Methodology and Early Findings of the Fourth Survey of Childhood and Adolescence Surveillance and Prevention of Adult Non-Communicable Disease in Iran: The CASPIAN-IV Study

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ABSTRACT

Background: The fourth survey of the surveillance system named "childhood and adolescence surveillance and prevention of adult non-communicable disease" (CASPIAN-IV study), was conducted among a national representative sample of Iranian students. This paper describes the methods and early findings of this survey.

Methods: This nationwide school-based study was conducted in 2011-2012 in 30 provinces of Iran among 13,486 students, 6-18 years (6640 girls, 75.6% from urban areas) and one of their parents.

Results: Mean age of students was 12.5 years. Based on the World Health Organization growth curves, 12.2% were underweight, 9.7% overweight and 11.9% were obese. Abdominal obesity was observed in 19.1% of students. The dominant type of cooking oil in urban families was liquid oil and hydrogenated fat (39% and 32%), most rural families used hydrogenated fat (53%), respectively. A total of 18% of students had at least 30 min of daily physical activity; 41% of students used computer in weekdays and 44% used it in weekends. Almost 34.5% of students reported to have at least one cigarette smoker and 21.5% reported to have a waterpipe smoker in their relatives. Moreover, 20.3% of students reported that they had suffered an injury needing the help of school health providers during the year prior to the study.

Conclusions: Current evidence on the health risky behaviors among Iranian children and adolescents confirms the importance of conducting comprehensive surveillance surveys to identify health risk behaviors. Data of this survey and the trend of variables provide necessary information for health policy makers to implement action-oriented interventions.

Keywords: Chronic diseases, prevention, risk behaviors, risk factors, school health, surveillance

Original Article

INTRODUCTION

The majority of behavioral risk factors of non-communicable

chronic diseases (NCDs) originate in childhood and adolescence.[1-5] Sedentary life-style has been linked to an undesirable cardiovascular disease risk profile including obesity,[6] insulin resistance,[7] and high blood pressure.[8] On the other hand, tobacco use at a young age has been associated with emotional and psychological problems, risky behaviors such as violence and sexual activity and an increased risk of cancers later in life.[9,10] In addition, childhood obesity has been linked to increased risk of dyslipidemia, hyperinsulinemia, hypertension and a number of psychosocial problems.[11,12]

The global school-based health survey (GSHS) in students has been developed by World Health Organization (WHO) and Centers for Disease Control and Prevention in cooperation with United Nations' UNICEF, UNESCO, UNAIDS. The GSHS was designed to help countries measure and assess the behavioral risk factors and protective factors among children and adolescents aged 13-17 years.[13] This surveillance system is entitled ''childhood and adolescence surveillance and prevention of adult non-communicable disease'' (CASPIAN) study. It is a national school-based surveillance of the risk behaviors and risk factors of chronic diseases using GSHS among children and adolescents in Iran. So far, four surveys of CASPIAN studies have been conducted, beginning from 2003 to 2004. The surveys are repeated every 2 years, with blood sampling for biochemical measurements every 4 years.[14-16]

This paper presents the methodological aspects and early findings of the 4th survey of CASPIAN study.

METHODS

The CASPIAN-IV study was performed in 2011-2012 in urban and rural areas of the central counties of 31 provinces in Iran. Data was checked at the district level by academic supervisors (expert of school health) and controlled by national supervisors and operators.

Study population and sampling framework

The study population consisted of students from elementary, intermediate and high schools of urban and rural areas. They were selected by multistage, cluster sampling method from 31 provinces of the country (48 clusters of 10 students in each province). Stratification was performed in each province according to the residence area (urban/rural) and school grade (elementary/intermediate/high school). The sampling was proportional to size with equal sex ratio; i.e., equal number of boys and girls were selected from each province and the ratios in urban and rural areas were proportionate to the population of urban and rural students. In this way, the number of samples in rural/urban areas and in each school grade was divided proportionally to the population of students in each grade.

Cluster sampling with equal clusters was used in each province to reach the necessary sample size. Clusters were determined at the level of schools, including 10 sample units (students and their parents) in each cluster.

The sample size was determined according to the cluster sampling method and to achieve a good estimate of the main risk factors of interest such as dietary behaviors, overweight and obesity and physical inactivity. The maximum sample size that could give a good estimate of all risk factors of interest was selected. Thus, the sample size was calculated as 480 subjects in each province. A total of 48 clusters of 10 subjects in each of the provinces and a total of 14,880 students and an equal number of their parents were selected from 31 provinces.

Procedure and measurements

Questionnaires

Two sets of questionnaires were completed for students and their parents. The questionnaires were obtained from GSHS and translated to Persian. The validity and reliability of questionnaires has been assessed previously.[17] The face validity was approved by the expert panel and in the phase of content validity assessment, questions got a score of more than 0.75 which affirm the content validity. Cronbach's alpha coefficient of the whole questionnaires was 0.97 and the Pearson correlation coefficient of the test-retest phase was 0.94, which confirmed the reliability of questionnaires.

The student questionnaire included questions about the relationship with peers, body image, and psychosocial environment of school, dietary habits, life-style habits, physical activity pattern, unintentional injuries, violence behavior, active and passive smoking, as well as psychosocial relations with family. Trained personnel completed

the questionnaires in a calm atmosphere inside the schools; the whole process was supervised and controlled by a team of health care professionals.

Concerns such as family composition, socio-demographic factors and genetic determinants (family history of hypertension, diabetes, obesity, sever osteoporosis, cancer), past history of student (birth weight, breastfeeding, type of complementary food), family dietary habits and unintentional injuries to the student were included in the parent's questionnaire. These questionnaires were also completed by trained interviewers and at least one of the parents was required to be present for answering the questions.

Physical measurements

All measurements were conducted under standard protocols and by using calibrated instruments. The project team measured height, weight, waist, hip and wrist circumferences. Weight was measured to the nearest 0.1 kg on a scale placed on a flat ground and subjects wearing light clothing and standing motionless and height were measured without shoes to the nearest 0.1 cm.[18] Waist circumference was measured using a non-elastic tape at a point midway between the lower border of the rib cage and the iliac crest at the end of normal expiration to the nearest 0.1 cm. Hip circumference was measured at the widest part of the hip at the level of the greater trochanter to the nearest 0.1 cm.[19] Body mass index (BMI) was calculated by dividing weight (kg) to height squared (m^2). We used the WHO growth charts to categorize BMI.[20] Abdominal obesity was defined as waist-to-height ratio of more than 0.5.[21]

Wrist circumference was measured to the nearest 0.1 cm on the dominant arm using a tape meter. Subjects were asked to hold their arm on a flat surface as a table. The superior border of the tape measure was placed just distal to the prominences of radial and ulnar bones. The wrist circumference was measured without the tape was too tight or too loose and with lying flat on the skin. Wrist circumference was measured before measuring blood pressure.

Blood pressure was measured in the sitting position on the right arm using a mercury sphygmomanometer with an appropriate cuff size. It was measured 2 times at 5-min intervals and the average was registered.[22]

Ethical concerns

Study protocols were reviewed and approved by ethical committees and other relevant national regulatory organizations. After complete explanation of the study objectives and protocols, written informed consent and verbal consent was obtained from the parents and students, respectively.

Statistical analysis

Mean of continuous variables was reported with 95% of the confidence interval (CI), categorical variables are expressed as a percentage. Comparison of mean of continuous variables across genders was investigated by Student *t*-test. Chi-square test was used to analyze categorical data. Statistical measures were estimated using survey data analysis methods in th StataCorp. 2011. Stata Statistical Software: Release 12. College Station, TX: StataCorp LP. package. $P < 0.05$ was considered as statistically significant.

RESULTS

The population of this survey consisted of 13,486 children and adolescents out of 14,880 invited subjects (participation rate of 90.6%) and one of their parents. The whole data of one of the provinces was not available; therefore analysis was performed on data of 30 provinces. The students were 6640 girls and 6846 boys with a mean age of 12.5 years (12.3-12.6, 95% CI). A total of 75.6% of students were from urban and nearly 24.4% were from rural areas. Tables 1 and 2 present the characteristics of students by sex and living area, respectively.

Overall, 12.2% (11.3% of girls and 13.0% of boys) were underweight, 9.7% (10.1% of girls and 9.3% of boys) were overweight and 11.9% (10.1% of girls and 13.6% of boys) were obese. Abdominal obesity was documented in 19.1% of students (17.8% of girls and 20.4% of boys; 21.2% in urban and 12.8% in rural residents).

Table 3 presents some health and dietary behaviors of students or their families. According to reports by students, 42% of urban participants and 34% of rural participants brush their teeth once a day, 34% of girls and 20% of boys reported to brush their teeth more than once a day. Overall, 37% of families in both urban and rural areas consumed whole-wheat breads. Most of the rural families used hydrogenated solid fat (53%) and the most prevalent types of cooking oil in urban families were liquid oil and hydrogenated solid fat

Table 1: Characteristics of participants according to gender: The CASPIAN-IV study

Variables	Boys (*n*=6846)		Girls (*n*=6640)		*P* value
	Mean	95% CI	Mean	95% CI	
Age (years)	12.4	12.1-12.6	12.6	12.3-12.8	0.202
Weight (kg)	43.1	41.9-44.3	41.8	40.8-42.7	0.066
Height (cm)	148.3	146.9-149.6	145.9	144.9-147.0	0.005
BMI (kg/m^2)	18.7	18.5-18.9	18.9	18.7-19.1	0.108
Waist circumference (cm)	67.9	67.2-68.6	66.3	65.7-66.9	<0.001
Waist-to-height ratio	0.46	0.45-0.46	0.45	0.45-0.46	0.033
Hip circumference (cm)	80.1	79.3-81.0	81.6	80.8-82.5	0.017
Wrist circumference (cm)	15.0	14.9-15.1	14.5	14.4-14.6	<0.001
Systolic blood pressure (mmHg)	102.8	102.1-103.6	100.2	99.6-100.9	<0.001
Diastolic blood pressure (mmHg)	65.6	64.9-66.2	64.1	63.6-64.7	0.001
Sleep duration (h)	9.0	8.9-9.0	9.0	8.9-9.1	0.415

CI=Confidence interval, CASPIAN=Childhood and adolescence surveillance and prevention of adult non-communicable disease, BMI=Body mass index

Table 2: Characteristics of participants according to living area: The CASPIAN-IV study

Variables	Urban (*n*=10,191)		Rural (*n*=3295)		*P* value
	Mean	95% CI	Mean	95% CI	
Age (years)	12.8	12.6-13.0	11.4	11.1-11.8	<0.001
Weight (kg)	44.6	43.8-45.5	35.7	34.3-37.0	<0.001
Height (cm)	149.3	148.3-150.4	140.1	138.5-141.8	<0.001
BMI (kg/m^2)	19.3	19.1-19.4	17.5	17.2-17.7	<0.001
Waist circumference (cm)	68.5	68.0-69.0	62.7	61.9-63.5	<0.001
Waist-to-height ratio	0.46	0.45-0.46	0.45	0.44-0.45	<0.001
Hip circumference (cm)	82.7	82.1-83.4	75.1	73.9-76.3	<0.001
Wrist circumference (cm)	14.9	14.8-15.0	14.2	14.1-14.3	<0.001
Systolic blood pressure (mmHg)	102.6	102.0-103.2	98.2	97.2-99.2	<0.001
Diastolic blood pressure (mmHg)	65.5	64.9-65.9	63.0	62.1-63.9	<0.001
Sleep duration (h)	8.9	8.9-8.9	9.3	9.1-9.4	<0.001

CI=Confidence interval, CASPIAN=Childhood and adolescence surveillance and prevention of adult non-communicable disease, BMI=Body mass index

(39% and 32%, respectively). More rural students reported to always add salt to table food than urban participants (36% vs. 29%, respectively, $P < 0.05$). A total of 13% of students skipped breakfast during weekdays. Overall, 36% of students ate junk foods every week, 31% consumed soft drinks every week and 24% ate fast foods every week. More urban students reported to use fresh fruit daily than rural students (59% vs. 45%, respectively, $P < 0.05$).

According to reports by students, 18% had at least 30-min a day leisure-time physical activity all days during the week prior to the study; however, 9% reported not to have any leisure time physical activity. Regular physical activity was reported as 24% among boys and 13% among girls. Of students participated, 41% used computer in weekdays and 44% in weekends; these frequencies were higher in urban areas and among boys [Table 4].

Regarding passive smoking, 34.5% of students reported to have at least one cigarette smoker and 21.5% reported to have waterpipe smoker in their relatives, totally 43.9% of students were passive smoker. Overall, 5.9% of students (7.5% in boys and 4.2% in girls) were ever smoker; this prevalence was higher in adolescents than in younger age group. The mean age of the first attempt to smoke was 11.9 years.

A total of 27.4% and 17.5% of students asserted that in the 3 months before the study they bullied others or experienced getting bullied which was

Table 3: Some health and dietary behaviors in Iranian children and adolescents: The CASPIAN-IV study

Variables	Urban (%)	Rural (%)	Total	
Teeth brushing				
More than once a day	27	26	27	
Once a day	42	34	40	
At least once a week	14	16	15	
Only once a week	7	8	7	
Less than once a week	3	4	3	
Never	6	11	8	
Type of bread consumed in family				
Whole-wheat	37	37	37	
Refined	63	63	63	
Dominant type of cooking oil in family				
Hydrogenated solid oil	32	53	37	
Liquid oil	39	31	37	
Ghee	3	3	3	
Frying oil	23	12	20	
Suet	1	1	1	
Butter	0	0	0	
Adding salt to table foods				
Always	29	36	31	
Sometimes	30	27	29	
Rarely	14	10	13	
Never	27	27	27	
Type of milk consumed in the family				
Pasteurized middle fat	43	29	39	
Pasteurized high fat	16	10	14	
Pasteurized low fat	21	13	19	
Non-pasteurized middle fat	11	25	14	
Non-pasteurized high fat	9	22	12	
	Breakfast (%)	**Lunch (%)**	**Dinner (%)**	
Number of weekdays that student eats meal				
0	13	2	2	
1	5	2	2	
2	6	2	2	
3	7	2	4	
4	7	3	6	
5	12	13	14	
6	50	75	70	
Student eats the meal in weekends				
Yes	89	98	95	
No	11	2	5	
	Daily (%)	**Weekly (%)**	**Rarely (%)**	**Never (%)**
Frequency consumption of some foods				
Cookies	34	42	21	3
Chips, cheese puffs and junk foods	13	36	37	14
Soft drinks	8	31	43	18
Fresh fruit	56	34	9	1
Dried fruit	22	37	32	9
Canned fruit juice	15	40	34	10

Contd...

Table 3: Contd...

Variables	Daily (%)	Weekly (%)	Rarely (%)	Total
Vegetables	36	46	14	4
Milk	46	33	14	7
Fast foods	3	24	49	24

CASPIAN=Childhood and adolescence surveillance and prevention of adult non-communicable disease

Table 4: Physical activity and leisure time activity in Iranian children and adolescents: The CASPIAN-IV study

Grades	Elementary %	Middle %	High %	Total %
Frequency of physical activity during past week (week days and weekend)				
Days				
0	5	9	13	9
1	15	25	25	20
2	21	14	14	17
3	13	16	15	14
4	9	8	9	9
5	6	4	3	5
6	8	8	6	7
7	22	16	14	18
Leisure time activity (week days/weekend)				
Activity and hours				
Doing homework				
1	41.35	24.22	25.22	32.28
2	35.32	32.28	26.22	32.28
3	15.17	22.22	21.19	19.19
≥4	8.11	21.22	24.28	16.19
Watching TV				
1	41.21	28.14	25.15	33.18
2	29.27	30.23	28.19	29/24
3	15.21	20.23	24/24	19/23
≥4	11.25	18.34	17.35	14/30
Computer games				
0	69/67	57/52	45/42	59/56
1	22/19	27/22	31/24	26/21
2	5/8	9/14	12/15	8/12
3	2/3	4/7	5/9	3/6
≥4	2/3	3/5	6/10	3/5

CASPIAN=Childhood and adolescence surveillance and prevention of adult non-communicable disease

significantly more frequent among boys than girls.

Regarding injuries, 20.3% of students (19.4% elementary, 23.1% middle, 18.9% in high school; 25.7% in boys and 14.6% in girls) reported that in the 12 months prior to the study, they had suffered an injury needing the help of school health providers. The prevalence of these injuries was not statistically different according to living area (20.1% in urban and 20.7% in rural areas). In most of the cases, the injury occurred in home (39.9%) when they were playing and/or exercising. We also asked parents about some factors of early life of their children. Most students had a history of using breast milk and homemade complementary foods. The average duration of breastfeeding of students during the two 1st years of life was 15.39 months.

DISCUSSION

In the fourth phase of CASPIAN survey,

different aspects of the general health status were assessed among a large number of Iranian children and adolescents. According to our findings, there is a need for reinforcement of the current health regulations and for setting practical policies, education and intervention strategies for both health promotion and primordial/primary prevention of chronic diseases.

In the current survey, both features of weight disorders, namely overweight and underweight were documented in the study participants and this confirms the nutrition and epidemiologic transition in Iran.[23,24] Compared with the CASPIAN-III study,[25] the increment in the prevalence of abdominal obesity was observed in the current survey (16.3% vs. 19%). The frequency of underweight had decreased from 13.9% in the CASPIAN-III study to 12% and it may be a confirmatory evidence for improvement in health care system. The aforementioned changes are consistent with the results reported from other studies conducted in the population of most developing countries in the East-Mediterranean region, which are experiencing double burden of nutritional disorders due to the rapid socio-economic alterations.[26-28]

Shifting away from healthy eating habits to fast foods, high-calorie low-nutrient diets combined with sedentary activities made children and adolescents more prone for development of overweight and its associated comorbidities as type two diabetes, cardiovascular and fatty liver diseases.[29-32]

Assessment of physical activity showed that most of the students were physically active for only 1 day/week; this finding is in line with the previous surveys of the CASPIAN study. Overall, the frequency and intensity of leisure time physical activity is low in Iranian children and adolescents. The exception was for elementary school students and rural districts devoting all weekdays for exercise. Having more free time, less homework and type of activities of elementary students, reinforcement of the ministerial regulations for physical activity in elementary schools, as well as more active life-styles in rural areas may explain such differences. The screen time was approximately two-fold higher than the recommended time.

Feeding pattern in the 1st year of life was breast milk, which can be a protective factor against many risk factors of chronic diseases, as obesity and hypertension. However, conflicting results exist and longitudinal studies are necessary to document such long-term effects.[33,34]

Regarding dietary habits; refined grains (63%) and liquid oil (39%) were mostly consumed among Iranian families. However, more than half of rural inhabitants (57%) reported consumption of solid hydrogenated fats. Added salt after the food preparation was mentioned by most of the students, except for elementary children. Type of dairy consumed was pasteurized-regular fat, eaten daily except for high-school students (weekly). Although the consumption frequency of unhealthy foods such as processed foods and low-nutrient snacks was low, parents declared that they made no significant changes in the child's diet in the year prior to the study.

Given the high prevalence of overweight and metabolic disorders in the country, it seems necessary to make practical policies to modify children's diet. As an example, dairy products, containing high amounts of calcium, with preventive effects against osteoporosis, overweight and insulin resistance, were not consumed daily among high-school students.[35,36]

Self-reported smoking was not prevalent among Iranian students compared to their peers in other countries,[37,38] however the first attempt to smoke was around 11 years, which was about 2 years earlier than the first CASPIAN study in 2003-2004.[39] This emphasizes on the importance of education and preventive approaches among families.

Assessment of the students' health status showed that most of the participants were in suitable health condition, rarely felt sadness, dizziness and so on. Violence, bullying and other aggressive behaviors, were not frequent, similar to reports from other countries.[40,41]

Study limitations and strengths

The main limitation of this study was its cross-sectional design by which causality cannot be determined. Despite this limitation, the major strengths of this survey are the large sample size and the nationwide design of the study, which ensures the representativeness of the findings and providing the possibility of making comparisons with previous phases of the CASPIAN study.

Besides, data of wrist circumference was collected for the 1st time during all CASPIANs; a measure which has been recently proposed as an important predictor of diabetes and pre-diabetes in adults and correlates with cardio metabolic risk factors. Finally, a high quality control of data collection was the other strength of this study.

CONCLUSIONS

The findings of this survey and the changes of variables studied in this surveillance system provide useful information for health policy makers and stakeholders to implement action-oriented interventions. The priorities of the health system for health promotion of children and adolescents are assumed to be development of effective intersectoral intervention programs promoting physical activity, healthy eating and improved life-style behaviors involving cooperative and immediate efforts of individuals, families, schools, community and government for primordial and primary prevention of NCDs.

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