The Relationship Between Obesity and Symptoms of Puberty Among the Adolescent Females

Tahany El-Sayed El-Sayed Amr[1], Tawheda Mohamed El-Saidy[2] and Awatef Abd-El-Razek Mohamed[3]

[1] Lecturer of Maternal &Newborn Health Nursing, Faculty of Nursing, Menoufia University, Egypt.
[2] Lecturer of Community Health Nursing, Faculty of Nursing, Menoufia University, Egypt.
[3] Assistant prof. of Community Health Nursing Faculty of Nursing El- Minia University, Egypt.
awatif19672002@yahoo.com

Abstract: Background: Puberty is a normal process of physical changes that occurs when a child's body transitions into an adult body. Over weight and obesity in adolescence stage are important predictors of adult obesity and predict elevated adult mortality and cardiovascular diseases rates. **Aim**: 1) To examine the body mass index distribution among adolescent females. 2) To identify the relationship between obesity and symptoms of puberty. **Design**: Across-Sectional design was used .**Sample**: The total sample was 200 female students. Their ages were ranged from 12 years to less than 21 years. **Tools**: The Researchers used three tools. An interviewing questionnaire, an assessment tool, and growth chart. **Results**: The mean age of the studied sample was 16.2 ± 1.6 years old and the mean of body mass index of the obese group was 34.4±4.9 kg /$m^{2.}$ The puberty age of more than two-third of the over-weight group ranged between 11-12 years. The mean age of menarche was 12.6 ±1.3 years. There were a statistically significant relation between obesity and menstrual irregularity (P<0.05). Regarding to dietary habits, there were 77.3% of the obese girls ate fatty foods and the majority of them were ate fast foods. In addition, 86.4% of the obese group drank beverages. There were a statistical significant differences between body mass index categories in relation to age of puberty and appearance of secondary sexual characteristics (P<0.05). **Conclusion**: obesity among adolescent females is an important concern. It can cause early puberty symptoms and menstrual irregularity. Also there were bad eating habits among adolescents that help them to have more fats and become obese. This can impact on their health. **Recommendations:** Early detection of obesity by using the BMI indicator to maintain healthy puberty. Also encourage the adolescent girls to eat healthy diet to avoid obesity and its complications.

[Tahany El-Sayed El-Sayed Amr, Tawheda Mohamed El-Saidy and Awatef Abd–El-Razek Mohamed **The Relationship Between Obesity and Symptoms of Puberty Among the Adolescent Females]** Life Science Journal 2012; 9(3):2334-2340]. (ISSN: 1097-8135). http://www.lifesciencesite.com.337

Key Words:(BMI) Body Mass Index,(WT):weight,(HT):Height,(WHO)World Health Organization, puberty, obesity.

1. Introduction

Adolescence is the transitional stage of physical and mental human development that occurs between childhood and adulthood. This transition involves biological, social and psychological changes. Puberty has been heavily associated with teenagers and the onset of adolescent development (***Christie, 2008***). Adolescence essentially begins when physiologically normal puberty starts and ends when the person develops an adult identity and behavior. This period of development corresponds roughly to the period between the ages of 10 and 19 years. Also, adolescence is usually accompanied by an increased independence allowed by the parents or legal guardians and less supervision, contrary to the preadolescence stage (***Hill, 2008***).

The overweight and obesity are serious public problems in children and adolescents and urgent measures are needed to suppress this epidemic and reverse the situation as soon as possible (***Antune & Moreira, 2011***). Worldwide, childhood obesity has risen to epidemic proportion (***WHO, 2006***). Dramatic increasing in the prevalence of obesity and overweight among children and adolescent are reported over the past three decade in both developed and developing countries (***James, 2004***). Generally obesity is prevalent in Saudi Arabia. Children from urban areas were more overweight and obese (***Al Qahtani, 2009***). Specifically in the Middle East region and in the KSA in particular, obesity has become a major health problem among all age groups (***Musaiger, 2004***), and the primary prevention of it become at the forefront of current public and community health concern. the prevalence of obesity in KSA was 23.3% and more than 50% of children between 14 and 18 years had weight above the 85th percentile (***Al-Dossary, 2010***). Risk factors for childhood obesity are parental work in a private sector and parental education, socioeconomic status, physical inactivity and a family history of obesity (***Al Qahtani, 2009***). In addition the other factors contributing to obesity include increases in calories and fast food consumption, and increases in television viewing (***Frank et al., 2005***).

Obesity and overweight in childhood have significant impact on both physical and psychological health for examples, obesity and overweight, are recognize as a major independent risk factor for many chronic diseases such as Cardiovascular disease, diabetes, musculoskeletal disorders and cancer ,as well as Obese Child has a higher chance of premature death and disability in adulthood (***Daniels et al., 2005***). In addition, overweight children and adolescents are at greater risk of adult obesity (***Reilly, 2003***).

Excess adiposity during childhood may influence pubertal development as well. In particular, obesity during childhood may lead to early signs of puberty in girls and delay puberty in boys. High androgen concentrations related to obesity in pre-pubertal girls could lead to earlier pubertal onset (***Christine et al., 2010***). Earlier puberty in girls

appears to be associated with a higher risk of psychological problems, risk-taking behavior, and even future breast cancer (***Golub et al., 2008***). Also childhood levels of obesity associated with earlier menarche in girls (***Frank et al., 2005***).

Significance of the study:

Childhood obesity has become a major health concern in recent decades, especially with concern to metabolic abnormalities that impart a high risk for future cardiovascular diseases. Recent data suggest that, excess adiposity during childhood may influence pubertal development. In particular, excess adiposity during childhood may advance puberty in girls ***(Solorzano & McCartney, 2010).*** An increase in childhood obesity prevalence has been observed worldwide, in both developed and developing countries ***(Wang & Lobstein 2006).*** Generally obesity is prevalent in Saudi Arabia. Children from urban areas were more overweight and obese (***Al Qahtani, 2009***). The overweight and obesity are serious public problems in children and adolescents and urgent measures are needed to suppress this epidemic and reverse the situation as soon as possible ***(Antune & Moreira, 2011).***

Aims of the study

1- To examine the body mass index distribution among adolescent females.
2- To identify the relationship between obesity and symptoms of puberty.

Research questions:

1. What are the body mass index distributions among adolescent females?
2. Is there a relationship between obesity and symptoms of puberty?
3. Is there a relationship between obesity and menstrual characteristics?

2. Subjects and Methods

The present study was carried out with the aim of :

a. Examine the body mass index distribution among adolescent females.
b. To identify the relationship between obesity and symptoms of puberty.

Research Design

Across-Sectional design was used to examine the body mass index distribution among adolescent students and to identify the relationship between body mass index categories and symptoms of puberty among adolescent students in the schools at Shaqra governorate.

Setting

The study was conducted at the schools of girls (Intermediate and Secondary schools) at Shaqra Governorate, KSA.

Subjects

The total sample was 200 students, the inclusion criteria of these students included were:

- Age from 12 years to less than 21 years.
- All levels of the students in the school (intermediate and secondary school) included.
- All students study at Shaqra governorate.

Data collection tools

The Researchers used three tools to collect the data, namely an interviewing questionnaire sheet for the students, an assessment tool for the students, which designed by the researchers based on review of pertinent literature, and were finalized after being revised by the professors, and college experts. The third tool adopted from textbooks and magazines.

- **Tool I**. Interviewing Questionnaire which includes personal data of the students, family history and the presence of obesity or not.
- **Tool II**. Assessment sheet which include measurement of the weight, height abdominal & hip circumferences, for all students. It also includes the history of the menstruation and its characteristics. The assessment sheet also includes eating habits, sleep hours, sports and drinking the soft drink.
- **Tool III**: growth chart. To compare the B.M.I with the age of the students and identify if they (under weight, healthy, overweight, and obesity) for each students.

Content validity and reliability:

Validity was determined by the professors and experts of the college who reviewed this instrument and judged it to measure what intended to be measured. Reliability was assessed by applying the tools on small number of students (10) who were excluded from the study. Reliability test was assessed by applying the questionnaire on 10 students using test-retest.

Pilot study

A pilot study was conducted to test the feasibility and applicability of the tools and the maneuvers of the interventions, and to estimate the time needed. It was carried on to 10 students.

Field work:

Data were collected through an interview and complete assessment of all students.

Student's assessment:

After complete history was taken from the student, the investigator performed measuring the anthropometric measurements like (the student weight, the student height, the abdominal and hip circumferences) then Body Mass Indexes were calculated manually by the formula (weight by K.G. divided by the square of the height by meter) for each student and take a score on the growth chart (under weight, healthy weight, overweight, and obesity). The investigators used special program from net to recalculate and to be sure about the body mass index categories.

Procedure

Before starting any step in the study, official letters were issued from the dean of the faculty of Applied Medical Sciences, Shaqra University to the directors of the Schools where the study was intended to be done. The letters explained the aim of the study, and solicited permission to carry it out. They have also emphasized the confidentiality of any obtained information. Data collection was during the first semester of academic year 1432-1433H (2011-2012).

Human Rights and Ethical Considerations

The subjects were chosen according to the criteria and they were interviewed after their informed consent was obtained to participate in the study. The researchers approached each student by giving her an overview of the study, and explained the procedures. The researchers also reassured the subjects that their privacy would be protected, and that any obtained information would be strictly confidential.

Statistical analysis

The collected data were coded for entry and analysis (SPSS) statistical soft ware package version (16). Data were presented using descriptive statistics in the form of frequencies and percentage. Quantitative variables were presented in the form of means and standard deviation. Qualitative variables were compared using chi-square test. Statistical significance was considered at *p*- value <0.05.

3. Results

Table (1) Shows the socio demographic characteristic of the studied sample. The mean age of the sample was 16.2±1.6 years. As regards the educational level, the majority of the over-weight and obesity group were in the secondary school (90.6 %). In relation to socio-economic level; more than half of the over- weight had a high economic level (51.9%). As regards family history of hereditary disease; about half of the obesity group (45.5%) had heredity disease and 40.7% of the over-weight group had history of obesity in the family.

Figure (1) illustrated that, 40.7% of the overweight girls have history of obesity in the family.

Table (2) shows the anthropometric measurements of the studied sample. There was a highly statistical significant difference between body mass index categories in relation to weight, abdominal circumference, and hip circumference (P<0.001*).

Table (3) shows the relationship between B.M.I categories & puberty age, appearance of secondary sexual characteristic of the sample. The puberty age of more than two-thirds of the over-weight group (66.7%) ranged between 11-12 years old. In addition, there was a statistically significant difference between BMI categories in relation to appearance of secondary sexual characteristics (P<0.05).

Table (4) shows relationship of B.M.I categories & menstrual characteristics of the studied samples. The mean age of menarche was (12.6 ±1.3 years), with statistical significant difference between BMI categories in relation to age of menarche and menstrual regularity (P<0.05). Regarding to dysmenorrhea, the majority of obese girls have dysmenorrhea (95.0%).

Figure (2) revealed that, the majority of girls with healthy weight had regular menstruation (89.9%). On the other hand, 40% of the obese girls had irregular menstruation.

Table (5) shows that, 77.3% of obese girls were ate fatty foods, and 86.4 of them preferred soft drinks.

Figure (3) illustrated that, 4.5% of obese students were suffered from chronic disease (diabetes mellitus), and 13.6 % of them were complained from psychological problems due to obesity.

Table (1): Socio Demographic characteristics of the studied sample.

Demographic characteristics	***Under weight n=59***	***Healthy weight n=92***	***Over weight n=27***	***Obesity n=22***	***Total n=200***	
	29.5%	***46.0%***	***13.5%***	***11.0%***	***No.***	***%***
Educational level						
• Intermediate school	28.8	3.3	3.7	9.1	23	11.5
• Secondary school	71.2	96.7	96.3	90.9	177	88.5
	x^2 = 25.2	***P*<0.001***				
Socio-economic level of the family						
• Low	0.0	0.0	0.0	4.5	1	0.5
• Middle	44.0	46.7	40.7	50.0	91	45.5
• High	49.2	42.4	51.9	18.2	86	43.0
• Very high	6.8	10.9	7.4	27.3	22	11.0
	x^2 = 19.12	***P*<0.05***				
Family history for heredity diseases						
• Yes	44.1	32.6	44.4	45.5	78	39.0
• No	55.9	67.4	55.6	54.5	122	61.0
	x^2 = 2.9	***P*>0.05**				
Obesity in the family						
• Yes	25.4	35.9	40.7	3.8	66	33.0
• No	74.6	64.1	59.3	68.2	134	67.0
	x^2 = 10.7	***P*>0.05**				
Age (Mean±SD)	**16.2 ± 1.6**					

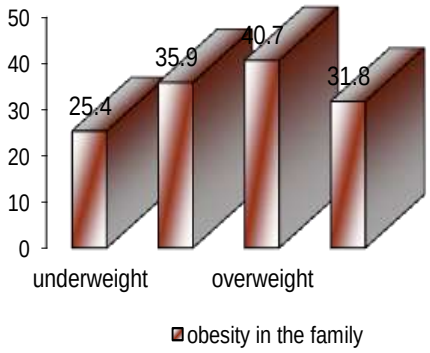

Figure (1): Relationship between B.M.I Categories and presence of obesity in the family.

Table (2): Anthropometric measurements of the studied sample.

Anthropometric measurements	***Under weight***	***Healthy weight***	***Over weight***	***Obesity***	***P-value***
	Mean ± SD	***Mean ± SD***	***Mean ± SD***	***Mean ± SD***	
• Weight	40.9±5.8	53.7± 8.1	67.2±5.7	83.6±16.1	P<0.001*
• Height	155.3±6.6	157.2±11.9	153.1±18.7	158.4±5.1	P>0.05
• Abdominal circumference	62.2±5.5	69.1± 6.2	78.4±8.1	89.3±12.6	P<0.001*
• Hip circumference	83.6±7.9	93.3±6.7	104.8±7.6	114.7±10.5	P<0.001*
• Body mass index	16.6±1.5	21.2± 1.9	27.3±1.4	34.4±4.9	P<0.001*

Table (3): B.M.I categories in relation to puberty age, and appearance of secondary sexual characteristic of the sample.

Variables	**Under weight n=59**	**Healthy weight n=92**	**Over weight n=27**	**Obesity n=22**
	29.5%	**46.0%**	**13.5%**	**11.0%**
Puberty age				
• 9-10 years	0.0	1.1	3.7	9.1
• 11-12 years	35.6	37.0	66.7	40.9
• 13-15 years	45.8	56.5	25.9	40.9
• More than 15	0.0	3.3	0.0	0.0
• No	18.6	2.1	3.7	9.1
	X^2 = 33.5 P<0.001*			
Secondary sexual characteristic such as breast development, axillaries' & pubic hair				
• Yes	79.7	97.8	92.6	90.9
	X^2 = 16.6 P<0.05*			

Table (4): Relationship between B.M.I. Categories & Menstrual Characteristics of The menstruated Studied girls (n=181).

Menstrual Characteristics	Under weight n=46	Healthy weight n=89	Over weight n=26	Obesity n=20	***P-value***
	%	**%**	**%**	**%**	
• Mean age of menarche	12.6 ± 0.9	12.8±1.4	11.8± 1.3	12.5± 1.4	P<0.05*
	12.6 ±1.3				
Regularity of menses					
• Regular	80.4	89.9	84.6	60.0	P<0.05*
• Irregular	19.6	10.1	15.4	40.0	
Duration of menses					
• less than 2 days	10.9	16.9	3.8	5.0	P>0.05
• 2-4 days	17.3	13.5	30.8	15.0	
• 5-7 days	60.9	62.9	61.6	75.0	
• More than 7 days	10.9	6.7	3.8	5.0	
Amount of menses					
• Scanty	6.5	11.2	15.4	25.0	P>0.05
• Moderate	65.2	65.2	76.9	70.0	
• Heavy	28.3	23.6	7.7	5.0	
Dysmenorrhea					
• Yes	82.6	86.5	92.3	95.0	P>0.05

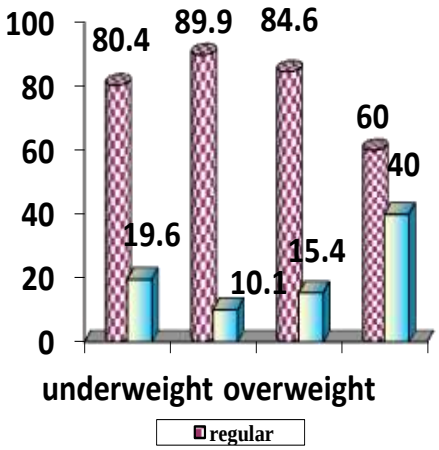

Figure (2): Relationship between B.M.I categories & menstrual regularity of the studied sample

Table (5): B.M.I Categories & dietary habits of studied sample.

dietary habits	*Under weight n=59*	*Healthy weight n=92*	*Over weight n=27*	*Obesity n=22*	*P-value*
Drinking tea & coffee					
• Yes	55.9	59.8	5.6	50.0	P>0.05
• No	44.1	40.2	44.4	50.0	
Fatty foods					
• Yes	62.7	78.3	48.1	77.3	P <0.05*
• No	37.3	21.7	51.9	22.7	
Fast foods					
• Yes	89.8	89.1	74.1	90.9	P >0.05
• No	10.2	10.9	25.9	9.1	
Soft drink					
• Yes	64.4	72.8	70.4	86.4	P >0.05
• No	35.6	27.2	29.6	13.6	

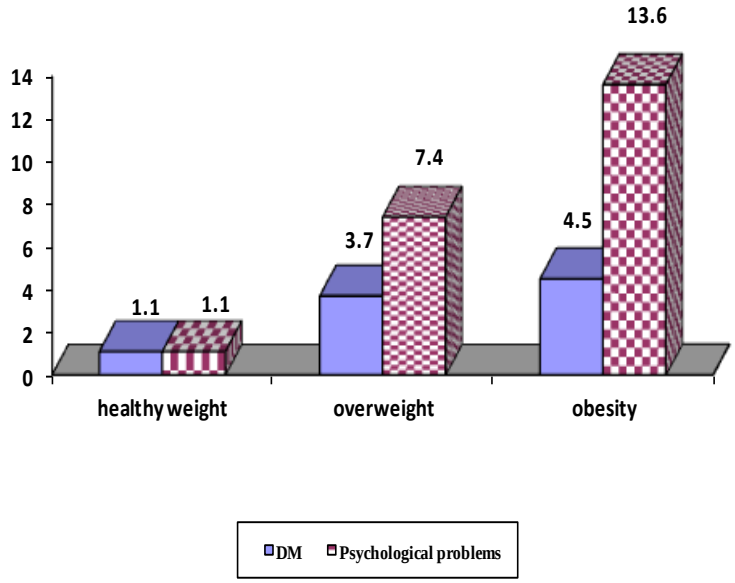

Figure (3) Relationship between obesity and presence of health problems for the studied sample

4. Discussion

Adolescence is the period of transition from childhood to adulthood (***Sigh et al., 2006***). The overweight and obesity are serious public problems in children and adolescents (***Antunes & Moreira, 2011***). The increasing problem of obesity has been reported from different regions in the kingdom (***Al Qauhiz, 2010***). The present study aimed to examine the body mass index distribution among adolescent females and to identify the relationship between obesity and symptoms of puberty.

Socio-demographic characteristics of the studied sample indicated that, the mean age of the students was 16.2±1.6 years old (Table 1), also more than three quarters of the sample were studying in the secondary school, this means that, all students were in an adolescence stage where the transitional from childhood to adulthood is rapid. In the current study the mean age of menarche was 12.6±1.3. This comes in agreement with ***Singh et al., (2006)*** who stated that, the age of menarche can ranged from twelve to fifteen years old. Also, this was confirming with ***Jannelli, (2005)*** who mentioned that, the first period or menarche occurring at an average age of twelve to thirteen years old.

Regarding to anthropometric measurements for the students, the present study explained that, the mean weight of the obese adolescent students was 83.6±16.1 kg (Table 2), while the mean height of them was 158.4±5.1cm and the mean of BMI was 34.4±4.9 kg/m^2. These findings are in an agreement with ***Wronka, (2010)***, and ***Yaruratanasirikul et a.l, (2011***). They indicated that, the over age of near-final height of the girls with early puberty was 154±4.9 cm. They concluded that, obese girls attained near final height (NFH) at an earlier age and had the same NFH normal-weight girls (***Townsend et al., 2011***). Also ***EL-Gilany et al.,(2010***) and ***Kleber et al.,(2011***) explained that, obese children are taller than normal weight children up to the age of fourteen years. Since obese children demonstrated pubarche, menarche and voice break later than their normal weight peers.

Rosenfield et al., (2009) mentioned that, the early onset of puberty may be related to obesity, so there is a need to know the prevalence of early pubertal milestones in non overweight children. Girls with excessive BMI had a significantly higher prevalence of breast appearance from ages 8.0 through 9.6 years and puberties from ages eight through ten years than those with normal BMI. The present study stated that, the puberty age of more than two-thirds of the over-weight group ranged between eleven to twelve years old (Table 3). In addition, there was a statistically significant difference between BMI categories in relation to appearance of secondary sexual characteristics (P<0.05). Also, the present study showed that, the mean age of menarche was earlier in the overweight adolescent students (11.8± 1.3) than the healthy weight girls (12.8±1.4).

These findings were in an agreement with many researchers (***Mesa et al., 2010***; ***Zaghloul et al., 2011***) who indicated that, the mean age of menarche was twelve years old and the prevalence of menarche before age 12 years was more than twenty four percent when studying girls who experienced rapid growth. Also ***Wronka, (2010***) explained that, the inverse correlation between BMI values & age of menarche. ***Novotny et al., (2011)*** explained that, female adolescent breast density was negatively associated with body fatness and positively associated with menarche.

There was a statistical significant difference between BMI categories in relation to age of menarche and menstrual regularity (P<0.05). Regarding to dysmenorrhea, the majority of obese girls have dysmenorrhea (Table 4). Also, forty percent of the obese girls had irregular menstruation (Figure 2). These findings are in an agreement with ***Souza et al., (2010***), they mentioned that, the presence of obesity can cause menstrual dysfunction such as amenorrhea or oligomenorrhea.

AL-Qauhiz, (2010) studies the obesity among Saudi female university students and indicated that, the frequency of drinking aerated beverages increased the risk of obesity significantly. This comes in agreement with the current results which stated that, more than three quarters of obese girls were ate fatty foods, and more than eighty six percent of them preferred soft drinks (Table 5).

But this findings are in contrast with ***AL Rethaiaa et al., (2010***) , ***ALQauhiz, (2010***) ***and Trainer, (2010***) who concluded that by analysis of dietary habits and life styles indicated that the predominance of unhealthy behaviors. They concluded also, both BMI and VFL had significant inverse correlation with the frequency of eating fatty & fast foods.

Trainer, (2010) explained that, The United Arab Emirates now have some of the highest proportion of obese/overweight people in the world, with correspondingly high rates of chronic disease. These results come in agreement with the present study which reported that, about five percent of obese students were suffered from chronic disease (diabetes mellitus), and about fourteen percent of them were complained from psychological problems due to obesity (Figure 3).

Conclusion:

Based on the results of the present study, the following were concluded:

- The overweight and obesity had an effect on the occurrence of menarche, becoming earlier than other group, menstrual regularity and presence of dysmenorrheal problem.
- There was a need for changing the eating habits for the adolescence such as reduce the eating of fatty foods and avoid drinking of soft drinks to prevent obesity in early ages.

Recommendations

1- Early detection of obesity by using the BMI indicator to maintain healthy puberty.
2- Encourage the adolescent girls to eat healthy diet and avoid fatty foods and soft drinks to avoid obesity and its complications.
3- Incorporating the health education programs about effect of obesity on health and importance of maintaining healthy weight in some of school subjects to increase the adolescence girls' awareness.

Corresponding authors
Name: Awatef Abd –El-Razek Mohamed
Address: Assistant prof. of Community Health Nursing, Faculty of Nursing : El- Minia University.
awatif19672002@yahoo.com

References

1- Al Qahtani, A., MD, (2009); WHY CHILDREN AND ADOLESCENTS OBESITY CHAIR? , College of Medicine, King Saudi University, Saudi Arabia. International Journal of Pediatric Obesity. 2009; 4 (Suppl 3).
2- Al Qauhiz NM (2010): Obesity among Saudi Female University Students: Habits and Health Behaviors. J Egypt Public Health Assoc., 85(1-2):45-59.
3- Al-Dossary SS, Sarkis PE, Hassan A, Ezz El Regal M, and Fouda AE(2010) Obesity in Saudi children: a dangerous reality. East Mediterr Health J Sep; 16(9):1003-8.
4- Al-Rethaiaa AS, Fahmy AE, and Al-Shwaiyat NM Nutr J. .(2010) Obesity and eating habits among college students in Saudi Arabia: a cross sectional study. NM Nutr J. Sep 19; 9:39.
5- American Academy Of child and adolescent's facts for families ,(2008).Available at http://WWW.About.comDefinitionof adolescence.htm
6- Antunes A, Moreira P.(2011) Prevalence of overweight and obesity in adolescents Acta Med Port. ; 24(2):279-84.
7- Christie D. Clinical review (2008); ABC of adolescence. Adolescent development. www.bmj.com. Accessed March 9, 2008.
8- Christine M. Burt Solorzano and Christopher R. McCartney. (2010); Obesity and the pubertal transition in girls and boys September; 140(3): 399–410. http://www.ncbi.nlm.nih.gov/pmc/articles/PMC2931339/
9- Daniels SR, Arnett DK, Eckel RH, Gidding SS, Hayman LL, Kumanyika S, Robinson TN, Scott BJ, St Jeor S, Williams CL: (2005); Overweight in children and adolescents: pathophysiology, consequences, prevention, and treatment. Circulation 2005, 111:1999-2012.
10- Donnel,(2010);Puberty http://www.About.com.Definitionofpuberty.htm http://www.answers.com/topic/puberty#ixzz18iGxtroP
11- El-Gilany AH, Hammad S. (2010): Body mass index and obstetric outcomes in Saudi Arabia: a prospective cohort study. Ann Saudi Med. 30(5):376-80.
12- FRANK M., PHILIP KHOURY[2], JOHN A. MORRISON (2005); Influence of obesity on timing of puberty, Article first publishedonline: 20DEC2005. http://onlinelibrary.wiley.com/doi/10.1111/j.13652605.
13- Golub MS, Collman GW, Foster PM, Kimmel CA, Rajpert-De Meyts E, Reiter EO, Sharpe RM, Skakkebaek NE, Toppari J. (2008);Public health implications of altered puberty timing. Pediatrics. 121(Suppl 3):S218–230.
14- Hill M. (2008); UNSW embryology normal development - puberty. embryology.med.unsw.edu.au. Accessed March 9,
15- James PT (2004); Obesity: The worldwide epidemic. Clinics in Dermatology 2004, 22:276-280.
16- Jannelli, MD, (2005); When should puberty start? Learn the signs of early puberty.
17- Jaruratanasirikul S, Thongkum K, and Sriplung H.(2011): Girls with early puberty attain a near-final height similar to their target height. J Pediatr Endocrinol Metab.; 24(5-6):339-45.
18- Kleber M, Schwarz A and, Reinehr T (2011): Obesity in children and adolescents: relationship to growth, pubarche, menarche, and voice break. J Pediatr Endocrinol Metab.;24(3-4):125-30.
19- Mesa JM, Araújo C, Horta BL,and Gigante DP.(2010): Growth patterns in early childhood and the onset of menarche before age twelve. Rev Saudi Publica. Apr; 44(2):249-60.
20- Musaiger AO. (2004); Overweight and obesity in the Eastern Mediterranean region: can we control it? East Mediterr Health J ; 10 (6): 789-793.6-S.S.
21- Novotny R, Daida Y, Morimoto Y, Shepherd J,and Maskarinec G.(2011). Puberty, body fat, and breast density in girls of several ethnic groups. Am J Hum Biol. ;23(3):359-65.
22- Reilly J, Methven E, McDowell Z, Hacking B, Alexander (2003); Health consequences of obesity.
23- Rosenfield RL, Lipton RB, Drum ML, (2009).Thelarche, pubarche, and menarche attainment in children with normal and elevated body mass index. Jan;123(1):84-8.
24- Scott JD, Johnson BL, Blackhurst DW and Bour ES..(2011): A retrospective cohort study of morbidly obese surgical patients, Surg Obes Relat Dis.Sep 16.
25- Shrestha A, Olsen J, Ramlau-Hansen CH, Bech BH,and Nohr EA.(20110) Obesity and age at menarche. Fertile Sterile. ; 95(8):2732-4...
26- Singh *et al.*, (2006); Knowledge assessment regarding puberty and menstruation among school adolescent girls of District Varanasi. Indian Journal. Rev. Soc. Med. Vol, 37. No.(1).
27- Solorzano C.M. & McCartney C.R. (2010): Obesity and the pubertal transition in girls and boys. Reproduction. Sep; 140(3): 399–410. doi: 10.1530/REP-10-0119.
28- Souza FA, Dias R, Fernandes CE, Pimentel F,and Dias D.(2010) Menstrual irregularity in women with class III obesity. Gynecol Endocrinol. Oct;26(10):768-72.
29- Townsend N, Rutter H,and Foster C.(2011) Variations in data collection can influence outcome measures of BMI measuring programmes. Int J Pediatr Obes. Oct;6(5-6):491-8
30- Trainer SS (. 2010) Body image, health, and modernity: women's perspectives and experiences in the United Arab Emirates. Asia Pac J Public Health Jul; 22(3 Suppl):60S-67S.
31- Wang Y, Lobstein T. (2006) : Worldwide trends in childhood overweight and obesity. Int J Pediatr Obes. 1:11–25. [PubMed].
32- World Health Organization (2011):Global strategy on diet, physicalactivityandhealthavailableat (htt://www.who.int/dietphysicalactivity/childhood).
33- World Health Organization Expert Committee (2009): prevalence of overweight and obesity in children and adolescents, fact sheet2.3 available at (htt://www.euro.who.int/ENHIS).
34- World health organization. (2006); Global Strategy on Diet, Physical Activity and Health. Retrieved 2006, from http://www.WHO.com
35- Wronka I. (2010) Association between BMI and age at menarche in girls from different socio-economic groups .Anthropol Anz.;68(1):43-52.
36- Zaghloul S, Ali HI, Harrison G, Popkin BM. (2011) the prevalence and trends of overweight, obesity and nutrition-related non-communicable diseases in the Arabian Gulf States Obes Rev. Jan; 12(1):1-13.