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Methodology and Early Findings of the Assessment of Determinants of Weight Disorders among Iranian Children and Adolescents: The Childhood and Adolescence Surveillance and PreventIon of Adult Noncommunicable Disease-IV Study

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ABSTRACT

Background: This paper presents the methodology and primary findings of a national project on determinants of weight disorders among Iranian children and adolescents at national and sub-national levels.

Methods: This nationwide study was conducted in 2011–2012 in Iran as part of the fourth phase of a national surveillance program entitled Childhood and Adolescence Surveillance and PreventIon of Adult Noncommunicable disease-IV study. It had two phases of qualitative and quantitative study. This multicentric study was conducted among 25,000 students aged 6–18 years, living in urban and rural areas of 30 provinces of Iran. Students were selected by multistage cluster sampling method. Data regarding weight disorders including sociodemographic variables, perinatal factors, lifestyle factors, family and student dietary habits, quality of life, and family history of chronic diseases as well as body image were gathered via validated questionnaires.

Results: Overall, 23043 students completed the survey (participation rate: 92.17%). The mean age of participants was 12.55 ± 3.31 years; 50.8% were boys, and 73.4% were from urban areas. Underweight was found in 10.4% of boys and 9.2% of girls, the corresponding figure for overweight and obesity was 21% and 18.3%. Abdominal obesity was found in 17.6% of students. Among parents, obesity was more frequent than other weight disorders, with higher prevalence in parents of girls than boys (24.5% vs. 21.5%, respectively, $P < 0.001$). Overweight and obesity were more prevalent in urban than in rural parents (66.7% vs. 59.7%, respectively, $P < 0.001$).

Conclusions: This survey serves as confirmatory evidence on the prevalence of dual burden of weight disorders in Iran. Its findings on determinants of weight disorders would help policymakers to implement relevant programs at national and sub-national levels.

Keywords: Adolescents, children, determinants, Iran, overweight, underweight

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INTRODUCTION

Growth disorders including the wide variations from lowest levels of underweight up to considerable situation of overweight are common health problems in the field of pediatrics.[1,2]

In children and adolescences, individual variation in the growth velocity and specific pattern of growth mainly affect from a complex settings of genetic factors, environmental factors, socioeconomic determinants, nutritional status, physical activity, and many other known and unknown exposures.[3,4] To achieve adequate physical growth, optimal mental development, and coping with chronic diseases, children and adolescents, need to adequate nutrition and physical activity.[5]

Considering the ascending trends in most of the world countries, and because of attributed short-term and long-term health adverse effects, these problems need to exact detection and rapid actions.[6] Epidemiological transition from communicable to noncommunicable diseases, socioeconomic advancement in developing countries, changes in lifestyle, nutrition, and physical activity, especially among the younger age groups, as the main predisposing factor should be more addressed in preventive and controlling programs.[7,8]

In Iran, national studies provide scientific evidences on dual burden of weight disorders in Iranian children and adolescents.[3,9] Given the considerable differences between different age groups and socioeconomic conditions, as well as between residents of different areas, aim to dealing with complex associations between predisposing factors of growth disorders and various combinations of environmental, social and psychological, determinants, we need to almost available data and evidences for both; planning and conducting target groups-specific programs.[10,11]

Despite priority of problem, there is an obvious gap in related knowledge.[11] Macroeconomic policy should be designed based on factors affecting the incidence of weight problems in different areas of the country.[12,13] Behaviors of nutritional patterns and sedentary lifestyle, as the main causes of overweight and obesity in children and adolescents, should be exactly analyzed based on different patterns of weight.[10]

Therefore, by using representative national and provincial data, benefiting from the comprehensive methodology, and following the updated standards and protocols, the aim of this study was to determine the factors associated with underweight, overweight and obesity (including general and abdominal obesity) of children and adolescents aged 6–18.

This paper aimed to explain definitions, organization, methodological design, methods of data gathering or generating, and early findings of a national project on determinants of weight disorders among Iranian children and adolescents at national and sub-national levels.

METHODS

Overview

The present study was developed as a part of a national survey of school students' high-risk behaviors of the school-based surveillance system entitled Childhood and Adolescence Surveillance and PreventIon of Adult Noncommunicable disease (CASPIAN-IV) study.[14]

The whole surveillance program includes various risk behaviors and risk factors, and because of the importance of dual weight disorders, as part of the fourth survey of the CASPIAN study, a simultaneous nationwide study was conducted in 2011–2012 to assess the determinants of weight disorders.

It was performed with an interactive partnership between the Ministry of Health and Medical Education; Ministry of Education and Training, Child Growth and Development Research Center, Isfahan University of Medical Sciences and Alborz University of Medical Sciences.

The main process

This is an applied descriptive analytical study which was followed through two phase of and qualitative studies:

Qualitative phase

At the first stage of project, a qualitative study was conducted to develop a valid and wide-ranging questionnaire for assessment of these parameters in a nationally representative sample of children and adolescents in Iran. Through focus group discussion with 275 children and adolescents and their parents, after a qualitative content analysis, the initial items were extracted. In the next step, the face validity was assessed by expert panelists using the quantitative method of the impact score. To assess the content validity, the content validity rate and the content validity index were determined. The internal consistency was examined by Cronbach alpha, and its test-retest reliability was determined.[10]

Quantitative phase

At this phase, expert collaborator exactly conducted the measurements of anthropometric parameters. Interviews and completing the questionnaires were exactly followed by trained interviewers.

Under the comprehensive supervision of executive manager, all of the processes were exactly monitored and evaluated by a team of trained experts. Completed

questionnaires were reviewed at the provincial level. After required revision, the provincial executive approved final versions.

At country level, data entry and require cleaning were performed in final databases.

Study population

The survey was performed among students aged 6–18 years, from urban and rural areas of 31 provinces of Iran. Eligible schools for our study were stratified according to information bank of Ministry of Education. Those students with non-Iranian nationality, gross physical disability, history of chronic disease, and history of chronic drug consumption were not recruited in the study. After determining clusters and target schools in any area, sampling was completed by a random selection of students.

Sample size and sampling methods

In the present study, children and adolescents aged 6–18 years were selected by multistage random cluster sampling from urban and rural areas of 31 provinces of Iran. Eligible schools for our study were stratified according to information bank of Ministry of Education, and then, they were selected randomly. In selected schools, students were also selected randomly.

Considering following formula, the sample size calculated as follows:

$$n=\frac{z^2\times P(1-P)}{d^2}$$

$Z=1.96$	For 95% CI
$P=0.5$	For maximum value of $P(1-P)$, the highest value of variance was set on $P=0.5$
$d=0.085$	Precision

CI=Confidence interval

For 2 sexes, 31 provinces, and 3 age groups, total sample sizes calculated approximately 25,000 students.

Ethical concerns

The study was conducted according to the declaration of Helsinki (Seoul, 2008). The ethics committees and other relevant national and provincial regulatory organizations gave ethical approval.

For each participant after complete explanation of the objectives and protocols, they were assured that their responses would remain anonymous and confidential. Participation in the study was voluntary, and all of the potential participants had the right to withdraw from the study at any time. Written informed consent and oral assent were obtained from parents and students, respectively.

Measurements

Under the supervision of expert health care professionals, the students filled out the self-administered questionnaire at school. A team of trained health care professionals recorded information in a checklist and conducted the examinations under standard protocol using calibrated instruments.

Based on findings of our primary study on validation of questionnaires for assessment of growth.

Parameters in Iranian children and adolescents, sociodemographic variables, perinatal factors, lifestyle factors, family dietary habits, students' history, and familial history of chronic diseases were addressed in questionnaires. Dietary intakes were assessed by a validated 168-item semi-quantitative food frequency questionnaire. The reliability and validity of all questionnaires were confirmed through previous studies.[10]

For assessment and scoring of quality of life, we used a standard questionnaire, validated in Iranian children and adolescents.[15,16]

Weight was measured to the nearest 200 g in barefoot and lightly dressed condition. Body mass index (BMI) was calculated as weight (kg) divided by height (Ht) squared (m^2). Waist circumference (WC) was measured by a nonelastic tape to the nearest 0.2 cm at the end of expiration at the midpoint between the top of iliac crest and the lowest rib in standing position. Hip circumference (HC) was measured at the widest part of the hip at the level of the greater trochanter to the nearest 0.1 cm. Wrist circumference was measured to the nearest 0.1 cm on the dominant arm using a nonelastic tape meter. Waist-to-hip ratio and waist-to-height ratio (WHtR) were calculated by dividing WC to HC and Ht, respectively.

The World Health Organization (WHO) standard curves were used to define underweight, overweight, and obesity. Definition of underweight was based on BMI less than 5th percentile for age and gender. Overweight subjects were classified as BMI between 85th and 95th percentiles, and obesity was considered as BMI greater than the 95th centile for age and gender. Abdominal obesity was considered as WHtR more than 0.5.[17] The WHO Child Growth Standards were applied, because they can be used to assess children everywhere, regardless of ethnicity, socioeconomic status and type of feeding.[18]

Statistical methods and analysis plans

We analyzed data using STATA package (Release 12. STATA Corp LP. Package, College Station, TX, USA). All analyses were performed using survey analysis method. Continuous variables are expressed as mean ± standard deviation (SD), and categorical data as number and percentage. Data analysis was conducted using Student's *t*-test and Chi-square test. $P < 0.05$ was considered as statistically significant.

RESULTS

In this national survey, 23,043 students out of 25,000 invited individuals participated (participation rate: 92.17%). Data of one province (South Khorasan) were not available. The mean age of participants was 12.55 ± 3.31 years without significant difference in terms of gender. Overall, 50.8% of students were boys, and 73.4% were from urban areas. Considering age, 31.2% were in the 6–9.9 years, 34.8% in the 10–13.9 years, and 33.9% in the 14–18 years age groups. 90.9% of students were from public schools and the rest from private schools.

The mean and SD of anthropometric indexes of students are presented in Table 1. Mean BMI was higher in girls; height, weight, WC, and WHtR were higher in boys. Of participants, 9.8% (10.4% of boys and 9.2% of girls) were underweight, 13% (13.2% of boys and 12.9% of girls) were overweight, and 6.6% were obese (7.8% of boys and 5.4% of girls). Abdominal obesity was found in 17.6% of students (18.9% of boys and 16.3% of girls).

Overweight and/or obesity was found in 18.3% of girls and 21% of boys; 21.8% in urban and 13.4% in rural areas; the corresponding figures for underweight were 9.2%, 10.4%, 8.7% and 12.8%, respectively.

Among normal weight participants, 70.4% had a correct perception of their body images. Significant associations existed between BMI categories and duration of watching TV in both weekdays and weekends. Appropriate quality of life was reported in 66.1% of normal weight participants, and 3% of obese group [Table 2].

Considering the weight status of parents, obesity was the most common weight disorder, with higher prevalence in girls' than in boys' parents (24.5% vs. 21.5%, respectively, $P < 0.001$). Overweight combined with obesity was more prevalent in urban parents than rural parents (66.7% vs. 59.7%, respectively, $P < 0.001$). Age and weight gain had a significant association ($P < 0.001$). Table 3 shows the parents weight status according to gender, residence area, and age group of students.

DISCUSSION

The findings of this national survey provide comprehensive scientific evidence for action-oriented policy making for prevention and control of growth disorders, as well as for health promotion of these age groups.

Most students were in the normal weight categories (57% of boys and 65.9% of girls). From normal weigh students, 61.4% had more than 2 h/day screen time, 61.7% used computer games, more than 2 h/day, and 61.7% reported that they have mild level of physical activity. These lifestyle habits exposed them to chronic diseases in their future adulthood.

In almost all weight categories, the physical activity levels were inadequate. Overall, the patterns of screen time, watching TV or computer games were higher than the recommended time. Present findings are consistent with some other studies in alarming low levels of physical activity among children and adolescents.[19,20]

Our national findings on the dual burden of nutritional disorders either underweight or overweight among Iranian children and adolescents, aligned with the results of most developing countries, emphasizes on the importance of considering the weight disorders consequences.[21,22] Rapid transition in lifestyle covers a wide dimension of related factors as habitual diet, and physical inactivity makes young individuals more susceptible to weight disorders.[22,23] The considerably high prevalence of abdominal obesity needs more attention for long-term adverse health effects.[24,25]

The relationships of lifestyle with obesity in parents and their children have been discussed in some previous studies.[26-28] The present results also emphasize the role of weight status of parents as one of the main risk factors for obesity in this group of children.

Given the importance and the extent of problem, many attempts have been focused on the prevention

Table 1: The mean and SD of anthropometric indices of participants by gender

	Boys			Girls			Total		*P*
	n	Mean	SD	*n*	Mean	SD	Mean	SD	
Height (cm)	11,702	148.63	19.80	11,334	146.24	16.10	147.45	18.15	<0.001
Weight (kg)	11,707	43.29	18.48	11,336	42.01	15.83	42.66	17.24	<0.001
BMI (kg/m^2)	11,702	18.73	4.72	11,334	19.01	4.78	18.87	4.75	<0.001
WC (cm)	11,700	67.72	15.64	11,333	65.96	12.95	66.86	14.41	<0.001
HC (cm)	11,702	80.94	89.55	11,329	82.16	18.15	81.54	65.09	0.157
Wrist circumference (cm)	11,697	15.48	6.53	11,329	15.33	26.08	15.40	18.88	0.555
WHR	11,698	0.85	0.18	11,329	0.82	0.85	0.84	0.61	0.002
WHtR	11,695	0.46	0.09	11,331	0.45	0.07	0.45	0.08	<0.001

BMI=Body mass index, SD=Standard deviation, WC= Waist circumference, HC=Hip circumference, WHtR= Waist-to-height ratio, WHR= Waist-to-hip ratio

Table 2: Weight disorders in children and adolescents according to different variables studied[†]

Variable	Category	BMI categories				
		Under weight	Normal weight	Over weight	Obesity	*P*
Sex	Boys	1212 (10.4)	8040 (68.7)	1539 (13.2)	911 (7.8)	<0.001
	Girls	1044 (9.2)	8217 (72.5)	1459 (12.9)	614 (5.4)	
Living place	Urban	1466 (8.7)	11664 (69.5)	2433 (14.5)	1230 (7.3)	<0.001
	Rural	776 (12.8)	4480 (73.8)	543 (8.9)	275 (4.5)	
Age groups (year)	6-9.9	768 (10.7)	5147 (71.5)	797 (11.1)	485 (6.7)	<0.001
	10-13.9	897 (11.2)	5390 (67.2)	1124 (14.0)	611 (7.6)	
	14-18	591 (7.6)	5720 (73.2)	1077 (13.8)	429 (5.5)	
Body image	Underweight	677 (9.4)	5109 (70.8)	962 (13.3)	472 (6.5)	0.71
	Normal	1176 (9.9)	8377 (70.4)	1542 (13.0)	811 (6.8)	
	Overweight	305 (10.4)	2064 (70.5)	376 (12.8)	182 (6.2)	
	Obese	90 (10.0)	651 (72.0)	109 (12.1)	54 (6.0)	
Physical activity	Mild	362 (15.6)	1436 (61.7)	359 (15.4)	167 (7.2)	0.30
	Moderate	2 (25)	5 (52.5)	0 (0)	1 (12.5)	
	Vigorous	125 (18.5)	40 (59.5)	111 (16.4)	38 (5.6)	
Watching TV (week days)	≤2 h/day	1823 (18.5)	6164 (62.5)	1331 (13.5)	550 (5.6)	<0.001
	>2 h/day	1057 (16.7)	3893 (61.4)	898 (14.2)	495 (7.8)	
Watching TV (weekends)	≤2 h/day	1116 (19.2)	3919 (62.1)	769 (13.2)	323 (5.5)	<0.001
	>2 h/day	1745 (17)	6367 (62.1)	1443 (14.1)	705 (6.9)	
Computer games (week days)	≤2 h/day	2191 (17.9)	7555 (61.7)	1702 (13.9)	793 (6.5)	0.007
	>2 h/day	180 (14.6)	763 (62)	201 (16.3)	87 (7.1)	
Computer games (weekends)	>2 h/day	2049 (18.4)	6901 (61.9)	1504 (13.5)	691 (6.2)	<0.001
	>2 h/day	330 (13.2)	1536 (61.5)	431 (17.3)	200 (8)	
Quality of life	Adequate	37 (22.4)	109 (66.1)	14 (8.5)	5 (3)	0.11
	Nonadequate	1465 (18)	5150 (63.8)	1018 (12.6)	448 (5.6)	

[†]Data are presented as *n* (%). BMI=Body mass index

Table 3: Weight status of parents according to gender, place of residence, and age group of students

Variable	Category	BMI of parents				*P*
		Under weight	Normal weight	Over weight	Obese	
Gender	Boys	211 (1.8)	3941 (34.1)	4903 (42.5)	2286 (21.5)	<0.001
	Girls	193 (1.7)	3638 (32.5)	4616 (41.3)	2736 (24.5)	
Living place	Urban	223 (1.3)	5282 (31.9)	7135 (43)	3935 (23.7)	<0.001
	Rural	175 (2.9	2246 (37.4)	2322 (38.7)	1258 (21)	
Age groups (year)	6-9.9	71 (2)	1289 (36.3)	1464 (41.1)	730 (20.6)	<0.001
	10-13.9	138 (1.8)	2549 (33.3)	3161 (41.3)	1805 (23.6)	
	14-18	163 (1.6)	3248 (32.1)	4331 (42.9)	2364 (23.4)	

Data are presented as *n* (%). BMI=Body mass index

and control strategies. In these regards, vast advocacy on serious short- and long-time health adverse effects, encouraging adopting physical activity habits in routine daily life and lifestyle promotion are the most acceptable domains for action plans.[21,29-31]

For children and adolescents, schools represent a suitable setting for interventional programs through which improving students' knowledge and attitude on their nutritional habits and physical activity lead to effective changes in demanded behaviors.[20,32-35]

This study faced some limitations. Similar to other questionnaire-based studies, the problems of underestimation or overestimation of the time spent on component as screen time or physical activity and the recall bias should be taken into account. Moreover, the cross-sectional nature of the survey limits the interpretation of the associations demonstrated in this study.

The present study has many strengths. This is the first comprehensive analysis of determinants of weight disorders at national and sub-national levels

in a nationally representative sample of the pediatric population in the Middle East and North Africa. Provided evidences have significant implications for policy making. Methodologically, considering the standard methods, almost data gathered for most accurate estimations. Moreover, different indicators including quality of life and body image have been considered in this study.

CONCLUSIONS

The current study documented important evidence on growth disorders and associating factors at national and sub-national levels. Interventional programs are suggested for preventive and controlling strategies. These estimations provide practical information for health policies and programs to implement action-oriented interventions at national and sub-national levels.

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