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Association of short stature with life satisfaction and self-rated health in children and adolescents: the CASPIAN-IV study

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Abstract

Background: Data on stature in Iranian children and adolescents at national level are limited. The purpose of this study was to investigate the association of short stature with life satisfaction (LS) and self-rated health (SRH) in children and adolescents.

Methods: Data were obtained from a nationwide survey entitled childhood and adolescence surveillance and prevention of adult non-communicable disease (CASPIAN IV). Participants were 14,880 children and adolescents, aged 6–18 years, who were selected using multistage, cluster sampling method from rural and urban areas of 30 provinces of Iran. LS and SRH were evaluated for every participant by the validated questionnaire prepared based on the global school-based student health survey of the World Health Organization (WHO). Height was measured according to the standard protocol. Short stature was defined as height less than –2 standard deviation (SD) below the mean height for age and sex.

Results: Overall, 13,484 participants with a mean (SD) age of 12.5 (3.36) years (49.24% girls, 50.75% boys) completed the study (response rate 90.6%). The prevalence of short stature, poor SRH and life dissatisfaction was 9%, 20.04% and 20.09%, respectively. Although in the univariate model, participants with short stature had significantly lower odds of LS [odds ratio (OR): 0.83, 95% confidence interval (CI): 0.71–0.97] and good SRH (OR: 0.79, 95% CI: 0.68–0.92), in the multivariate model, only the association of short stature with good SRH remained statistically significant (OR: 0.82, 95% CI: 0.69–0.98).

Conclusions: Results of the present study show that participants with short stature are at the greater risk of poor SRH and decreased LS in comparison with the subjects with normal height.

Keywords: children and adolescents; Iran; life satisfaction; self-rated health; short stature.

Introduction

Normal growth and development is an important characteristic of healthy childhood and adolescence. This is a multi-factor progress which is influenced by both genetic and acquired environmental factors. Decreased height or

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short stature, also called stunting, is a developmental and multi-factorial condition that is one of the main concerns for the parents and the healthcare giver of children. After diabetes, short stature is considered as one of the most common causes of referring to pediatric endocrinologists [1–3].

In addition to growth hormone deficiency (GHD) and idiopathic short stature (ISS), short stature as a condition could be the consequence of a spectrum of disorders, including Turner syndrome, Noonan syndrome, Prader-Willi syndrome or deletion/mutation of the homeobox gene *SHOX* (short stature homeobox) and even as a result of chronic renal insufficiency [4].

Short stature is defined as a height below the third percentile or as a height of ≥ 2 standard deviations (SDs) below the normal stature for age and sex according to the population reference [5]. The World Health Organization (WHO) reported that 215 million children were short stature in 2000 throughout the world, while it decreased to at least 165 million children in 2011 [6]. In contrast to the decreasing trend of short stature in the world, it has remained an important concern of public health in many developing countries. By 2020, it is estimated that 142 million children (21.8%, 95% CI: 24.8–28.7) in the world will be short stature. In addition, it is predicted that Asia and Africa will have a similar prevalence of short stature by the year of 2020 (68 and 64 million, respectively) [7].

The data from a national study, entitled "Iranian National Study of Malnutrition Prevalence" in 2008, stated that 4.7% of Iranian children had short stature [8]. In another study, Motlagh et al. found a prevalence of 6.5% of short stature in 862,433 children entering elementary schools (48.4% girls, 77.2% urban resident) in a national survey in 2008 in Iran [9].

The literature illustrated that short stature in early childhood is associated with poor psychological functioning in late adolescence [10], obesity in adulthood [11], poor child development, poor school achievement [12], increased susceptibility to infection and poor cognitive and psychomotor development [13], and elevated risk of mortality in childhood and in adolescence [14].

It was demonstrated that there is negative correlation between height in adult life and health-related quality of life (HRQoL) [15]. The results of a study conducted among the general adult population in the UK have reported that short stature in adult life is significantly associated with a reduction in HRQoL [15]. Life satisfaction (LS) is defined as an overall assessment of one's own quality of life (QoL) according to his or her chosen criteria [16]. In addition, self-rated health (SRH) is an individual's perception and independent predictor of long-term health, including both the physical and mental health, which is defined based on the "subjective assessment of general health status" [17].

The importance of growth disorders in early childhood may necessitate the identification of the relationship between short stature and psychosocial parameters among participants with short stature. However, the negative effect of short stature on the child's development and physical and psychological functions is not limited to the childhood. More evidence has shown that short stature in adults is associated with reduced productivity and work capacity in adults [18]. In addition, shorter adults are at a greater risk of cardiovascular disease, obesity and all cause of mortality in men and women [19].

To the best of our knowledge, the current study is one of the first national reports, not only in Iran but also in the Eastern Mediterranean region, providing information on the association of short stature with LS and SRH among the Iranian participants.

Materials and methods

The data of the present study were collected from the fourth phase of a national school-based surveillance program, entitled the childhood and adolescence surveillance and prevention of adult noncommunicable disease (CASPIAN IV). In 2011–2012, CASPIAN study was performed in a large national representative sample of Iranian children and adolescents to establish a school-based surveillance system for risk factors and risky behaviors related to chronic diseases. The study protocol has been published previously [20]. In this national cross-sectional survey, 13,486 Iranian participants aged 6–18 years were recruited by using stratified multistage, cluster sampling method from both rural and urban areas of 30 provinces. Stratification sampling was performed according to the information bank of the Ministry of Health and Medical Education, and then, the selection of schools and participants from each school was random.

Trained healthcare providers conducted the interviews, completed two sets of questionnaires (for participants and their parents) and performed anthropometric measurements for each participant in a calm and friendly environment.

The questionnaires were prepared based on the WHO global school health survey (GSHS) in the Persian language. The validity and reliability of questionnaires have been evaluated previously [21]. Information about the LS, SRH, socioeconomic status (SES), physical activity, screen time (ST), passive and current smoking, family size, family composition, depression and anxiety "and so on" was obtained by self-reported questionnaire for each participant.

LS was defined by a single question: In general what is your sense toward life now? Participants complete a scale from 0 as "not at all satisfied" to 10 as "totally satisfied". Scales above six were further classified as satisfied and used in the analysis.

SRH was assessed by a single item, "How would you describe your general state of health?" The categories of response were "very good,"

"good," "moderate" and "bad". "Very good" and "good" were categorized as good, and "moderate" and "bad" were categorized as bad.

To determine the SES of participants, we used the methodology which was approved previously in the Progress in the International Reading Literacy Study (PIRLS) for Iran [22]. Using principle component analysis (PCA) variables including parents' education, parents' job, possessing private car, school type (public/private), type of home (private/rented) and having personal computer in home were summarized in one main component. This main component was categorized into tertile. The first tertile was considered as a "low SES", the second tertile as "moderate SES" and the third tertile as "high SES" groups.

Watching TV or leisure time spent on a computer or a total ST ≥ 2 h/day was considered as high and < 2 h/day as low ST.

Assessment of anthropometric measures

Anthropometric measurements were obtained by trained examiners under a standardized protocol using calibrated research equipment. Body weight was measured while the subjects were minimally clothed without shoes to the nearest 0.1 kg on a SECA digital scale (SECA, Germany). Height was measured to the nearest 0.1 cm using a stadiometer while the participants were barefoot in the standing position and the shoulders were in a normal state. Body mass index (BMI) was calculated as weight (kg) divided by height squared (m^2). Short stature was defined as height less than –2 SD below the mean height for age and sex.

Physical activity

We implemented a self-reporting questionnaire to assess the physical activity that was performed outside of school, lasting at least 30 min and causing heavy sweating with large increases in breathing or heart rate. Children reported the frequency of their physical activity during a week in four categories including none, 1–2 days, 3–6 days and every day of a week, respectively. For statistical analysis, we considered 0–2 days/week as mild, 3–5 days/week as moderate and 6–7 days/week as vigorous levels of physical activity.

Ethical considerations

After an explanation of the objective and procedure of the study, a written informed consent and oral assent were taken from participants and their parents, respectively, prior to enrollment of subjects in the study. The study protocol was approved by Isfahan and Tehran University of Medical Sciences Ethics Committees (Ethics Committee's code: 188092).

Statistical analysis

Statistical analyses were performed in the STATA 9 software [23]. Association of height status and studied variables was assessed using the χ^2-test. All categorical variables were expressed as percentages (95% CI: confidence interval) and age was expressed as a mean (95% CI). We used multivariable logistic regression models to evaluate the relationship between short stature as a dependent variable and SRH and LS as independent variables according to gender. These associations were evaluated in five different models including crude model (without adjusting) and four adjusted models. Confounder variables were considered in adjusted models including age, gender, living area, SES, BMI, passive and active smoking, depression, anxiety, physical activity, ST and living with parents. Statistical significance was considered at $p < 0.05$.

Results

Overall, 13,484 Iranian participants were enrolled in this survey with a participation rate of 90.6%. The mean age of the participants was 12.5 (SD: 3.36) years. The population study consisted of 49.24% girls and 50.75% boys. Of the participants, 75.6% and 24.4% were from urban and rural areas, respectively.

The total prevalence of short stature was 9% (95% CI: 8.35%–9.67%) among the studied children and adolescents. It is also evident that of the children and adolescents studied, 578 (8.6%) of boys and 616 (9.4%) of girls had short stature ($p = 0.21$). Regarding the LS, our data showed that 20.09% of the participants were dissatisfied. A 20.04% proportion of the studied participants reported poor SRH.

Baseline characteristic data of the studied participants, according to the height status, are presented in Table 1. As shown in this table, the short stature was significantly more prevalent among the participants who were living in rural areas and had poor SRH, ST > 2 h per day and family size > 4 subjects. In addition, participants who were active cigarette smokers and/or were underweight according to the BMI criteria had more prevalence of short stature compared to the others.

Table 2 compares the prevalence of short stature according to the categories of SRH and LS by gender. As presented in Table 2, we found that short stature had a significant association with both SRH and LS. By considering gender, these associations were statistically significant only in boy participants, not in girl participants. Poor self-rated health was more prevalent among short stature students.

Furthermore, the prevalence of short stature was higher among the participants who believe in having dissatisfaction in life ($p < 0.001$).

Association of short stature with LS and SRH in the logistic regression model is presented in Table 3. Although in the univariate model (model I), participants with short stature had significantly lower odds of LS [odds ratio (OR): 0.83, 95% CI: 0.71–0.97] and good SRH (OR: 0.79, 95% CI: 0.68–0.92), in the multivariate model (model IV), only the association of short stature with good SRH remained statistically significant (OR: 0.82, 95% CI: 0.69–0.98).

Table 1: General characteristics of subjects by height status in Iranian adolescents: the CASPIAN-IV study.

	Height status		p-Value
	Short stature	Normal stature	
Age, year[a]	12.2 (12.1–12.5)	12.5 (12.4–12.6)	0.10
Sex[b]			
Male	8.6 (7.7–9.5)	91.4 (90.4–92.3)	0.21
Female	9.4 (8.5–10.4)	90.6 (89.6–91.5)	
Region[b]			
Urban	7.1 (6.4–7.8)	92.8 (92.2–93.5)	<0.001
Rural	14.7 (13.1–16.6)	85.2 (83.4–86.9)	
Socioeconomic status[b]			
High	5.4 (4.6–6.2)	94.6 (93.8–95.4)	<0.001
Moderate	8.0 (7.1–9.0)	92.0 (91.0–93.0)	
Low	13.8 (12.6–15.2)	86.2 (84.8–87.4)	
Screen time[b]			
≤ 2 h/day	90.3 (89.6–91.1)	9.6 (8.9–10.4)	<0.001
>2 h/day	94.3 (93.2–95.2)	5.7 (4.8–6.7)	
Depression[b]			
No	8.9 (8.3–9.7)	91.0 (90.3–91.7)	0.60
Yes	8.6 (7.5–9.9)	91.4 (90.1–92.5)	
Anxiety[b]			
No	9.1 (8.4–9.8)	90.9 (90.2–91.6)	0.35
Yes	8.5 (7.4–9.7)	91.5 (90.3–92.6)	
Family size[b]			
≤ 4 persons	7.3 (6.6–8.1)	92.7 (91.9–93.4)	<0.001
>4 persons	10.5 (9.6–11.5)	89.5 (88.5–90.4)	
Passive cigarette smoking[b]			
No	8.6 (7.8–9.5)	91.4 (90.5–92.2)	0.29
Yes	9.2 (8.3–10.1)	90.8 (89.9–91.6)	
Active cigarette smoking[b]			
No	90.9 (90.2–91.5)	9.1 (8.5–9.8)	0.006
Yes	95.4 (92.4–97.2)	4.6 (2.7–7.6)	
Living with parents[b]			
With both parents	91.1 (90.4–91.7)	8.9 (8.3–9.6)	0.22
With one parent	92.5 (89.9–94.4)	7.5 (5.6–10.1)	
With no parent	87.7 (80.3–92.6)	12.3 (7.4–19.7)	
BMI, kg/m^2[b]			
Underweight[b]	13.7 (11.9–15.7)	86.3 (84.3–88.0)	<0.001
Normal weight	8.6 (7.9–9.4)	91.4 (90.6–92.1)	
Excess weight	7.3 (6.0–8.7)	92.7 (91.3–93.9)	
Physical activity[b]			
Low	8.5 (7.5–9.5)	91.5 (90.5–92.4)	0.33
Moderate	8.8 (7.9–9.8)	91.1 (90.2–92.1)	
High	9.5 (8.5–10.7)	90.5 (89.3–91.5)	

[a]Data are presented as means (95% CI); [b]data are presented as percentages (95% CI).

Discussion

The current investigation is the first cross-sectional study to assess the effect of short stature on HRQoL at population level in Iranian children. In the present analysis of a representative national sample of Iranian children and adolescent population aged 6–18 years, we found that the prevalence of short stature was 9%. The prevalence of short stature in this study was higher than 3.7% that was previously reported in first grade primary school students of Tehran (capital of Iran) in 2013 [24]. We found that short stature was more prevalent among the girl participants compared to the boys (9.4% vs. 8.6%). However, this difference was not statistically significant in this study. In the previous study, Esfarjani et al. reported that the prevalence of short stature among Tehran students is statistically and significantly higher in girls (4.4%) compared to boys (2.8%), $p < 0.05$ [24].

Table 2: Comparison of short stature with self-rated health and life satisfaction by sex in Iranian adolescents: the CASPIAN-IV study.

	Self-rated health			Life satisfaction		
	Poor	Good	p-Value	Dissatisfy	Satisfy	p-Value
Male						
Short stature						
Yes	25.9 (22.3–29.9)	74.1 (70.1–77.7)	0.001	26.7 (22.7–31.0)	73.3 (69.0–77.2)	<0.001
No	18.9 (17.7–20.1)	81.1 (79.9–82.3)		19.8 (18.5–21.2)	80.2 (78.8–81.5)	
Female						
Short stature						
Yes	21.3 (17.7–25.3)	78.7 (74.7–82.2)	0.64	19.4 (16.2–23.0)	80.6 (77.0–83.8)	0.83
No	20.4 (19.2–21.7)	79.6 (78.3–80.8)		19.7 (18.4–21.1)	80.2 (78.8–81.6)	
Total						
Short stature						
Yes	23.5 (20.9–26.4)	76.4 (73.6–79.0)	0.002	22.9 (20.3–25.7)	77.1 (74.3–79.7)	0.01
No	19.6 (18.8–20.5)	80.4 (79.5–81.2)		19.8 (18.8–20.8)	80.2 (79.2–81.2)	

Data are presented as percentages (95% CI).

Table 3: Odds ratios (95% CI) for life satisfaction and self-rated health between BMI and physical activity status in Iranian adolescents: the CASPIAN-IV study.

	Self-rated health (good/poor)			Life satisfaction (satisfied/dissatisfied)		
	OR	95% CI	p-Value	OR	95% CI	p-Value
Short stature						
Model I[a]	0.79	0.68–0.92	0.003	0.83	0.71–0.97	0.01
Model II[b]	0.77	0.66–0.90	<0.001	0.81	0.70–0.95	0.01
Model III[c]	0.80	0.67–0.95	0.01	0.89	0.75–1.07	0.22
Model IV[d]	0.82	0.69–0.98	0.03	0.88	0.74–1.05	0.18

[a]Without adjusted (crude model). [b]Adjusted for age and sex, and living area. [c]Additionally adjusted for other characteristics including socio-economic status, active smoking, passive smoking, depression, anxiety, living with parents, physical activity and screen time. [d]Additionally adjusted for BMI.

According to our results, some variables including region area, SES, ST, family size, active smoking and BMI are the main contributors to short stature prevalence in the studied children and adolescents. Participants who live in rural areas had poor SES, ST >2 h and family size ≥4 persons and subjects with obesity are more likely to have short stature. This finding is consistent with other studies, which showed significant differences of short stature prevalence between urban and rural areas [25].

It was demonstrated the short stature has a positive association with lower educational levels of parents [26], living in a rural area and an economically backward area [25] and poor SES in previous studies.

Besides ISS, potential underlying factors of short stature contained genetic factors, environmental factors (living area, climate and usual habits) and nutritional parameters that result in intrauterine growth restriction and postnatal malnutrition. In addition, short stature could be a clinical feature of the wild spectrum of hormonal and non-hormonal disorders.

Previous investigations have reported various rates of short stature. The main reasons for this controversy result from the use of different criteria for defining short stature and the difference in the range of age, gender, race, nutritional status and SES of the studied population. Therefore, it is likely that the cause of short stature in each country, or even in different cities of each country, is due to the mixture of exposure to influencing factors.

Furthermore, the main aim of our study was to determine the association of short stature with LS and SRH in Iranian children and adolescents. According to our knowledge, few studies have investigated the effect of short height on LS and SRH in childhood and adolescents. Our data illustrated that participants with short stature reported poor SRH and low LS. Different studies have reported controversy regarding the association of height with social behaviors and various aspects of QoL.

While previous studies suggested that short stature has a negative influence on the psychosocial functioning and HRQoL of the participants with short stature, another recent investigation disproved the negative effect of short stature on these parameters [27–30]. Sommer et al. reported that height is not a strong determinant of HRQoL at population level [27].

According to the result of a study conducted by Tran et al., there was a direct association between short stature in adolescents with academic difficulties among the studied population [31].

However, the relationship between LS and academic achievement has been investigated previously and conflicting results have been revealed. Differences in the objective measurements, subjective measurements, criteria of academic achievement, the population level of the study (national and individual levels) and different age, cultural and developmental studied groups were the main causes of this controversy.

In a recent study by Crede et al. it was reported that the parents' education, in particular the mothers' education, has a moderating effect on the positive association between academic achievement and LS, so that the positive association was only observed in the group of students whose mothers had achieved the same education as or a higher education than their own children [16].

It has been suggested that the correlation between academic performance and LS might be bilateral [32] which is called "the good circle" [16]. It means that academic achievement and LS will have an improvement effect on each other. In the previous phase of this nationwide study, CASPIAN III study that was conducted with 5738 students aged 10–18 years in 2009–2010 has reported that 7% of Iranian adolescents were short stature with higher prevalence among underweight males (52%) than their female counterparts (48%) [33]. In this study, short stature was defined as height-for-age < –2 SD. The prevalence of short stature among 10–18-year-old children and adolescents was higher than that of WHO 2007 [34] and USCDC 2000 [35] in both genders.

Another study among the same population reported that short stature was more prevalent in low-SES regions. The highest and the lowest prevalence of short stature were observed in the Southeast (lowest SES) and the Central area of Iran (highest SES), respectively [36]. Family SES is an important determinant of people's LS. Several studies have previously reported a positive relationship between SES and LS, while high-SES families are typically more satisfied than ones with low SES [37]. According to these findings, we suggest that SES could be a mediating factor between short stature and LS. However, Chen et al. revealed that self-esteem may play a mediating role in the relationship between SES and LS, which per se is moderated by optimism. Therefore, the mediating effect of self-esteem is stronger among the subjects with low optimism than for those with high optimism [38].

Individuals with short stature are at a higher risk of developing low self-esteem, depression, social immaturity, behavioral problems, psychological problems and academic difficulties than normal children. This is not only because of height-related physical limitations in daily working, but also because short-statured children and adolescents are more likely to experience social isolation, discrimination and stigmatization and be underestimated by parents, peers and teachers [29]. These may affect the self-perception and the social integration of children and adolescents with short stature. However, the intensity of these possible difficulties is dependent on the degree of short stature and the personal ability to cope with short stature [39].

Recently, Quitmann and colleagues performed an investigation among 345 short-statured children aged 8–18 years and their parents. They demonstrated that children with current short stature are at a greater risk of internalizing problems. The results of this study suggest that assessment of HrQoL is an important instrument for evaluation and identification of psychosocial problems in children with short stature for more assessment and intervention [40]. Although it is noticeable that other social and non-social factors may have an influence on the relationship between short stature and QoL. According to the result of a study among 137 short-statured children and adolescents aged 8 and 18 years who participated in the European quality of life in short stature youth (QoLISSY) study, it was demonstrated that coping strategies mediate the relationship between short stature and QoL which is per se dependent on the socio-demographic and clinical characteristics [41].

In conclusion, we observed that Iranian short-statured children and adolescents are at a greater risk of poor SRH and decreased LS compared to subjects with normal height. We think there may be some mediating factors that affect this association and we suggest that this hypothesis be assessed in future studies.

The major strengths of this survey are the large sample size, the nationwide design of the study and a high response rate of 90.6%. By considering these factors, we ensure that the results of this study could be expanded to the general population.

One of the limitations of this study is the nature of the study design itself, being a cross-sectional study design and using self-reported data. More studies are needed to

evaluate the effect of growth hormone treatment in participants with short stature on the studied variables.

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