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Body mass index in children and its relation with socio-economic factors in West-Azerbaijan, Iran

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Original Article

Abstract

BACKGROUND: By the epidemiological transition, most of the developing countries still have malnutrition problem as well as different levels of obesity and overweight as most important risk factors of non-communicable and chronic diseases. Body mass index (BMI) is a suitable index for studying them. Thus, the aim of this study was to investigate the relationship between children's BMI and household socioeconomic status in West-Azerbaijan province, Iran, in 2015.

METHODS: This cross-sectional study was conducted on 1024 children aged 6-7 years who were assessed in Sanjesh Plan conducted by Organization of Exceptional Education and Training. To determine BMI, world health organization (WHO) Growth Reference (2007) was used. Then, to estimate the risk factors affecting BMI, chi-square test and categorical (multinomial) logistic regression were used.

RESULTS: The results showed that obesity, overweight, and thinness were 2.5%, 12.7%, 5.2% in girls, and 4.4%, 12.3%, and 1.8% in boys, respectively, which were statistically significant. Of all the variables studied, insurance, occupation and education level of parents, birth order, and number of household members were not statistically significant. The rest of indicators such as gender, location of residence (city or village), ethnicity, and development degree were statistically significant.

CONCLUSION: Since analysis showed that BMI had relation with development degree and location of residence, it can be said that West-Azerbaijan is at the median of transition. Therefore, health policy makers should pay enough attention to prevention of obesity and overweight as well as elimination of thinness and malnutrition.

KEYWORDS: Body Mass Index, Overweight, Thinness, Socioeconomic Status, Preschool Children

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Introduction

Nowadays, with the epidemiological transition, the world is experiencing chronic and non-communicable diseases. Overweight and obesity have been considered as major risk factors for cardiovascular disease (CVD), some cancers, and diabetes in recent decades. Industrialization and urbanization have changed the lifestyle and affected the risk factors.[1]

Developing countries are at different levels of epidemiological transition based on the performance of their health systems. Most of them still have the problem of malnutrition because of unequal distribution of income, low education or cultural problems. On the other hand, these countries are facing the levels of

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overweight and obesity simultaneously; moreover, the burden of overweight and obesity now is changing its direction toward poor people.[2] Overweight is not limited only to adults, and is also an emerging health problem in children even in developing countries.[3]

Iran, as a country in the Middle East and North Africa (MENA) region, has a high prevalence of obesity and related diseases such as metabolic syndrome and diabetes in different age groups.[4-6] Body mass index (BMI) as an indicator of health is a good indicator to classify obesity, overweight, and thinness. There are special courses for the growth of overweight and obesity including prenatal, ages of 5-7 years, and adolescents.[7] Obesity and overweight in this period have been considered as one of the risk factors for non-communicable diseases in adulthood. Obesity in childhood compared with adult obesity has more adverse effects due to longer exposure;[8] so, the study of this indicator in childhood can be one of the needs of each community.

Given the contradictions that exist in research results from different countries and the importance of public health and the key role of prevention in promoting it, and also for reducing healthcare costs and considering the effect of different socio-economic status on BMI, it is essential to identify risk factors to prevent obesity epidemic in the country and to have healthy population. Since many factors are involved in obesity and overweight, accurate identification of effective factors can provide very bright prospects of the nature of this phenomenon for the health policymakers, health officials and planners, and all those working in the healthcare field.

According to the literature review done, no study assessed the BMI based on data of the Health Assessment Plan (Sanjesh Plan) and also on pre-school children in West-Azerbaijan province, Iran. Therefore, the aim of this study was to investigate the relation between children's BMI and socio-economic status of their households and other factors among all pre-school children born in 2008-2009 who were assessed in the Health Assessment Plan (Sanjesh Plan) in West-Azerbaijan province in summer of 2015.

Materials and Methods

The study design was cross-sectional and it was a part of Health Assessment Plan of pre-school children (6-7 years old) in West-Azerbaijan province. Plan is done every year by the Organization of Exceptional Education of Iran. The reference population of the study included all children who had participated in the Plan. The number of province cities was 17 that both rural and urban areas were considered. The sample size was determined using Cochran formula, so to raise the power of the study, it was multiplied by 1.5 then using proportional sampling and considering the number of all children participated in the Plan in each city, the number of sample (600) was divided into proportions; since one city had very small proportion and its sample size was only 5, 25 persons were added to the sample size of each city to be sure that each city had at least 30 individuals, so that parameters could be estimated more accurate; therefore, final sample size was estimated as 1024 persons. Data were provided for the study in Excel file that had been collected during 2015 summer. Individuals were selected from the file by random number generation method using Microsoft Excel software (version 2007) for each city separately. BMI was calculated as weight in kilograms divided by the square of height in meters; weight and height of children were measured by scale and meter accurately, then the classification of BMI for each child was determined by standard cut-offs of World Health Organization (WHO) Growth Reference (2007). Other data included gender, location of residence (city or village), education and occupation of parents separately, having basic and supplementary

insurance, city of residence, number of household members, and birth order were asked from parents, all data were entered in electronic system. Development degree was extracted from article that determined this factor.[9] BMI based on WHO Growth Reference (2007) included 5 categories as sever thinness, thinness, normal, overweight, obese (http://www.who.int/growthref/en/).

Number of household members and birth order were categorized based on the frequency of quartiles; thus, first quartile was considered as first category, second quartile as second category, third quartile as third category, and fourth quartile as fourth category, so that frequency of data in each category was almost equal and analysis was done more accurately. The majority of ethnicity of province cities was Kurd and Turk, so ethnicity was classified in 3 categories included Kurd cities, Turk cities, and mixed cities (Turk and Kurd together).

Chi-square test was applied to analyze differences between proportions of variables' categories and BMI categories. Variables that their reported probability values (P-values) were lower than 0.05 were selected as significant. Among 12 variables, 6 variables included having basic and supplemental insurance, occupation and education of fathers, occupation of mothers, and birth order were not statistically significant. Statistically meaningless variables were excluded step by step. Estimates of association of BMI with significant variables including gender, education of mothers, number of household members, location of residence (city or village), ethnicity of each city, and development degree of city were performed by calculating the odds ratios (ORs) in logistic regression tests for categorical outcomes (multinomial) and the corresponding 95% confidence interval (CI) in two levels. First, the variables one by one and then all significant variables including gender, location, ethnicity, development degree altogether were entered in regression with fixing effect of each other. P-values were based on two-sided tests, the established statistically significant level was 5%, and the likelihood test was used to assess significance. SPSS software (version 16, SPSS Inc., Chicago, IL, USA) was used for all analyses.

Results

The distribution of all 1024 pre-school children by gender was 545 (53.2%) boys and 479 (46.8%) girls. The number of children living in the urban area was 811 (79.2%) and in the rural area was 213 persons (20.8%). 91.41% of children had basic insurance and only 12.3% of children had supplemental insurance. Percentage of households with 1-3, 4, 5, and 6-13 members were 25.00, 46.00, 18.36, and 10.64, respectively. This province has 17 cities whose ethnicities are Kurd and Turk, and some cities have Kurd and Turk together. Number of cities that had Kurdish people was 5, 7 cities had Turk, and 5 cities had Kurd and Turk together. Cities, based on development degree, had 3 categories as 18.94% developed, 15.04% semi developed, and 66.02% undeveloped. The results showed that percentage of children that had obesity, overweight, thinness, and sever thinness were 3.5, 12.5, 3.0, 0.4, respectively, and other children (80.6%) were normal; therefore, overweight and obesity were more than thinness and sever thinness in this province.

Among 12 variables that their relationship with BMI was assessed using chi-square test, 6 variables including education and occupation of fathers, occupation of mothers, having basic and supplemental insurance, and birth order were not statistically significant. Results showed that obesity, overweight, and thinness (with sever thinness) in girls were 2.5%, 12.7%, and 5.2%, respectively, and in boys 4.4%, 12.3%, and 1.8%, respectively. These differences between girls and boys were statistically significance (Table 1).

Then 6 statistically significant variables from chi-square test were analyzed one by one using multinomial logistic regression. In this step, 2 variables including education level of mothers and number of household members were not statistically significant.

Table 1. Results of chi-square test for association between the categorical variable of body mass index (BMI) and independent variables

Other variables \ Category of BMI	Thinness [n (%)]	Overweight [n (%)]	Obese [n (%)]	Chi-square	df	P
Gender						
Boy	10 (1.80)	67 (12.30)	24 (4.40)			
Girl	25 (5.20)	61 (12.70)	12 (2.50)	11.31	3	0.010
Location						
Village	11 (5.20)	42 (19.70)	4 (1.90)			
City	24 (3.00)	86 (10.60)	32 (3.90)	17.45	9	0.001
Education level of mothers						
Illiterate/elementary	20 (3.80)	79 (15.00)	12 (2.30)			
Middle school	7 (3.70)	18 (9.50)	6 (3.20)			
High school/diploma	4 (1.70)	26 (11.14)	10 (4.40)			
Academic	4 (5.30)	4 (5.30)	7 (9.30)	21.06	9	0.012
Education level of fathers						
Illiterate/elementary	21 (5.20)	53 (13.10)	10 (2.50)			
Middle school	8 (3.10)	34 (13.00)	8 (3.10)			
High school/diploma	3 (1.30)	31 (13.80)	11 (4.90)			
Academic	3 (2.30)	10 (7.60)	7 (5.30)	14.27	9	0.113
Occupation of mothers						
Employed	4 (5.80)	7 (10.10)	5 (7.20)			
Unemployed	31 (3.20)	121 (12.70)	31 (3.20)	4.61	3	0.203
Occupation of fathers						
Employed	18 (2.50)	86 (12.00)	28 (3.90)			
Unemployed	11 (5.50)	32 (15.90)	3 (1.50)			
Unknown	6 (5.70)	10 (9.40)	5 (4.70)	12.07	6	0.060
Having basic insurance						
Social security	6 (2.20)	37 (13.60)	10 (3.70)			
Iran health	8 (4.20)	28 (14.70)	9 (4.70)			
Other insurances	17 (3.60)	54 (11.40)	13 (2.80)			
Without insurance	4 (4.50)	9 (10.20)	4 (4.50)	5.77	3	0.123
Having supplementary insurance						
Yes	2 (1.60)	12 (9.50)	8 (6.30)			
No	33 (3.70)	116 (12.90)	28 (3.10)	5.77	3	0.122
Number of household members						
1-3	7 (2.70)	23 (9.00)	15 (5.90)			
4	21 (4.50)	59 (12.50)	16 (3.40)			
5	3 (1.60)	26 (13.80)	5 (2.70)			
6-13	4 (3.70)	20 (18.30)	0 (0)	18.00	9	0.035
Birth order						
First	17 (3.60)	58 (12.20)	17 (3.60)			
Second	13 (3.80)	44 (12.80)	15 (4.30)			
Third	4 (3.10)	15 (11.50)	4 (3.10)			
Fourth-tenth	35 (3.40)	11 (15.30)	0 (0)	5.16	9	0.820
Ethnicity of each city						
Kurd	7 (2.40)	25 (8.70)	11 (3.80)			
Turk	17 (4.60)	15 (4.10)	10 (2.70)			
Kurd and Turk	11 (3.00)	88 (23.80)	15 (4.10)	75.49	6	< 0.001
Development degree						
Developed	1 (0.50)	83 (42.80)	0 (0)			
Semi-developed	6 (3.90)	7 (4.50)	6 (3.90)			
Undeveloped	28 (4.10)	38 (5.60)	30 (4.40)	207.10	6	< 0.001
Total	35 (3.40)	128 (12.50)	36 (3.50)			

BMI: Body mass index; df: Degree of freedom

Table 2. Results of multinomial logistic regression for the association between 3 categories of body mass index (BMI) and all 4 independent variables together

Category of thinness and sever thinness	OR	AOR	P	95% CI
Gender				
Boy	0.34	0.32	0.004	0.15-0.69
Location				
Village	1.96	2.26	0.037	1.05-4.87
Development degree				
Developed	0.18	0.09	0.028	0.01-0.77
Semi-developed	0.92	0.91	0.868	0.32-2.59
Category of overweight/obesity based on BMI				
Ethnicity				
Kurd	0.36	1.07	0.799	0.60-1.93
Turk	0.19	0.45	0.040	0.21-0.96
Development degree				
Developed	6.43	5.40	< 0.001	3.10-9.43
Semi-developed	0.82	1.54	0.295	0.68-3.50

BMI: Body mass index; OR: Odds ratio; AOR: Adjusted odds ratio; CI: Confidence interval

Then, other 4 variables that were significant including gender, location of residence (city or village), ethnicity, and development degree of cities were altogether assessed in the multinomial logistic regression with fixing effect of each other, that the results have been provided in table 2.

Finally, using multinomial logistic regression, thinness in boys was approximately 3 folds lower than girls (95% CI = 0.15-0.69). In rural areas, thinness was 2 folds more than city areas (95% CI = 1.05-4.87). And in developed cities, thinness was 11 folds lower than undeveloped cities (95% CI = 0.01-0.77).

Based on ethnicity, Turkish cities had obesity and overweight 2 folds lower than mixed cities (Turk and Kurd) (95% CI =0.21-0.96). Based on development degree, obesity and overweight were 5 folds more in developed cities than undeveloped cities (95% CI =3.10-9.43).

Discussion

In this study, overweight and obesity were more than thinness and severe thinness, that this result is consistent with results of other studies at the same age such as Danielzik et al.[10] and Mendez et al.[11] studies. Kelishadi et al. also showed that thinness was lower than overweight and obesity, they assessed BMI rates at the national level at ages of 6-18 years in 2007, and found that percentage of obesity in 6-year-old children was 4.87% and overweight was 9.99%,[12] that its comparison with the present study reveals a lower obesity and a higher percentage of overweight in this province compared to the national level.

In our study, thinness in boys was lower than girls that is consistent with the study of Jazayeri in Tehran, Iran, that revealed that the percentage of obesity and overweight of 6-year-old boys was higher than girls at the same age.[13] On the contrary, Mendez et al. study in Mexico showed that more proportion of girls were obese,[11] and also Gerdin et al. study on Swedish children showed that at the age of 7, girls were more obese or overweight than boys,[14] which presents that the obesity based on gender is different between different geographic locations which is likely due to different cultures and geographic conditions.

In this study, thinness in rural areas was higher than the urban areas, which is consistent with Mei et al. study.[15] It was showed that overweight rate in urban areas was higher than the rural areas, which can be due to more evident changes in the urban lifestyle toward using fast foods and also decreased physical activity of children in the

urban areas.

The education level of parents was obtained as a significant and important variable in many studies such as Lamerz et al. study.[16] However, in this study parents education was not significant. In comparison to Lamerz et al. study, the insignificance of these variables may be due to the difference in the percentage of parents' education level in various studies. Percentage of the education level of Lamerz et al. study and the present study shows that almost 50% of German parents and about only 10 percent of West-Azerbaijan parents are university-educated. It can be said that only the level of university education, not any educational levels of parents, can be effective on the BMI, so this variable is not statistically significant in this study; because in our study the majority of parents' education level is lower than the university level, while in Lamerz et al. study the majority of parents had the university degree, so in Lamerz et al. study parents' education level had a relationship with BMI of children.[16]

About job of parents, there was no significant relationship between fathers and mothers occupation with BMI of their children, that the results are consistent with Lamerz et al.[16] study.

This study showed that ethnicity can be effective on BMI. This result is consistent with Mirmohammadi et al. study[17] that showed that BMI in Turk boys was higher than other ethnicities, but Mendez et al.[11] study did not show any relation between BMI and ethnicity.

In Karimi and Ghorbani study on 6-12 years old children in Semnan province, Iran, which has the highest development degree between all provinces of Iran, percent of obesity and overweight was 8.3% and 11.1%, respectively.[18] Compared to West-Azerbaijan province that has the lowest development degree among other provinces, obesity is higher and overweight is lower than the present study, so that it can be a confirmation for economic development effect on BMI; therefore, it can be said that by developing and industrialization, West-Azerbaijan will face more obesity and overweight.

About development degree of cities, the number of obese and overweight children in developed cities was higher and thinness (with sever thinness) was lower than undeveloped cities, that is consistent with the WHO statement according to which, overweight and obesity are risk factors whose prevalence has been confirmed in developing countries that are involved in socio-economic transition.[19] Salehiniya et al. study on children under 5 in Tehran also showed that obesity in the north of Tehran was more than the south, that reflects the impact of development on obesity.[20] Gontarev et al. study showed a significant relationship between socio-economic status and BMI in boys and girls.[21] Moreover, Popkin and Gordon-Larsen showed that nutrition transition had 5 stages and was in close relation with the demographic and epidemiological transition, so urbanization, economic growth, technological changes of work and food production, and massive growth of information are important in stages of nutrition transition.[2]

Overall, among 12 variables studied, finally 4 variables showed statistically significant relationship with BMI of children. At the end, using multinomial logistic regression, it was shown that thinness was less in boys. On the contrary, thinness was more in a rural area and obesity (and overweight) was more in those who live in cities with higher development degree.

Conclusion

We studied the BMI status in West-Azerbaijan and its relation with 12 variables. According to the results, obesity and overweight have significant relationship with development degree of each city, so considering the consistency of this issue with global transition, by developing economic situation of our

country in the future years, we will face more overweight and obesity and consequently non-communicable diseases associated with them. Therefore, the health policy makers should be aware of this province situation and pay attention to it for prevention and decreasing them.

Risk factors trend in West-Azerbaijan is consistent with the patterns that have been seen in other countries, as in developed countries first rich households and then the poor faced obesity and overweight. This presents an opportunity to intervene and prevent the onset of social inequalities that are likely to ensue by further economic development. The marked gender inequality in BMI needs further exploration. In rural areas, there is a serious need of planning for underweight girls. Given that almost 20 percent of children had abnormal BMI, so in the case of generalizing to the population, in fact, from 54700 first-grade students in this province in 2015 almost 10000 ones had abnormal BMI. This requires the attention of planners of health field for prevention of non-communicable and other diseases related with these risk factors.

Study strengths: -Using data of the Health Assessment Plan for the first time in West-Azerbaijan, so that this study can be performed every year because the Plan will be performed every year. Thus, the trend of BMI in this province and in all of Iran can be studied.

- Assessing the BMI and its relation to other factors for the first time in the province on both genders

Study weak points: Using ethnicity of each city instead of ethnicity of each child because of lack of data on the Plan.

Conflict of Interests

Authors have no conflict of interests.

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