic explanation of low prevalence of tobacco smoking in this group is the limited purchasing power.

On measuring BP, 2.1% were found to be hypertensive and 15% were pre-hypertensives. This is far below the prevalence of hypertension in adults (26.3%) according to Egyptian NHP [12]. Reports from other developing countries showed significant decrease in BP among adolescents. This was explained by the changes in lifestyle such as diet and physical activity rather than improved hypertension control [5].

The prevalence of diabetes and hypercholesterolemia in our study group was also lower than adult population of the Egyptian NHP [12] (0.4% and 8.3% vs. 7.9% and 12.2% respectively).

Our study showed obesity and overweight to have prevalence of 10.7% and 27.9% respectively. However, abdominal obesity was shown in 43.9% of participants. Female students suffered abdominal obesity at a higher rate compared to male students (48.8% vs. 33.8%). This is nearly matching the data from Egyptian NHP [12] where abdominal obesity was shown in 57.8% of adult females vs. 37% of adult males. Chatwal et al. [16] from India, using the WHO references, showed that the overall prevalence of obesity and overweight was 11.1 and 14.2 respectively. However, a more recent study on young Indian adults [17] showed a prevalence rate of overweight/obese category to be 15.25% which is far less than our prevalence rate. The high prevalence of obesity in Cairo could be partly explained by the higher consumption of fast food outside home within the past four decades. Fast food is characterized by being high in calories, salt, saturated fat and simple carbohydrates. On the other hand, Delta region is characterized by its rural and suburban nature. The lower socioeconomic status, the limited recreational facilities and opportunity for physical activity may explain the increased prevalence of overweight and obesity.

Although BMI is the most studied index, being significantly related to CVD risk factors as demonstrated by cross-sectional and prospective studies [3,18], there are increasing doubt about its role in predicting CVD events which has led to an increasing focus for abdominal obesity indices [19]. A computed tomography study demonstrated that WHtR showed the highest correlation with intra-abdominal fat compared to BMI, waist circumference and waist-to-hip ratio [20]. WHtR was first used in the Framingham study [21] and proved to be weakly associated with age. We used this index to test abdominal obesity in different geographical areas in Egypt and its gender distribution.

Among all Egyptian university students, SUE had the highest prevalence of abdominal obesity in females. On the other hand; NUE was shown to have the lowest prevalence of abdominal obesity and also one of the lowest prevalence of obesity according to BMI. We do not have clear explanation for increased prevalence of abdominal obesity in female students from SUE. However, we consider certain traditions preventing young adult females in this geographical area from participation in regular exercise program to be the most likely explanation. In addition, the possibility of being at home for more hours, watching television for example, may add a contribution to increasing body fat overtime [22]. This should raise attention for measuring not only exercise level but also levels of sedentary behavior. The lack of routine health visits and decreased role of primary care physicians in this region may be another explanation. In addition, screening for cardiovascular risk factors including obesity may not be feasible or affordable for most individuals at this age group throughout Egypt.

The clustering of cardiovascular risk factors among young adults in Egypt needs effective preventive measures to be implemented. Today's adolescents and young adults with their relatively low risk factor prevalence, will be tomorrow's adult with higher prevalence of risk factors and ultimately patients suffering cardiovascular disease. Public health service should be designed for promoting healthy lifestyles and preventive programs should be tailored to different age groups in the community.

Limitations

The major weakness of this survey is that it only included volunteers who presented to the survey office and it is not a random sample.

Because the sample was taken from non-medical university students, this could not be representative to the whole sector of young adults in Egypt. The different socioeconomic and educational classes should be considered in the future research.

Self-reported exercise and diet is notoriously inaccurate. Inclusion of family history of CVD risk factors could enhance the interpretation of risk factors in our participants. However, this was beyond our scope.

Conclusion

This is one of the few reports exploring the prevalence of cardiovascular risk factors among young adults in Egypt. Pre-hypertension was prevalent in our study population. Obesity, particularly, the abdominal type was very prevalent especially in females. The frequency of performing regular exercise was quite low. The identification of the existence of these risk factors, can contribute to the development of preventive strategies which should be adapted to the socio-cultural and economic context.

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