

***Birth order, number of siblings, parent's education as associated factors of adolescence obesity***

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***Abstract***

Obesity in adolescents show high prevalence specially in developing countries. Although birth order and sibling size have been mathematically coupled and in spite of their respective effect on both overweight and obesity, they have not been estimated before separately. Moreover, the educational achievement of parents might have impact on their children's nutritional status.

**Objective** This study aims to assess how birth order and number of siblings affect adolescent obesity risk and to examine the impact of parent's education on adolescent obesity, the results will indicate which family members may be prioritized for inclusion in adolescent obesity prevention programs.

**Methodology** A self-administered questionnaire was used to collect data on 90 adolescent aged 10 to 18 years old. It included sex, age, birth weight, birth order, number of siblings, lifestyle, and parents' educational level by a self-administered questionnaire completed by an adult member of the family. Adolescents' height and weight were done at nutrition and immunity clinic, Medical Research Centre of Excellence. The Centre of Disease Control's (CDC) BMI cut-off points were used to classify cases as normal (5–84<sup>th</sup> percentile) or obese ( $\geq 95^{\text{th}}$  percentile).

**Results** Adolescent's BMI was not associated with neither parent's education nor birth order. Distribution of the number of siblings was different in both groups as regards BMI but with no statistical significance.

**Conclusion** The study showed no association between adolescent's BMI and parent's education or order of birth. There was no significant association between number of their siblings and the development of obesity.

**Key words:** Sibling, Birth-order, Parental education, Adolescence, Obesity

***Introduction***

Obesity with all its negative effects whether pathological or psychological is considered as a major health problem particularly in adolescence because of its great effect on their whole life as it tends to persist to adulthood (*Reilly et al.,2003*).

The Middle East is the second largest region in the world in terms of prevalence of obesity after North American countries (*Mahfouz et al.,2018*). Obesity is considered as a global health problem

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with different etiological factors ( *Meller et al.,2010*). Some of them has been associated with many family variables as age and body mass index of the parents, siblings' number, child birth order, and socioeconomic level (*Chen and Escarce,2010*).

Few information about how birth order and siblings' number may influence obesity among adolescents, so it is useful to evaluate impact of having older or younger siblings as well as the number of siblings on obesity to help in identifying those having high risk (*Ochiai et al.,2012*).

Several studies had been done; one of which reported that parental understanding emanating from their level of awareness and level of education, has a great effect on correction of some erroneous food behaviors and such indicating a potential association between parental education with adolescent's obesity and this will help identifying participants in intervention programs for prevention (*Doustmohammadian et al.,2010*).

### **Volunteers and methods**

The current study was conducted at the Medical Research Centre of Excellence (MRCE) in the clinic of nutrition and immunity, as a part of a project funded by the National Research Centre. The cases were 45 adolescents with body mass index above or equal to 85<sup>th</sup> centile. The control group were 45 individuals age and sex matched with adolescents and their body mass index below 85<sup>th</sup> centile.

**Inclusion criteria:** Both sex adolescents aging 10-18 years old.

**Exclusion criteria:** Any organic cause of obesity

**Data collection:** An adult member of the household was interviewed and asked to complete a prepared questionnaire about adolescence age and sex. In addition to some family information as each sibling's number, birth order and the parents' education level. The questionnaire was revised by the interviewer and age was recalculated. Parents' educational levels were divided into four categories: illiterate, elementary, middle, and high according to the data given in the questionnaire.

**Anthropometric measurements:** Height and weight for all individuals were taken to the nearest 0.1 cm and 100 g using the Holtain portable measuring device and a digital Seca scale while the participant was barefooted and wearing minimal clothing. Before the examination, the scale was calibrated. At least two physicians conducted each of these measurements; average of both measurements was recorded. BMI was calculated using the following formula: Weight (kg) / Height (m)<sup>2</sup>. The Center for Disease Control and Prevention (CDC) BMI cut-off values were used to classify the adolescents as normal. (5–84<sup>th</sup> percentile) and obese (≥95<sup>th</sup> percentile).

The programme Anthracic v1.66 Home was used to plot the data on WHO curves. (*WHO,2014*).

**Analyzing data:** There were 3 categories for the sibling's number: (none), (1-2), (3-4), and (>4) (4groups) for birth order: lone child, oldest child, youngest child, others. Parental education was divided to high, middle, elementary and illiterate. Statistical significance was defined as a p value of less than 0.05. The Statistical Package for the Social Sciences (SPSS) version 16.G was used.

**Ethical Approval:** According to the ethical standards of the World Medical Association (Declaration of Helsinki) approval number 16130, each child's care provider gave written informed consent to take part in the research. The Medical Ethical Committee of the National Research Center gave its approval to the research(*WHO website ,2019*).

## Results

The study group was divided into two equal groups of 45 children each (total 90 children), 31 (34.4%) males and 59 (65.6%) females. According to the WHO growth charts, the case group's cut off BMI was 85th centile, whereas the control group's cut off BMI was 85th centile. The average age of the participants was (13.05 ±2.61) and (12.62 ±2.6) for case and control groups respectively. Detailed anthropometric data according to BMI percentiles is shown as mean and standard deviation in table (1).

**Table (1):**  
Anthropometric Data of the Study Groups

	Case(n=45)	Control(n=45)
Age (years)	13.0±2.61	12.62±2.6
BMI	30.55±5.61	17.22±2.71
BMI centile	98.3±2.68	34.4±28.16
Weight (kg)	73.41±18.26	37.39±10.68
Weight centile	96.26±4.8	27.43±25.0
Height (cm)	154.16±10.65	146.0±13.0
Height centile	51.5±28.89	32.6±28.74

**Table 2:**  
Comparing BMI as regards Number of Siblings

No of total siblings	Obese	Non-Obese	P value a	P value b
None	1(2.20%)	1(2.30%)	1.000	0.349
1-2	25(55.60%)	31(70.50%)	0.423	
3-4	17(37.80%)	9(20.50%)	0.117	
>4	2(4.40%)	3(6.80%)	0.655	

<sup>a</sup>P value using Chi-Square to compare between Obese and Non-Obese cases.

<sup>b</sup> P value using Crosstab Chi-Square for comparison between all groups.

Characteristics of the sample studied showed that most of the non-obese (70.5%) had 1-2 siblings compared to (55.6%) of the obese. On the other hand, more than one third of the obese (37.8%) had 3-4 siblings compared to less than quarter of the non-obese (20.5%) The distribution of the number of siblings was different in both groups but statistically insignificant (P-value 0.349) as shown in table (2).

**Table 3:**  
Comparing BMI with Parental Educational Level

	No of total siblings	Obese	Non-Obese	P value a	P value b
Father Educational Level:	High	15(34.90%)	16(37.20%)	0.857	0.436
	Middle	17(39.50%)	21(48.80%)	0.516	
	Elementary	3(7.00%)	3(7.00%)	1.000	
	Illiterate	8(18.60%)	3(7.00%)	0.132	
Mother Educational Level:	High	7(15.90%)	14(31.80%)	0.127	0.127
	Middle	19(43.20%)	20(45.50%)	0.873	
	Elementary	11(25.00%)	4(9.10%)	0.071	
	Illiterate	7(15.90%)	6(13.60%)	0.782	

<sup>a</sup> P value using Chi-Square to compare between Obese and Non-Obese cases for each group.

<sup>b</sup> P value using Crosstab Chi-Square to comparison between all groups.

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As regards level of education, middle level was the most encountered in the study group with a percentage of (39.5%) & (43.2%) of obese siblings vs (48.8%) & (45.5%) of non-obese siblings in fathers and mothers respectively. Although, the frequency of obese child (n=11) was almost the triple of non-obese (n=4) for the mothers with elementary education but the difference is statistically insignificant (P-value =0.07).(Table 3)

**Table 4:**  
Correlation of BMI with Birth Order

Parameters	*r	P value
BMI with Order	-0.094	0.382
BMI with No of total siblings	-0.032	0.764

\*r= Correlation Coefficient (Spearman Correlation). P>0.05 is considered not significant.

In table 4, A trial to examine the possible correlations between the adolescents' BMI and their birth order and number of siblings, no statistically significant difference were found between either of them and BMI. This suggests that adolescent's BMI (weight) were driven by neither the sibling was (younger or older) nor number of their siblings.

## Discussion

Obesity is an increasing health problem growing rapidly all over the world and is considered one of the most prevalent hazards to public health as childhood obesity usually track to adulthood and also obesity is linked to subsequent chronic diseases hypertension, cardiovascular and metabolic diseases (*WHO website ,2019*).Prevalence of obesity was 6.0 to 26.6% among males and 4.6 to 17.3% among females according to WHO European Childhood Obesity Monitoring Initiative reports (*Wijnhoven et al.,2013*).Children in the Middle East and Eastern Europe had the highest prevalence of obesity, with adolescents residing in Kuwait and Qatar having a higher rate of overweight and/or obesity(*Bahreynianet al.,2017*).

Obesity is a multi-factorial disorder with different etiological factors, several studies have indicated that obesity in adolescents are linked to family causes including both,genetic and environmental effects, among these environmental factors, parental overweight, dietary habits, and socio-economic status come to be contributed to childhood obesity (*Jiang et al.,2013*).

The mean age of the studied group were  $13.0 \pm 2.61$  years and their mean BMI was  $30.55 \text{ kg/m}^2$  with BMI SDS  $\pm 5.61$ . They were age and sex-matched with 45 non obese children whose mean age was  $12.62 \pm 2.6$  years and mean BMI was  $17.22 \pm 2.71 \text{ kg/m}^2$ .

This study showed that birth order and siblings' number had no effect on adolescents' obesity risk and no impact of parent's education on adolescents' obesity, the results may indicate which family members may be prioritized for inclusion in adolescent obesity prevention programs.

**Relation to sibling birth order and number of siblings:** In this study, there were no statistically significant interactions by sibling birth order suggesting that adolescent's obesity was not driven by whether the sibling was younger or older.

As regards relation of birth order with obesity, there were no significant correlation and these findings are congruent with research that showed no link between obesity and first born children compared to children born in other birth orders, concluding that a higher risk of obesity is explained by the absence of siblings rather than birth order (*Haugaard et al.,2013*). While others studies reported that increased adiposity and overweight is linked with older siblings (*Celi et al., 2003*) others showed that youngest children showed significantly increased ORs for overweight (*Ochiaiet al.,2010*).

In this study no association between adolescents' obesity and number of siblings and this came in accordance with a study that did not find any relation between siblings' number and adolescents' over weight (*Hesketh et al.,2003*) and another one done later which found no significant influence of having siblings on overweight (*Nemecek et al.,2017*).

Although, our findings were not statistically different but results were comparable and this might be explained as an additional child may serve as an extra burden on the family and thus decrease availability of healthy food, resulting in increasing the incidence of obesity particularly in families with low educational level. Another explanation is that the presence of multiple siblings may decrease chance of regularity in sports in terms of abundance of money and time.

It is also known that a a single child 's mother is more interested in persuading her child to eat healthy food and participate in active play and may be an incentive for the mother to increase the time allocated to physical activity rather than a mother with several children These suggestions did not agree with a study that indicated that a larger number of siblings, regardless of each individual sibling's activity level, promotes active long-term lifestyles (*Hallal et al.,2006*).

**Interaction by parental education:** Parent's education level did not appear to be a significant predictor of obesity in adolescents may came to the small sample size. The current study demonstrated that there was no significant association between parental education and the development of obesity, where most of our children whether obese or non-obese had fathers with middle education (39.5%) (48.8%) respectively and had also mothers with middle education (43.2%) (45.5%) respectively, moreover, although, the number of obese children was triple that of non-obese for the mothers with elementary education but the difference is statistically insignificance.

These results came in accordance with a study that did not find significant relationship between parental education level and weight gain, similar results could be seen for the status of maternal educational (*Nemecek et al.,2017*). Studies showing that maternal education had a greater impact on adolescent's obesity than the paternal one as young child actually spend more time with their mothers and that mothers are more involved with their children concerning diet intake and participating in physical activities (*Lamerz et al.,2005*).

A Study reported that parental education was inversely associated with child overweight and others discovered that children whose parents had a low educational level had a higher rate of overweight and/or obesity (*Bahreynian et al.,2017*).

Some studies have found that a higher educational level of the parents can lead to higher incomes and thus increased food availability and consumption in the home. On the contrary it may be related, with improved child care and enhanced nutritional knowledge (*Giugliano and Carneiro ,2004*). In several studies, there was a positive effect of higher education for parents on weight gain in children

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in countries with higher economic status, which is stronger with fathers compared to mothers than low economies, where higher parental education is associated with higher probability that their children are obese.

There are many possible explanations for these differences. First of all, diet practices and healthy food intake lifestyle as reducing both of caloric intake, fat consumption, and regular physical exercise are more in the higher economy (*Muthuri et al.,2016*).

One more explanation is cultural and social norm discrepancies between high and low educational parents as in some developing countries, an obese child is seen as a "healthy child", with adequate rich unhealthy food , these more educated families moving to a higher social environment and have greater access to motorized transportation, engage less in active travel ,coupling these with minimal knowledge about the health risks associated with obesity, along with lack of awareness of the need of keeping a healthy body weight and participating in suitable amounts of physical exercise explain the positive relationship between parental education level and child BMI in low-income nations (*Katzmarzyk and Mason ,2009*)(*Guedes et al., 2011*).

An Iranian study found a relation between maternal high educational level and risk of adolescent's overweight (*Doustmohammadian et al.,2010*).Although, this came in accordance with some developing countries studies (*Xie et al.,2007*) but was different to others in Western European countries where parental education, especially the maternal had a prophylactic effect against children's obesity (*Moreno et al., 2004*).This might be owing to the varying influences of social and economic risk variables in different nations. Family, friends together with all types of media are good influencers on teens, so parental education may influence eating behavior and thus adolescents' obesity(*El-Shaheed et al., 2020*).

### Recommendations

These findings may be useful for researchers working in obesity prevention programs to consider that it is equally useful to involve either younger or older siblings in targeting adolescent's weight related behaviors and it is also the case in involving adolescents with multiple siblings. To reduce the risk of obesity in the following generation and eliminate socioeconomic health inequalities, preventive community and school-based interventions should begin early.

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**Conflicts of interest:** There are no conflicts of interest stated by the authors.

**Limitation of the study:** The limited size of our sample may have prevented us from detecting interaction even if it exists. Another limitation of the study was taking parental education only for correlation with adolescents' obesity rather than taking socioeconomic status as a whole including parental occupation, family income for this correlation. Hence, it is advisable to suggest a study with higher number of cases and including the economic status of the parents

## References

**Bahreynian M, Qorbani M, Khaniabadi BM, Motlagh ME, Safari O, Asayesh H, Kelishadi R. (2017):**

Association between obesity and parental weight status in children and adolescents. Journal of clinical research in pediatric endocrinology; 9(2):111.

**Celi F, Bini V, De Giorgi G, Molinari D, Faraoni F, Di Stefano G, et al. (2003):**

Epidemiology of overweight and obesity among school children and adolescents in three provinces of central Italy, 1993–2001: study of potential influencing variables. Eur J Clin Nutr; 57:1045–1051.

**Chen AY, Escarce JJ . (2010):**

Family structure and childhood obesity, Early Childhood Longitudinal Study - Kindergarten Cohort. Prev Chronic Dis; 7(3): A 50 Declaration of Helsinki available at the link: <https://www.wma.net/wpcontent/uploads/2018/07/DoH-Oct2008.pdf>

**Doustmohammadian A, Abdollahi M, Bondarianzadeh D, Houshiarrad A, and Abtahi M. (2012):**

Parental Determinants of Overweight and Obesity in Iranian Adolescents: A National Study Iranian J Pediatr; 22 (1: 35-42

**El-Shaheed AA, Mahfouz NN, Elabd MA, Sallam SF. (2020):**

Physical activity patterns in Egyptian obese and nonobese adolescents assessed using a validated WHO questionnaire. J Arab Soc Med Res; 15:6-10.

**Giugliano R, Carneiro EC. (2004):**

Factors associated with obesity in school children. *J Pediatr*; 80(1):17-22.

**Guedes DP, Rocha GD, Silva AJ, Carvalhal IM, Coelho EM. (2011):**

Effects of social and environmental determinants on overweight and obesity among Brazilian school children from a developing region. Rev Panam Salud Publica.; 30(4):295–302.

**Hallal PC, Wells JC, Reichert FF, Anselmi, L, Victora CG. (2006):**

Early determinants of physical activity in adolescence: prospective birth cohort study. BMJ; 332:1002–1007. Haugaard LK, Ajslev TA, Zimmermann E, Ångquist L, Sørensen TI. Being an only or last-born child increases later risk of obesity. PLoS One 2013; 8:1–9.

**Hesketh T, Qu JD & Tomkins A. (2003):**

Health effects of family size: cross sectional survey in Chinese adolescents. Arch Dis Child; 88: 467–471.

**Jiang MH, Yang Y, Guo XF, Sun YX. (2013):**

Association between child and adolescent obesity and parental weight status: a cross-sectional study from rural North China. J Int Med Res ; 41:1326- 1332

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**Katzmarzyk PT, Mason C. (2009):**

The physical activity transitions. *J Phys Act Health*; 6(3):269–280.

**Lamerz A, Kuepper-Nybelen J, Wehle C, Bruning N, Trost-Brinkhues G, Brenner H, et al. (2005):**

Social class, parental education, and obesity prevalence in a study of six-year-old children in Germany. *International Journal of Obesity*; 29, 373–380

**Mahfouz NN, Fahmy RF, Nassar MS, Wahba SA. (2018):**

Body weight concern and belief among adolescent Egyptian girls. *Open access Macedonian journal of medical sciences*; 6(3):582.

**Meller FO, Loret de Mola C, Assunção MC, Schäfer AA, Dahly DL, Barros FC. (2018):**

Birth order and number of siblings and their association with overweight and obesity: a systematic review and meta-analysis. *Nutrition reviews*;76(2):117-24.

**Moreno LA, Tomas C, Gonzalez-Gross M, et al. (2004) :**

Microenvironmental and socio-demographic determinants of childhood obesity. *Int J Obes Relat Metab Disord*; 28(Suppl 3):S16-20.

**Muthuri SK, Onywera VO, Tremblay MS, Broyles ST, Chaput J-P, Fogelholm M, et al. (2016):**

Relationships between Parental Education and Overweight with Childhood Overweight and Physical Activity in 9–11-Year-Old Children: Results from a 12- Country Study.; *PLoS ONE* 11(8): e0147746. doi: 10.1371/journal.pone.0147746

**Nemecek D, Sebeľský C, Woditschka A, Voitl P. (2017):**

Overweight in children and its perception by parents: cross-sectional observation in a general pediatric outpatient clinic. *BMC pediatrics*.; 17(1):1-0.

**Ochiai H, Shirasawa T, Ohtsu T, Nishimura R, Morimoto A, Obuchi R, Hoshino H, Tajima N, Kokaze A. (2012):**

Number of siblings, birth order, and childhood overweight: a population-based cross-sectional study in Japan. *BMC public health*;12(1):1-7.

**Reilly JJ, Methven E, McDowell ZC, Hacking B, Alexander D, Stewart L, et al. (2003):**

Health consequences of obesity. *Arch Dis Child*; 88:748–752 WHO growth charts for Canada March 2014 revision, software used: AnthroCalc v1.66 Home. <Who growthcharts.ca> <https://www.dietitians.ca/Dietitians-Views/Prenatal-and-Infant/WHO-Growth-Charts.aspx> WHO website last visited in 27th March 2019 [https://www.who.int/maternal\\_child\\_adolescent/topics/adolescence/development/en](https://www.who.int/maternal_child_adolescent/topics/adolescence/development/en)

**Wijnhoven TMA, Van Raaij JMA, Spinelli A, Rito AI, Hovengen R, Kunesova M, et al. (2013):**

WHO European childhood obesity surveillance initiative 2008: weight, height and body mass index in 6-9-year-old children. *Pediatr Obes*.; 8:79–97.

**Xie B, Chou C, Spruijt-Metz D, Reynolds K, Clark F, Palmer PH, et al. (2007):**

Sociodemographic and economic correlates of overweight status in Chinese adolescents. *Amer J Health Behavior*; 31(4):339-52.

تأثير المستوى التعليمي وترتيب الولادة وعدد الأخوة على السمنة لدى المراهقين

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### الملخص العربى

**مقدمة :** تتزايد معدلات انتشار السمنة لدى المراهقين بشكل ملحوظ خاصة فى البلاد النامية وعلى الرغم من إقتران ترتيب الولادة وعدد الأخوة رياضياً على وزن الشخص ، وتأثير كل منهما على زيادة الوزن والسمنة ، إلا أنهما لم يتم تقديرهما من قبل بشكل منفصل ، علاوة على ذلك ، فقد يكون للمستوى التعليمي للوالدين تأثير على الحالة الغذائية لأطفالهم.

**الهدف :** تم إجراء هذه الدراسة بهدف تقييم مدى تأثير ترتيب الولادة وعدد الأخوة على مخاطر السمنة لدى المراهقين وفحص تأثير المستوى التعليمي وتثقيف الوالدين على السمنة لدى المراهقين ، واستشير النتائج إلى أفراد الأسرة الذين قد يتم منحهم الأولوية لإدراجهم فى برامج الوقاية من السمنة لدى المراهقين .

**طريقة البحث :** تم استخدام استبيان ذاتي الإدارة لجمع البيانات عن الأفراد الذين تتراوح أعمارهم بين 10 و 18 عاماً ، بما فى ذلك الجنس والعمر والوزن عند الولادة وترتيب الميلاد وعدد الأخوة ونمط الحياة والمستوى التعليمي للوالدين من خلال استبيان تم إجراؤه ذاتياً وتم ملؤه بواسطة فرد مبالغ من الأسرة ، بينما أجريت قياسات طول و وزن الأشخاص فى عيادة التغذية والمناعة وتم استخدام النقاط الفاصلة لمؤشر كتلة الجسم فى مركز السيطرة على الأمراض والوقاية منها (CDC) لتصنيف الأشخاص على أنهم عاديون بنسبة (5% - 84%) فى حين سجل البدناء (95%)

**النتائج :** اختلف توزيع عدد الأخوة فى كلا المجموعتين فيما يتعلق بمؤشر كتلة الجسم ولكن مع عدم وجود نتائج ذات دلالة إحصائية ، ولم تظهر نتائج الدراسة إختلافاً ذا دلالة إحصائية فى الارتباط بين ترتيب الميلاد وعدد الأخوة .

**الخلاصة (الاستنتاج):** لم يكن مؤشر كتلة الجسم للمراهقين مدفوعاً بترتيب الولادة ( كونه الأصغر أو الأكبر سناً ) ولا عدد الأخوة . ولم يكن هناك ارتباط كبير بين تعليم الوالدينوإصابة بالسمنة .

**الكلمات المفتاحية :** الأخوة ، ترتيب الولادة ، تربية الوالدين ، المراهقة ، السمنة