

also been reported in Iran [4,5,6,7]. Results of the Comprehensive Study on Household Food Consumption Patterns and Nutritional Status of Iran in 2001-2003 indicated that overweight was prevalent among Iranian adolescents. Prevalence of at risk for overweight and overweight among boys aged 15 to 19 years was 6% and 3.6%, respectively. The related figures for girls were 10.2% and 3.7%, respectively [8]. Prevalence of overweight in high school students was 11.2% in 2004 [9].

Childhood and adolescence obesity seems to be one of the most important factors in the development of chronic diseases in Iran [10]. Overweight and obesity among children and adolescents is a complex health problem with wide-ranging causes including genetic, social, cultural and behavioral factors, all of which may interact [11]. Parental body mass index (BMI) and maternal age at child's birth have been suggested to be the most important family variables associated with children's weight status [12,13]. Despite a tremendous amount of research, there remains controversy about the potential association between some parental determinants, including parental job and education, with adolescents' weight status [11,14]. The information on this relationship is important for the identification of the contributors to weight status in adolescence, which could be applied in designing relevant intervention programs that will address the needs of different groups of the community. The aim of this study was therefore to investigate the parental determinants of overweight and obesity in Iranian adolescents at national level.

Subjects and Methods

Study design and population

This cross sectional study was conducted within the framework of the Comprehensive Study of Household Food Consumption Patterns and Nutritional Status of I.R. Iran during 2001-2003. Households were selected by cluster systematic sampling in urban and rural areas. Among the 7158 participating households (including 35924

individuals), data on 7908 adolescents aged 11-19 years (3750 girls and 4158 boys) was analyzed.

Anthropometric measurements

Height was measured without shoes and to the nearest 0.1 cm and weight was measured in light clothes to the nearest 100 g on a digital Seca scale. The scale was calibrated before the examination. Each of these measurements was performed by at least 2 nutritionists, one of them took the measurements and the other one recorded the readings. The mean of two measurements was recorded. BMI was calculated as weight in kilograms divided by height in meters squared [15]. BMI cut-off points provided by the Centers for Disease Control and Prevention (CDC) [16] were used for classification of the adolescents to underweight (<5th percentile), normal (5-84th percentile), at risk of overweight (85-94th percentile) and overweight (\geq 95th percentile). For the purpose of simplicity, the CDC's 85-94th percentile is referred to as overweight and the \geq 95th percentile is referred to as obesity in this paper. Parents' weight status was defined according to BMI. Obesity was defined as BMI \geq 30, overweight as $25 \leq$ BMI < 30, normal weight as $20 <$ BMI < 25 and underweight as BMI < 20, respectively [17].

Parental characteristics

Socio-demographic data was collected by interviewing an adult member of the family (in most cases the mother). Age was recorded as date of birth. Age of children and parents was calculated by subtracting date of birth from the interview date. Mother's age at the child's birth was calculated by subtracting mother's age from adolescent's age. Parental age and mother's age at child birth were categorized into quartiles. Fathers' job was categorized to laborer, farmer, driver/shopkeeper, self-employed, public employee/teacher/military and others. Mothers were classified as housewives or employed. The educational level of parents was classified into 4 groups: illiterate, elementary, high school and tertiary.

Data analysis

Epi info 2002 (Ver 1.1.2; Centers for Disease Control and Prevention, Atlanta, Georgia) was used to calculate the BMI percentiles. Data entry

and statistical analysis was performed using MS Access and SPSS11.5 (SPSS Inc., Chicago, IL).

Gender characteristics were compared using Student's t-test. The Chi-square test was used to assess the association between categorical variables and to compare the weight status between boys and girls. A binary logistic regression analysis was performed to identify independent risk factors of overweight or obesity. Analyses regarding overweight and obesity were performed separately for adolescents. The weight status of the adolescents (normal weight-overweight and normal weight-obese, respectively) was used as dependent variable; sex and all parental factors (parental age, mother's age at child's birth, parental weight status, parental job and parental education) were put into the model as independent variables. The first' category was used as reference in each variable. Level of significance was set at 0.05.

Findings

Population demographic

Data on 7908 adolescents, 11-19 years old (3750 girls and 4158 boys) in 7158 participating households was included in the analysis. The mean age of adolescents was 15.2±2.5 years. A large number of fathers were laborers (23.2%) or drivers and shopkeepers (23.6%) and the majority of mothers were housewives (88%). While more than one third (37.2%) of fathers did have a high school degree, nearly half of mothers (44.2%) were illiterate.

Weight status of adolescents

Table 1 shows that boys were significantly heavier and taller than girls. The prevalence of

overweight in boys and girls was 6.2%, and 8.7%, respectively. The prevalence of obesity among boys and girls was similar (3.3%) (Fig. 1).

Parental factors

Table 2 demonstrates parental factors of adolescents based on weight status. Parental weight status, parental education and father's job showed significant associations with weight status in adolescents ($P<0.001$). The prevalence of overweight and obesity was significantly higher in adolescents who had parents with a higher BMI ($P<0.001$). Obesity among adolescents whose fathers were drivers or shopkeepers was 1.9 times more prevalent than those whose fathers were farmers (4.2% vs 2.2%). Higher literacy of parents was associated with overweight and obesity in adolescents. No association was observed between parental age, mother's age at child's birth, and mother's job and the weight status of adolescents.

Identification of independent risk factors

To determine which factors have the strongest influence on the development of overweight and obesity in adolescents, binary logistic regression analyses were performed. Tables 3 and 4 show the significant variables identified in the logistic regression analyses. Parental overweight and obesity, parental education and father's job seem to be the major parental determinants for developing overweight and obesity in adolescents.

Discussion

To investigate the underlying causes of adolescents' obesity at a national level more systematically, this report provides a first attempt

Table 1: Anthropometric characteristics of Iranian adolescents by sex group

Variable	Boys (N=3750)		Girls (N=4158)		Total (N=7908)	
	Mean	SD	Mean	SD	Mean	SD
Age (years)	15.1	2.4	15.3	2.5	15.2	2.5
Weight (kg) ^a	50.6	14.5	48.7	11.6	49.6	13.0
Height (m) ^a	160.0	14.2	154.2	8.9	157	12.0
BMI (Kg/m ²) ^a	19.4	3.5	20.3	3.8	19.8	3.7

^a Significant differences between boys and girls (T-test, $P<0.001$).

Table 3: Logistic regression analysis of parental status and overweight adolescents

Variable		Odds Ratio ^b	95% Confidence Interval	P value
Sex	Boys	1		-
	Girls	1.3	1.1-1.6	0.001
Parents' overweight	None	1		-
	Only mother	2.1	1.5-2.9	<0.001
	Only father	1.6	1.3-2.1	<0.001
	Both	2.4	1.6-3.6	<0.001
Parents' obesity	None	1		-
	Only mother	3.2	2.4-4.4	<0.001
	Only father	1.7	1.1-2.6	0.01
	Both	7.5	5-11.2	<0.001
Mother's education	Illiterate ^a	1		-
	Elementary	1.1	0.8-1.4	0.3
	High school	1.1	0.8-1.5	0.2
	Tertiary	1.6	1.0-2.4	0.01

^a The first category is reference

^b Only variables with significant ORs are shown. Variables entered into the model: sex, parental age, mother's age at child birth, parental overweight and obesity, parental job and parental education

association between parents' educational level and weight status of the adolescents (Table 2). Interestingly, overweight and obesity in adolescents was only associated with parents having tertiary education (OR:1.6, P=0.01). Many studies have shown that the educational

achievement of parents, both fathers and mothers, is associated with their children's nutritional status [2,24]. Higher educational level of parents, in one hand, could lead to a higher income and consequently a higher availability and intake of food at the household level [1,25]. On the

Table 4: Logistic regression analysis of parental status and obese adolescents

Variable		Odds Ratio ^b	95% Confidence Interval	P value
Parent's overweight	None	1		-
	Only mother	2.1	1.2-3.5	0.005
	Only father	1.8	1.2-2.7	0.001
	Both	3.1	1.7-5.5	<0.001
Parent's obesity	None	1		-
	Only mother	3.4	2.1-5.4	<0.001
	Only father	3.0	1.7-5.4	<0.001
	Both	15.1	8.7-26.2	<0.001
Father's education	Illiterate ^a	1		-
	Elementary	1.0	0.6-1.7	0.8
	High school	1.1	0.7-1.7	0.5
	Tertiary	1.9	1.0-3.5	0.02
Mother's education	Illiterate ^a	1		-
	Elementary	1.0	0.6-1.5	0.9
	High school	1.3	0.8-2.0	0.1
	Tertiary	1.8	1.0-3.2	0.02
Father's job	Laborer	1		-
	Farmer	0.5	0.3-0.8	0.01
	Driver and shopkeeper	0.7	0.5-1.1	0.1
	Self employee	0.5	0.3-0.9	0.02
	Public employee	0.4	0.2-0.6	<0.001
	Others	0.4	0.09-1.7	0.2

^a The first category is reference

^b Only variables with significant ORs are shown. Variables entered into the model: sex, parental age, mother's age at child birth, parental overweight and obesity, parental job and parental education

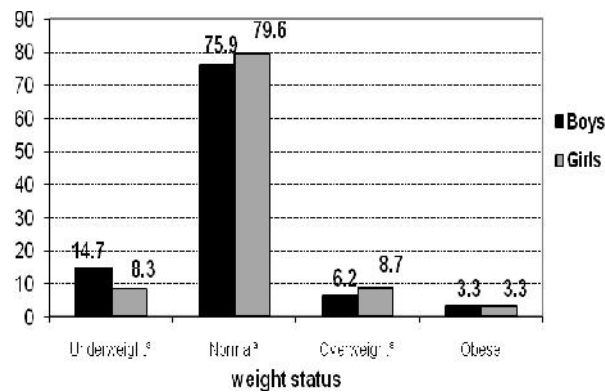


Fig. 1: Weight status of Iranian adolescents by sex
^aSignificant differences between boys and girls ($P < 0.001$)

other hand, it might be positively associated with higher nutritional awareness as well as better caring of children [26]. It is important to note that most (60-80%, data not shown) of the highly educated parents in the present study were overweight or obese. We found the same association between the high level of mother's education and risk for becoming overweight in adolescents as reported by another study [27]. Also, this finding was consistent with other studies from developing countries [2,28,29]. The results of our study were, however, different to other studies showing that parental education, especially maternal education, had a protective effect against overweight in children [30,31]. This may be due to different patterns of socio-economic risk factors' effects in Iran compared to those described in the Western European countries. Other Iranian studies demonstrated mixed results, both contradicting and supporting the findings of current study [8,32,33]. The results of these studies, however, should be cautiously compared to our findings, since the sample size and age range of participants in these works were more limited than those in the current national, data-based research.

As observed in other studies we found a significant association between father's job and adolescents' weight status [27,34]. Odds of Obesity among adolescents whose fathers were farmers was lower than those whose fathers were laborers. This suggests that adolescents in these families may be more involved in and helping with labor-intensive jobs running in their family. This finding is in accordance with a previous study

suggesting that differences in family lifestyle due to parental occupation type may be related to weight status among adolescents [34]. Also, the results of logistic regression analysis showed that odds of adolescents becoming overweight decreases with fathers being self-employed and public employee, teacher or military (white collars) compared with fathers being laborer (blue collar). In Iran, careers of this type generally have higher earnings compared with laborers. Findings of another study among Iranian households demonstrated that in higher socio-economic groups, consumption of bread and cereals as well as sugar and sweets decreased and consumption of meat, fruit and vegetables increased significantly [35]. While this dietary pattern is regarded as beneficial to optimum body weight, we were not able to determine the intra-household food allocation by the methodology used to collect the data. In a study in central Iran, it was shown that BMI > 85th was more prevalent among adolescents in families with an average income compared with high income families [36]. This could be explained by the assumption that father's job is a major determinant of household income and can therefore affect household food intake.

Generally, females have a higher prevalence of overweight than males and it has been suggested that this may be related to gender differences in the brain's response to hunger and satiety [37]. In Iran boys are reported to be more physically active than girls [36]. Cultural constraints on girls imply that they spend more time indoors and thus have easier access to food. This agree with the

results of a previous study [38]. It should be noted that this findings imply to the situation in years 2001-2003, while social status has dramatically changed since then. This change is considerable and its consequences as pertained to food intake need to be investigated in future research.

This study found no association between mother's job and adolescents' weight status, similar to the findings reported by another study [18]. This could be explained by the assumption that most of the mothers were housewives. However, the role of employed mothers, who have an external job, is very much the same as housewives in terms of provision of food and care to their children. As observed in other studies [39,40], mother's age at child birth and parental age did not show any association with adolescents' weight status in the present study.

The authors acknowledge that there have been some limitations affecting the findings of this study. Due to the cross-sectional nature of the study, it is difficult to say whether the differences in determinants precede or follow changes in body weight. Therefore, prospective studies (with long-term follow-up) are needed to analyze data of 'incident' children, i.e. children who become overweight or obese during the course of the study. It is also tempting to speculate the genetic factors that can add to the remaining variance.

Conclusion

Parental overweight and obesity, parental education and father's job seem to be the major determinants of overweight in Iranian adolescents. Knowing that it is easier to prevent obesity, rather than to cure it, future prevention programs must take into account these risk factors.

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Conflict of Interest: None

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