RISK SCORING SYSTEM FOR PREDICTION OF ABDOMINAL OBESITY IN A NATIONAL SAMPLE OF YOUTHS: CASPIAN STUDY

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Abstract

BACKGROUND: Abdominal obesity is a predictor for many cardio-metabolic disorders in different age groups. The use of available information on factors associated with abdominal obesity has been proposed as an effective way of identifying at-risk individuals. This study aimed to assess the effectiveness of a risk scoring system for abdominal obesity in a large and representative population of youths.

METHODS: Waist-to-height ratio (WHtR) is an effective surrogate measure of abdominal obesity in children. This analysis was performed to find out the normal cut off value for WHtR by calculating the risk score.To develop a risk score to identify high-risk individuals for abdominal obesity, we analyzed data from a national survey, entitled CASPIAN Study, that was conducted on a nationally - representative sample of Iranian students aged 6-18 years. The risk equation was determined by a multiple logistic regression analysis, and Receiver Operator Characteristics (ROC) analysis was used to determine the cut-off value for the risk equation.

RESULTS: The independent risk factors associated with abdominal obesity were living in rural area, attending public school, positive family history of diabetes and obesity in first and second degree relatives, lower mother's education level, number of household members; whereas physical activity decreased this risk. The area under curve (AUC) for the ROC was 63% (95% CI: 0.612, 0.643).A CASPIAN study population value ≥ 39 had optimum sensitivity (64%) and specificity (54%) for determining abdominal obesity score.

CONCLUSION: This method can be helpful in screening and prevention of abdominal obesity by identifying those at-risk individuals in a timely manner.

Keywords: Risk Score; abdominal obesity; prediction; children.

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Introduction

The global increase in overweight and obesity at a young age has alarming prospects in both developed[1] and developing countries.[2] Interest in childhood precursors to childhood obesity, is increasing because it has long-term association with the risk of chronic diseases notably cardiovascular diseases and diabetes.[3,4] Furthermore it has emerged as an important predictor for short and long-term metabolic complications and adverse health hazards.[1,5,6]

It is well documented that among adults, abdominal obesity is a better predictor than generalized obesity for the risk of cardio metabolic disorders and chronic diseases. Furthermore, abdominal obesity is a critical component of the clinical practice and epidemiological studies criteria for the definition and diagnosis of metabolic syndrome in adults and has been used to define the metabolic syndrome in adolescents, as well.[7]

In adults, the waist circumference (WC) correlates well with intra-abdominal fat mass and has proved to be an independent risk for obesity-related diseases.[8,9]

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It is known as a useful anthropometric measure for abdominal obesity in children as in adults.[10] Although in adults, different WC cut-off values are suggested for different populations,[11] no international standards exist for children, and the cut-off values generally differ from population to population. Hence it is suggested that waist-to-height ratio (WHtR) can be used as a simple index to identify children with abdominal obesity in large epidemiologic studies and mass screenings.[12]

A complex interaction of genetic, environmental, and behavioral factors is known as the underlying cause of childhood obesity.[13] Experience is limited about the influence of environmental factors on abdominal obesity in early life, and major effort is needed to better understand the factors associated with this complex disorder in the pediatric population. This study was conducted to investigate the association of some socio-demographic and lifestyle factors with WHtR, as a measure of abdominal obesity in a large national representative sample of children for the first time in a non-western population**,** Our other objective was to develop and test the validity of abdominal obesity risk score in an Iranian population of youth

Materials and Methods

The full methodological details of this study have been published previously.[14] Briefly, this national study entitled "Childhood Adolescences Surveillance and Prevention of Adult Non-communicable Diseases (CASPIAN) study "was conducted in 2003-2004 on a nationally-representative sample of Iranian school students, aged 6-18 years.

We studied the association of socio-demographic factors such as sex, age, residence area (rural/urban), school type (private/public), family history of diabetes, obesity, hypertension and hyperlipidemia, parental education level and job type, the number of household members, as well as lifestyle behaviors such as physical activity and the frequency of consumption of different food groups with abdominal obesity. A WHtR cut-off of 0.5 was used to define high risk of waist circumference for participants of both genders.[12,15] Independent risk factors associated with abdominal obesity and the risk equation were determined by stepwise multiple logistic regression analysis. A risk score was developed from above factors. The variables of interest have been treated in two ways. First, their distribution has been divided within each area, separately and results have been presented as the odds of abdominal obesity in each group and 95% confidence interval (CIs) for these relative odds have been estimated from the logistic regression analysis. Second, the results are presented as logistic regression coefficients and significance levels. Coefficients of the models were used to assign a score value for each variables.

Optimal cut-point for the risk score (the point with the highest sensitivity and lowest false-positive rate) was depicted by the ROC analysis. Statistical analyses were conducted by using the software package SPSS version 13.0 for Windows (SPSS, Inc., Chicago, IL), and $P < 0.05$ was considered as significant.

Results

The mean age of participants was 12.2 $\pm$ 3.3 years. Of the participants, 15% were from rural and 85% from urban areas, 90% studied in public schools and 10% in private schools. The results showed that 54% of mothers had a primary and lower level education, 21% had an intermediate school education, 20% had a high school education, and 5% had a university degree. The mean WHtR value was 0.43 $\pm$ 0.06 (range = 0.14-0.87).

Overall, 10% of the study population had abdominal obesity. The results of logistic regression for the factors in the study are shown in Table 1. The score for each significant variable varied for zero to hundred and the total abdominal obesity risk score was calculated as the sum of these scores. Sensitivity and specificity for detecting undiagnosed abdominal obesity were calculated for different cut of points. As presented in Figure 1, the area under curve (AUC) for the ROC was 63% (95% CI: 0.612, 0.643). A CASPIAN clinical subject value $\geq$ 39 had optimum sensitivity and specificity, 64% and 54% respectively. Table 2 shows the different cut-off point for clinical subjects.

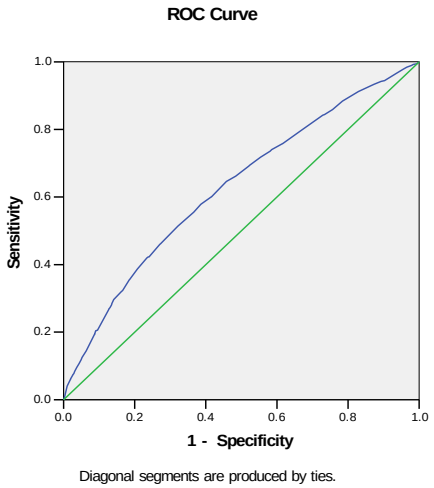

Fig 1. ROC curve of Risk score for undiagnosed abdominal obesity from CASPIAN study
The area under curve was 63% (95% CI 0.612-0.643). The cut of point abdominal obesity risk score≥ 39, Sensitivity was 64% and specificity 54%.

Table 1. Logistic regression models with abdominal obesity as dependent variable

variables	B	S.E	P-value	OR (95% C.I)	Score
Physical activity (< 28.45)	-0.160	0.080	0.047	0.852 (0.728, 1.830)	6
Household (Ref ≥ 8)					
5-7	0.216	0.087	0.014	1.241(0.846, 1.472)	8
≥ 4	0.062	0.143	0.664	1.064 (0.418, 1.410)	2
Mother education (Ref = 5-7)					
4	0.222	0.114	0.051	1.249 (0.999, 2.362)	25
3	0.281	0.122	0.021	1.325 (1.043, 1.684)	10
1-2	0.544	0.161	0.001	1.723 (1.257, 2.362)	8
Obesity History (Ref = No)	0.462	0.081	0.000	0.630 (0.537, 0.739)	18
Diabetes History (Ref = No)	0.185	0.087	0.034	1.203 (1.014, 1.427)	6
School type (Ref = Private)	0.563	0.111	0.000	1.755 (1.413, 2.180)	25
Distinct (Ref = Urban)	0.375	0.117	0.001	1.455 (1.158, 1.830)	12
Constant	0.767	0.315	0.015		
Maximum Score					100

Table 2. Sensitivity and specificity of cut-off points

cut off points	Sensitivity	1 - Specificity
≥ 35.0000	0.718	0.446
≥ 36.5000	0.694	0.477
≥ 37.5000	0.692	0.479
≥ 38.5000	0.662	0.516
≥ 39.5000	0.646	0.542
≥ 40.5000	0.601	0.584
≥ 41.5000	0.601	0.584
≥ 42.5000	0.580	0.613
≥ 43.5000	0.578	0.614
≥ 44.5000	0.555	0.634

Discussion

The results of this study, that to the best of our knowledge is the first of its kind, showed that living in rural area, attending public school, and lower maternal education level, which are usually considered as indicators of having lower socioeconomic status, increased the risk of abdominal obesity in children. This finding is in line with some previous studies showing that social class measured by income and education can be more powerful than genetics in predicting future health problems, including obesity.[16] Childhood social circumstances are also reported to have an important influence on cardiovascular disease risk in adulthood.[17] The simplest explanation for the relation of obesity and socioeconomic status, might be the unhealthy lifestyle behaviors in families with lower socioeconomic levels. In the current study, the only protective factor against abdominal obesity was physical activity. The role of sedentary lifestyle on childhood obesity is well established,[18,19] and families should be encouraged to increase the daily physical activity of their children.

Ethnic differences have been documented for anthropometric measures of children,[20] however the ratio used in the current study is applicable to various ethnicities. The risk score uses existing patient information, it may have a useful role in stratifying a practice population so that only those at highest risk are offered diagnostic testing, rather than the whole population. This approach is likely to generate less anxiety for false positive results than population screening by questionnaire or other medical tests, as well as lower costs, particularly when the score is automatically calculated by computer. The ROC curve indicates that the risk score could have a role in strategies to identify subjects with undiagnosed abdominal obesity in children.

Conclusion

This is the first study to test the performance of a simple risk score, using routinely collected data as a screening tool for undiagnosed abdominal obesity in the youth population. Although the cross-sectional nature of this study does not allow assessing the causality, it highlights the role of modifiable factors on abdominal obesity among children and adolescents.

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