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Obesity among primary school children in Al-Fayoum Governorate and Port Said City : A comparative study

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Abstract:
Background: *Obese children are more likely to become overweight or obese adults than children of normal weight, and therefore they are at risk for associated adult health problems, including heart disease, type 2 diabetes, stroke, several types of cancer, and osteoarthritis.*
Aim: *To compare the reported prevalence of obesity and overweight among primary school children in Al-Fayoum Governorate to that in a similar study conducted in Port Said City. Also to study the relative effects of factors contributing to childhood obesity.*
Subjects and Methods: *Data for children aged 6-12 years from two studies conducted in Egypt; one in Al-Fayoum Governorate (2018-2019) and the other in Port Said City (2010-2011). Data were collected in the form of anthropometric measurements (weight, height, and body mass index).*
Results: *The prevalence of obesity and overweight was 20.2% and 18% in Al-Fayoum Governorate, and 13.5% and 17.7% in Port Said City respectively. Obesity and overweight were more prevalent in girls than in boys in both governorates.*
Conclusion: *A childhood obesity epidemic is becoming evident in Egypt, but the prevalence of obesity varies across governorates due to differences in risk factors as family history, consumption of fast food and lack of physical activity.*
Keywords: *Obesity, Overweight, Al-Fayoum, Port Said.*

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I. Introduction

The World Health Organization (WHO) defined obesity as "a condition of excessive body fat or adiposity which exceeds healthy limits that presents a risk to the health"[1].Childhood obesity is a major public health crisis nationally and internationally with the prevalence of childhood obesity increasing over the last few years[2]. Obesity has been addressed as a global epidemic. There are 155 million (1 in 10) children classified as overweight, and around 30-45 million as obese. Worldwide childhood obesity is one of the most serious public health challenges of the 21st century[3]. The prevalence of obesity among children aged 6 to 11 years increased from 6.5% in 1980 to 19.6% in 2008[4]. In Egypt, obesity among school aged children is considered an emerging concern; the Egyptian Medical Association for the Study of Obesity in early 2010 estimated that 15 percent of Egyptian (school-age) children are obese, in comparison to its 1990's estimate of only 6 percent[5].

Childhood obesity has been linked to numerous medical conditions. These conditions include, but are not limited to, fatty liver disease, sleep apnea, type 2 diabetes, asthma, cardiovascular disease, high cholesterol, cholelithiasis (gallstones), glucose intolerance and insulin resistance, skin conditions, menstrual abnormalities, impaired balance, and orthopedic problems[6]. Obesity plays an important role in psychosocial limitations and in quality of life of children in terms of psychological, social, emotional and school functional performance. Results showed obese children have significantly lower physical, social, school functioning and total score of pediatric quality of life inventory than normal weight children[7].

The exact cause of obesity is unknown; however, it appears to be a complex relationship among biologic, psychosocial, and behavioral factors, which include genetic makeup, socioeconomic status, and cultural influences[8]. Although environmental factors are considered a major contributor in obesity, genetic variants also play an important role substantially in its pathogenesis. Obesity is classified into three main

categories on the basis of genetic etiology. The identification of genes that underlie these categories of monogenic, syndromic, and polygenic obesity has greatly increased our knowledge of the mechanisms behind this condition[9].

Obesity is mainly explained by a prolonged positive energy imbalance due to increased energy intake and decreased spending. Physical activity determines the number of calories that are spent or stored in the body as fat. It maintains healthy weight status because of its effective impact on body composition, metabolism, and increasing energy expenditure[10].The time that children devote to sedentary activities has increased dramatically in the past few decades. This increase in sedentary patterns, i.e. using buses to go to school, not having physical education classes and watching TV an average of 3 to 4.5 h / day, has been suggested as a behavioral determinant of children's and adolescent's obesity[11].

Increased fast food consumption has been linked with obesity in the recent years. Foods served at fast food restaurants tend to contain a high number of calories with low nutritional values. There is an increased body of evidence that childhood obesity often persists through adulthood and yet there is higher possibility of response to lifestyle modification in children as opposed to adults. Based on this finding, interventions aiming at modifying risk factors to prevent childhood obesity should be a priority. It is thus imperative to understand the magnitude and determinants of childhood obesity in order to develop effective preventive strategies[12]. Studies focusing on estimating the prevalence of obesity in Egypt are increasing aiming to highlight the risks of obesity in children; a study of Hamada and Abdel Azim which estimated the prevalence of obesity and overweight in primary school children in El-Minea Governorate revealed the effects of multiple factors affecting obesity in childhood[13].

The main objective of this study was to compare the findings of two studies carried out in Egypt to find the prevalence of obesity and overweight among primary school children; one in Al-Fayoum Governorate and the other in Port Said City. We also aimed to study factors that contribute to childhood obesity.

II. Subjects and methods

Study design:
Comparative cross-sectional study.

Subjects:

Children aged 6-12 years old attending state-run schools and who underwent anthropometric measurement and filled in a self-administrated questionnaire.

Data sources:

Prevalence of obesity and overweight among governmental primary school children in Port Said City study

A cross-sectional study was conducted on a sample of students attending state-run schools in Port Said City between March 2011 and April 2011. The sampling frame included the listed state-run schools supplied by the Educational Directorate of Port Said. 1800 students were selected from the 6 districts of Port Said City. The study included a well-constructed questionnaire administrated to parents. Both sexes were selected through multistage random sampling technique[14].Of the 1800 students who were given the questionnaire only 852 completed it and proceeded with anthropometric measurements.

Prevalence of obesity and overweight among governmental primary school children in Al-Fayoum governorate study

This study was a cross sectional study that was conducted on students from both genders ranging in age from 6-12 years old with a total of 1462 students during the first school term of the academic year 2018/2019 in Al-Fayoum Governorate. It covered the 6 districts of Al-Fayoum governorate using a well-constructed self-administrated questionnaire[15].

Measures:

Anthropometric measurements in children enrolled in Port Said study:

The researchers personally took different anthropometric measurements in the examination room, after instructing the students to take off heavy clothes.

Weight: One suitable weight balance measuring to the nearest 0.5 kg was used. Students were weighed while wearing light school uniform.

Height: A suitable fixed metallic meter scale measuring to the nearest 0.5 cm was used.

BMI: body mass index was calculated by dividing weight in kg by square height in meters.

Percentile body mass index was obtained by plotting BMI against standard percentile Egyptian curves for each sex. Overweight was defined as BMI more than 85th and less than 95th percentile for age and sex, and obesity

was defined as BMI more than 95th percentile for age and sex compared to standard Egyptian growth charts constructed by the faculty of medicine, Cairo University and National Research Center[14].

Anthropometric measurements at Al-Fayoum study:

The researcher personally took different anthropometric measurements at the examination room, after instructing the students to take off heavy clothes.

Weighing Scale SH-8024: was used to measure weight in kg and height in cm.

BMI**:** was calculated as mentioned above.

BMI= weight (kg) / height (m)^2

Tape measure was used to measure waist circumference in cm.

Body mass index percentile was obtained by plotting body mass index against standard percentile of the Egyptian curves for each sex. Overweight and obesity were defined as above.

Statistical analysis:

Results were analytically tested using normal tests (Z) to test the difference between means of BMI for the two governorates and chi-squared (X^2) to test the relation between study variables. For all tests ($P<0.01$) was considered to be statistically significant.

III. Results

Comparison between children ages and anthropometric measurements in study groups (table 1)

On average Port Said children were significantly taller and heavier than their Al-Fayoum counterparts but BMI was comparable.

Table 1: Age and anthropometric characteristics of each study sample

	Port Said City	Al-Fayoum Governorate	P- Value
Year of data collection	2010/2011	2018/2019	
Sample size	852 students	1462 students	**0.01**
Age (years)	9.5 (1.8)[a]	9.41 (1.67)	**NS**
Weight (kg)	39.12 (12.6)	35.41 (18.13 kg)	**0.01**
Height (cm)	137.4 (11.7)	128.23 (12.8 cm)	**0.01**
BMI[b]	20.3 (4.2 kg/m^2)	20.63 (4.67kg/m^2)	**NS**
Males (no, %)	424 (49.7%)	716 (48.9%)	**NS**
Females (no, %)	428 (50.3%)	746 (51.1%)	**NS**

[a] Mean (standard deviation) , [b] Body mass index NS :not significant

The prevalence of obesity and overweight in both governorates (table 2, figure 1)

The overall prevalence of obesity and overweight was higher in Al-Fayoum governorate (combined prevalence was 38.2%) than in Port Said City (combined prevalence was 31.2%). ($p<0.05$)

Table 2: Distribution of percentile BMI categories in both governorates

	Port Said City	Al-Fayoum Governorate
Prevalence of obesity	13.5%	20.2%
Prevalence of overweight	17.7%	18%
Prevalence of normal and underweight	68.8%	61.7%

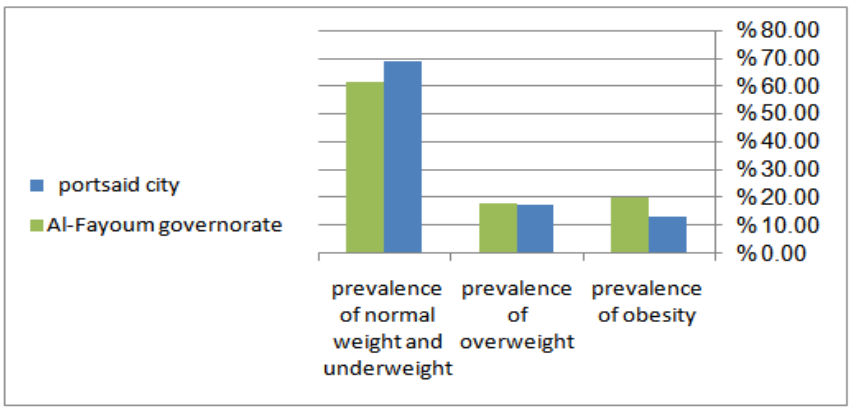

Fig1. Distribution of percentile BMI categories in both governorates

Differences as regards age groups (table 3)

There were significant differences between the prevalence of obesity and overweight in each age group (in each one, the higher prevalence was in Al-Fayoum governorate) except in the overweight (8-10 years) and (10-12years) age groups where there were no significant differences between Port Said and Al-Fayoum.

Table 3: Differences between both governorates in different age groups

Variables	Port Said City		Al-Fayoum Governorate		x^2	P- Value	Sig
	N	%	N	%			
Age Group (6-8) Obese	49	5.8%	92	6.3%	15.719	0.005	Sig.
Age Group (6-8) Overweight	40	4.7%	93	6.4%	22.028	0.005	Sig.
Age Group (8-10) Obese	33	3.9%	84	5.7%	31.727	0.005	Sig.
Age Group (8-10) Overweight	48	5.6%	61	4.2%	3.296	0.06	NS.
Age Group (10-12) Obese	33	3.9%	120	8.2%	61.854	0.005	Sig.
Age Group (10-12) Overweight	63	7.4%	109	7.5%	13.275	0.9	NS.

Sig. : significant NS : not significant

Differences based on gender (table 4)

Obesity was more prevalent in both girls and boys of Al-Fayoum than in those of Port Said City. Similarly, overweight was significantly higher in girls of AlFayoum than in Port Said City. However, overweight was higher in Port Said boys than in their Al-Fayoum counterparts. Obesity and overweight tended to be higher in females than in males in both geographical areas except for overweight in Port Said which was higher in boys (9.1%) than in girls (8.5%).

Table 4: Differences between governorates regarding gender

Variables	Port Said City	Al-Fayoum governorate	x^2	P- Value	Sig
	N	N			
Gender (Boys) Obese	55 (6.4%)	143 (9.7%)	42.370	0.005	Sig.
Gender (Girls) Obese	60 (7%)	153 (10.4%)	40.054	0.005	Sig.
Gender (Boys) Overweight	78 (9.1%)	122 (8.3%)	9.857	0.01	Sig.
Gender (Girls) Overweight	73 (8.5%)	141 (9.6%)	23.975	0.005	Sig.

Sig. : significant

Differences regarding history of obesity (table 5)

There were a variety of differences in the prevalence of obesity and overweight & history of obesity and overweight in both sample groups.

Table 5: Differences between governorates regarding history of obesity

Variables	Port Said City		Al-Fayoum governorate		x^2	P- Value	Sig
	N	%	N	%			
Family history of obesity (No) Obese	89	10.4%	110	7.5%	71.746	0.005	Sig.
Family history of obesity (No) Overweight	60	7.04%	125	8.5%	85.82	0.005	Sig.
Family history of obesity (One parent) Obese	69	8.09%	122	8.3%	14.577	0.7	NS
Family history of obesity (One parent) Overweight	76	8.9%	95	6.5%	28.472	0.005	Sig.
Family history of obesity (both) Overweight	38	4.5%	43	2.9%	20.481	0.005	Sig.
Family history of obesity(both) obese	15	1.7%	64	4.4%	30.174	0.005	Sig.

Sig : significant NS :not significant

IV. Discussion

This study includes data for children aged 6-12 years from two studies conducted in Egypt. It looked at the prevalence of obesity and overweight among primary school children in Al-Fayoum governorate in a study carried out between 2018 and 2019 and compared it with another similar study conducted in Port Said City between 2010 and 2011. We also to aimed study factors contributing to childhood obesity.

Once obesity is established in children, it is hard to reverse. Monitoring the prevalence of obesity in order to plan services for the provision of care and to access the impact of policy initiatives is essential[16]. To our knowledge, our study is the first attempt to examine childhood obesity and overweight across governorates of Egypt using national growth reference. Egyptian growth charts 2002 were constructed from a sample size of 33189 girls and boys (from birth to age of 21 years) from Cairo and Delta regions[17].

The important finding of this study is the high prevalence of overweight and obesity among the primary school children across both governorates. However, the overall prevalence of obesity and overweight was higher in Al-Fayoum governorate (38.2%) when compared to Port Said City (31.2%). This is in spite of the fact that Al-Fayoum is much poorer than Port Said. In a 2011 study of poverty in Egypt, Fayoum registered a 40% prevalence of poverty compared to only 5% in Port Said (which is one of the more affluent cities of Egypt), and an 18% poor access to food compared to only around 4% in Fayoum , this is based on "A Profile of Poverty Across Egypt and Recommendations Egypt Network for Integrated Development Policy Brief 2015".This shows that the childhood overweight/obesity epidemic is becoming evident across all socioeconomic levels of Egypt and can be related to lifestyle changes and rapid urbanization.

Similar results were also found by other authors investigating the same issue in other parts of Egypt, namely Mostafa et al. who found that the prevalence of overweight/obesity in primary school children in Damanhur city in El-Behera Governorate was 37% distributed as 17.2% overweight and 19.8% obese[18], Khalifa et al. who found that overall prevalence of obesity and overweight among primary schools children in El-Sharkia governorate -Kafr district was 58.6% distributed as 34.2% overweight and 24.4% obese[19], another similar study conducted in Menoufia governorate revealed an overall prevalence of overweight and obesity of 19.6%[20] and finally a study conducted in Alexandria governorate revealing an overall prevalence of obesity and overweight of 23.4%[21]. This variation might be attributed to the difference in standard curves used for defining obesity and overweight in some studies which used the WHO curve.

In comparison with other Arabian countries, In Kuwait, it was revealed that the prevalence of overweight and obesity among school children was 45.3% distributed as 30.7% overweight and 14.6% obese in 2009 [22]**.** Another study conducted in Abu Dhabi, United Arab Emirates, illustrated that the prevalence of overweight and obesity was 33.6% (14.7% overweight and 18.9% obese) [23]. In addition; evidence suggests that the prevalence of obesity and overweight is relatively high in many European countries. For example, Krassas et al. reported that the prevalence of overweight in Greek children aged 6–10 years was 25.3%[24],Manzoli et al. reported that the prevalence of overweight in students aged 6–16 years was 40.6% in Italy[25] and in Spain it was 40.0%[26]. The differences seen in the results of these studies might be attributed partially to the effect of genetic factors, lifestyle and environmental factors, and also the variations in the age groups of the samples. Differences in study methods and definitions of obesity and underweight across the various studies may be considered as an explanation as well[27].

In our study when we compared prevalence rates of obesity in boys and girls we found it to be higher in girls both studies. These results match with El-Shafie et al. who found that the prevalence of obesity among female individuals (10.1%) was higher than in male individuals (7.7%) in Alexandria governorate[21], but are different from those of Isbaih in Nablus who found that the prevalence of overweight and obesity was higher in boys (21.2%) than in girls (18.5%)[28]. This difference between boys and girls may be related to population habits as in Egypt where girls are frequently prevented from engaging in sports activities especially in rural areas. It may also be linked to the African perception that fatness and the fuller body shape in females imparts beauty. Girls in such settings do not feel disadvantageous when they become overweight.

The study showed that the prevalence of obesity and overweight varies across the two studies. We feel that while this may be attributed to social, economic, and environmental factors or perhaps genetic differences between the two populations the eight year difference between the two studies may be the reason for the generally higher rates of obesity in the Al-Fayoum district reflecting a trend towards more overweight and obesity in Egypt. A more recent study is needed to see present rates of overweight and obesity in Port Said City..

Our analysis showed a positive history for the prevalence of obesity, family history of obesity and overweight in many of the families across the two studies. This comes in agreement with Bahreynian et al. who reported that children from families with obese parents were at a significantly higher risk of obesity compared to children of normal-weight parents[29]. Mo -Suwan et al.; found that the risk of obesity in children increased 2–3 folds with a positive family history of obesity[30]. This is probably due to genetic and/or life style factors as the types of food available in the house and the food preferences of family members which influence the type of

food that children eat. In addition, family meal times can influence the type of food consumed and the amount there of. Furthermore, family habits regarding physical activity influence the nutritional status of the child[31].

Increased fast food consumption has been linked with obesity in recent years. Foods served at fast food restaurants tend to contain a high number of calories with low nutritional values[32]. In Al-Fayoum, there was significant relation between percentile BMI and fast food consumption (P value= 0.005) [15], and in Port Said, there was significant relation between percentile BMI and fast food consumption (P value< 0.001)[14]. These results come in agreement with a similar study in El-Minea, in which their results revealed a highly significant association between fast food consumption and obesity[13]. This might be attributed to urbanization of many rural areas and the recent appearance of fast food restaurants in Egyptian community. Fast food has been found to be a contributor to childhood obesity in many first world countries as well[33]. Another British study reported that the consumption of fast food was associated with significantly higher BMI score; higher body fat percentage; and increased odds of being obese [34]**.**

In Port Said, the study showed that there was a significant relationship between percentile BMI and the hours spent in watching TV[14] while in Al-Fayoum, the study showed that 6% of obese students claimed to watch TV for less than an hour, 7.9% watch for 1-2 hours, 2.4% watch for 3-4 hours, 1.5% more than 5 hours and 2.5% do not watch TV, but there was no significant relationship between number of hours watching TV and percentile BMI[15]. This difference may be related to the duration of extended television watching needed for the development of obesity (more than 2 y) and could remain undetected after a few months or even years of observation[35]. The El-Minea study reported a positive correlation between the hours spent in watching TV and obesity and there were more than 90% of children who spent more than hour/day watching TV[13] as did the study by Proctor et al. who found television watching to be an independent predictive factor of an increased BMI and obesity over time[37]. Conversely, Robinson et al. in North California failed to show any relationship between time spent watching TV and the development of obesity in girls over a two-year period[36].

Studies assessing the association between physical activity and childhood obesity have been relatively consistent with less active children at an increased risk of obesity when compared to more active children[38]. In Port Said about 47.3% had no participation in sports[14]. The study in Al-Fayoum revealed that 7.9% of students have high rate of active play (5 times or more per week), 14.7% of students have active play (3-4 times per week), 34.2% of students have active play (1-2 times per week) while 43.2% of students have no participation in active play[15]. This finding comes in agreement with Rahman et al. who found that physical activity level was significantly higher among the non obese students than their obese counterparts[39]. In contrast, other studies have not demonstrated a link between physical activity or sedentary behavior in predicting the occurrence of overweight or obesity[40]. Unfortunately, most schools pay little attention to physical education and physical activity. Moreover; students get less encouragement to take part in physical activity regularly. In addition facilities for games are usually inadequate.

V. Conclusion

The finding of the present study helps in revealing the most important factors causing child obesity in different governorates of the Egyptian society. These results will help the health care providers to develop treatment plans for childhood obesity. The findings concluded that the overall prevalence of obesity and overweight was higher in Al-Fayoum governorate than in Port Said City, possibly due to the eight year difference in time between the two studies. The prevalence rate of obesity was higher in girls than in boys. There was a significant relation between prevalence of obesity, family history and fast food consumption.

Limitations

The eight year difference between the two studies means that we cannot accurately say if the differences found were due to a true rising trend in the prevalence of obesity in Egypt or due to a geographical difference.

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Conflict of interest

None declared

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