Puberty signs and its relationship with lifestyle in 8-to-10-year-old girls: A descriptive-analytical study

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Abstract

Introduction: Declining the age of puberty causes many different physical, emotional and social changes that lead to negative consequences in adolescence and middle age. In the past 100 years, the average age of puberty has declined all over the world. External factors related to the lifestyle have effects on general sequences of puberty stages. The present study aimed to evaluate the puberty signs and their relationship with the lifestyle of 8-to-10-year-old girls in Ahvaz City. Materials and Methods: This descriptive-analytical study was conducted on 200 girls between 8 to 10 years of age from public schools of Ahvaz City from 2019 to 2020. Multi-stage cluster random sampling was used. The lifestyle questionnaire was distributed among the parents, and the children were examined physically for secondary sex characteristics. To analyze the data, SPSS 22 was used with the analyses and descriptive methods. Results: 57.6% of the children experienced puberty, with an average onset age of 9.36 for girls. There was a significant relationship between the age of puberty onset and birth order (P = 0.007), body mass index (P = 0.001), nutrition of 8-year-old girls (P = 0.008) and alcohol abuse of 9-year-old girls’ families (P = 0.039). There was no significant relationship between the beginning age of puberty with environmental, social and psychological health. Conclusion: Results indicated a lower age of puberty onset compared to previous studies in the country. Therefore, these results can be a database for future analyses and comparisons.

Keywords: Early puberty, lifestyle, lifestyle dimensions, puberty

Introduction

Puberty is a complicated biological process, which can be controlled by the dynamic interaction of genetic agents and regulatory factors, including endogenous agents, environmental messages, lifestyle, food diet, endocrine disorders and socioeconomic status.¹,² Such a process encompasses secondary sex characteristics, full fertility capacity, rapid bone maturation and rapid growth. That is why puberty is related to various aspects of health.³,⁴ Traditionally, the age of puberty is supposed to be 8-year old for girls and 9-year old for boys.⁵,⁶ Early puberty is more prevalent among girls than boys.⁷,⁸ In a study, Soriano-Guillen and Argente (2019)⁹ reported that the chance for early puberty is 25 times more in girls than in boys. Since growth is stopped after puberty, there is concern that children may not accomplish their full growth if

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they have early puberty.\[10\] Results of various studies have shown the probability that puberty in lower ages results in depression, aggressiveness or venereal diseases.\[10,13\] Other likely risks might be adolescent pregnancy, cardiovascular diseases in middle age, metabolic syndrome and breast cancer.\[10,13\]

In the past two decades, cross-sectional data from studies in Europe and the US have shown that the rate of early puberty has risen among both sexes.\[14\] Recent studies by Eckert-Lind et al. (2020)\[15\] showed that the large onset declined to nearly three months in every decade from 1977 to 2017. In a study, Kim et al. (2015)\[16\] reported that the prevalence of early puberty in Korea decreased from 3.3% to 50.4% in every 10,000 girls and 0.3 to 1.1 in every 100,000 boys. Also, national research in Iran during 1989-1990 has shown that the average menarche age declined one month every four years.\[17\] The reason for such a decline is not clear, but it is supposed to be influenced by childhood obesity related to eating habits or western lifestyle, exposure to sexual content from TV or the Internet, endocrine disorders related to ecological pollution and improvement of nutrition that is a result of better socioeconomic or socio-hygienic conditions which may influence early puberty.\[5,17\]

Various studies have indicated the effects of different indices of lifestyle, including diet, sleeping, physical activity, etc., on puberty onset in different countries.\[6,11,17-19\] Nevertheless, most of these studies have investigated only one index of the relationship of lifestyle with early puberty signs. In addition, there are limited studies on the age range of 8–10 which is the lowest natural age of puberty onset. This study is, therefore, the first comprehensive study, both nationally and internationally, to determine the puberty signs and their relationship to lifestyle among 8-to-10-year-old girls in Ahvaz City. The study has addressed the effects of all lifestyle indices on puberty onset age in girls; therefore, the results add new findings to the literature as well as provide valid data and comprehensive guidelines to promote a healthy lifestyle among children of 8 to 10 years of age.

**Materials and Methods**

This descriptive analysis registered by IR.AJUMS.REC.1398.676 code of conduct was done in 2019-2020 on 200 elementary school girls who were from 8 to 10 years of age in Ahvaz City. The inclusion criteria included: (1) being Iranian and being a resident of Ahvaz City for at least three last years, (2) having no history of metabolic or endocrine diseases, (3) having no history of mental diseases, (4) no use of medicines influencing productive system or puberty. The exclusion criterion was a denial of filling the questionnaire. Multi-stage stratified random sampling was used. Two schools were selected randomly from among four areas of Ahvaz City. The population consisted of 25 children (n = 25) who were selected randomly using random numbers chart from among 8-to-10-year-old students. The researcher met the students personally at their school and selected them. Then, the students and their parents were informed of the study objectives. The parents were ensured of information confidentiality and that they could leave the study whenever they wanted. Informed consent was taken from the parents. Data collection started with checking the children's height and weight. A physical examination checklist, including five steps of breast development and pubic hair, was completed by either visual checking, with clothes on, or asking the mother about breast development, or, if necessary, touching the breasts by the mother. In the present study, the individuals with Tanner stage 2 were counted as having puberty signs. Following the physical examinations, questionnaires were filled out by parents.

The instruments of the study were a research-made questionnaire containing demographic items (students age, parents age, education, occupation, number of children in the family, birth order, monthly income, breastfeeding, residential status, having a personal tablet or mobile phone), examinations checklist, and researcher-made children's lifestyle questionnaire. A researcher-made lifestyle questionnaire consisted of 31 items addressing six factors, including physical health, nutrition, mental/psychological/social/environmental health and denial of drug abuse. Scoring was done with a 4-item Likert scale (0 = never, 1 = sometimes, 2 = often, 4 = always). Higher scores indicated better lifestyles. Content validity method was administered to measure scientific validity of demographic information questionnaire, physical examinations checklist, and children's lifestyle questionnaire. Regarding the variables, after studying related books or published papers, the author made the questionnaire and distributed it among ten professors and faculty members of the Nursing Department of Ahvaz Medical University. The final version was formulated after collecting the professors’ ideas. The validity of the questionnaire was measured by content validity and structural validity. Cronbach’s alpha was also used to measure the reliability, which was at a good level (0.73%).

Quantitative variables were reported as mean, median, standard deviation and Interquartile range, and the qualitative variables were reported as number (percent). The normality of the data was measured by the Kolmogorov-Smirnov test. For single-variable analysis, multi-variable Poisson lag regression was used. In multi-variable analysis, the variables whose P value in the single-variable analysis was lower than 0.2 entered the model. All the analyses were completed by SPSS 22 and AMOS 24. The significance level was considered smaller than 0.05 for the above tests.

**Findings**

The sample of this study consisted of 200 girls, with the age range of 8–10. Demographic data of the girls and their families are shown in Table 1. The highest frequency of father education (40%) and mother education (52%) was high school diploma degree. As such, the highest frequency of children number was two children (45%), and the lowest frequency was seven children (0.5). For birth order, the highest frequency was related to the first child (51.5%), and the lowest (7.5%) was for the fourth child or more.
The results of evaluations showed that puberty started in 57.5% of the children; however, there were no signs of puberty onset in 42.5% of them [Table 2]. The results also indicated that the mean age was 9.06. The average age of children with puberty onset was 9.36, and it was 8.66 for those with no puberty signs. The mean height and weight were 135.55 cm, and 34.56 kg, respectively. The mean body mass index was 18.60 kg/m$^2$.

Table 2 shows the mean SD of the father's age, mother's age, and personal mobile phone use.

BMI mean in girls with puberty was higher than girls without puberty ($P = 0.001$). Risk estimation in BMI was 1.45. This risk was calculated for 5 units of increase in BMI; that is, for every 5 units rise in BMI, the chance for puberty signs increases up to 1.45 times [Table 3]. The first children were more likely (1.41) to have early puberty than other children ($P = 0.007$). In this study, BMI, mother's age, birth order, and residential area were other major variables, and they make the final analyses be the most important variables.

Results from dimensions of lifestyle are shown in Table 4. In model 1, lifestyle dimensions were addressed as single variables without any other variables. Model 2 addressed lifestyle dimensions with variables like BMI, mother's age, mother's education, birth order and residential area. There was a significant relationship between the prevalence of puberty signs and variables of physical health ($P = 0.040$) and nutrition ($P = 0.008$) among 8-year-old children. There was also a significant relationship between the prevalence of puberty signs and denial of drugs in families among 9-year-old children ($P = 0.039$).

Results from the evaluation of the multi-variable relationship of puberty onset with lifestyle are shown in Table 5. Based on the results, there was no significant relationship between puberty signs prevalence and lifestyle with important variables ($P = 0.359$.)
Results of the present study, which was conducted to determine puberty onset and its relationship with lifestyle among 8-to-10-year-old girls, showed that puberty signs were prevalent among 57.5% of the participants. Epidemiologic studies reported that observing puberty signs in 8-year-olds was 43% among black girls, 31% among Spanish girls and 18% among white girls. The reason for the difference between the results of this study with other studies might be the differences in geography, age group and genetics among the participants. Besides, Lian et al. (2019) did a study on Chinese girls where they reported that puberty signs onset was 47.4% among girls, which is in contrast to our study. The difference might be due to the population of the studies.

Discussion

In the present study, the onset of puberty signs was estimated at 9.36 years old. In 2006, the mean of puberty onset of girls in Tehran was 10.10 years, in 2013. It was 9.52 in Ahvaz (9.52). Results of these two studies indicated a decline of about 0.85 years in seven years period, and the comparison with the present study showed a decline of 0.16% years in a second seven years. In a study by Shiasi-Arani et al. (2016), the mean puberty age of girls in Kashan City was about 8.44, which is not consistent with our study results. One reason for this discrepancy might be climate differences. Also, unlike our findings, Khadgawat et al. (2016) found that the mean of puberty beginning age was 10.8 for girls. One reason for this discrepancy might be differences in sample size as well as age groups.

Results of epidemiologic studies show that higher levels of BMI influenced early puberty in 7 to 8-year-old girls. Likewise, the
Table 4: Multi-variable relationship of puberty onset with dimensions of lifestyle

| Lifestyle sub-units                | The onset of puberty (Mean±SD) | Model I | Model II |
|-----------------------------------|--------------------------------|---------|----------|
|                                   | Yes                            | No      | RR (95% CI) | P       | RR (95% CI) | P       |
| Physical health                   |                                |         |           |         |           |         |
| Total                             | 1.59±0.33                      | 1.54±0.58         | 1.07 (0.86, 1.34) | 0.523   | 1.10 (0.90, 1.35) | 0.349   |
| 8 years old                       | 1.82±0.49                      | 1.60±0.75         | 1.81 (0.85, 3.84) | 0.125   | 2.18 (1.04, 4.61) | 0.040   |
| 9 years old                       | 1.57±0.55                      | 1.58±0.66         | 0.99 (0.69, 1.39) | 0.933   | 1.04 (0.74, 1.44) | 0.839   |
| 10 years old                      | 1.51±0.51                      | 1.27±0.61         | 1.20 (0.93, 1.55) | 0.161   | 1.14 (0.92, 1.42) | 0.229   |
| Nutrition                         |                                |         |           |         |           |         |
| Total                             | 2.12±0.56                      | 2.06±0.53         | 1.10 (0.88, 1.37) | 0.405   | 1.04 (0.84, 1.29) | 0.725   |
| 8 years old                       | 2.23±0.61                      | 2.07±0.53         | 1.46 (0.72, 2.93) | 0.293   | 2.27 (1.24, 4.15) | 0.008   |
| 9 years old                       | 2.12±0.51                      | 2.15±0.55         | 0.96 (0.66, 1.41) | 0.838   | 0.83 (0.53, 1.31) | 0.830   |
| 10 years old                      | 2.08±0.58                      | 1.89±0.48         | 1.14 (0.93, 1.40) | 0.214   | 0.98 (0.81, 1.19) | 0.851   |
| Psychological Health              |                                |         |           |         |           |         |
| Total                             | 2.01±0.53                      | 1.95±0.58         | 1.08 (0.86, 1.34) | 0.508   | 1.06 (0.86, 1.31) | 0.584   |
| 8 years old                       | 2.00±0.52                      | 2.01±0.46         | 0.97 (0.45, 2.11) | 0.984   | 1.07 (0.47, 2.45) | 0.874   |
| 9 years old                       | 1.98±0.60                      | 1.84±0.75         | 1.13 (0.82, 1.55) | 0.451   | 1.10 (0.77, 1.57) | 0.599   |
| 10 years old                      | 2.03±0.49                      | 1.95±0.60         | 1.07 (0.82, 1.39) | 0.629   | 0.97 (0.79, 1.20) | 0.783   |
| Social health                     |                                |         |           |         |           |         |
| Total                             | 1.179±0.76                     | 1.02±0.72         | 1.12 (0.96, 1.31) | 0.151   | 1.11 (0.96, 1.28) | 0.151   |
| 8 years old                       | 0.95±0.69                      | 1.09±0.74         | 0.83 (0.50, 1.36) | 0.449   | 0.87 (0.52, 1.45) | 0.594   |
| 9 years old                       | 1.20±0.73                      | 1.03±0.67         | 1.13 (0.87, 1.47) | 0.353   | 0.90 (0.60, 1.33) | 0.593   |
| 10 years old                      | 1.23±0.81                      | 0.075±0.65        | 1.17 (1.02, 1.36) | 0.029   | 1.11 (0.98, 1.26) | 0.088   |
| Environmental health              |                                |         |           |         |           |         |
| Total                             | 2.47±0.69                      | 2.48±0.74         | 0.99 (0.84, 1.17) | 0.908   | 1.01 (0.87, 1.17) | 0.937   |
| 8 years old                       | 2.44±0.73                      | 2.45±0.79         | 0.99 (0.64, 1.52) | 0.949   | 1.15 (0.77, 1.72) | 0.488   |
| 9 years old                       | 2.55±0.53                      | 2.38±0.76         | 1.20 (0.83, 1.72) | 0.333   | 1.15 (0.80, 1.64) | 0.444   |
| 10 years old                      | 2.42±0.78                      | 2.71±0.50         | 0.89 (0.77, 1.02) | 0.102   | 0.95 (0.84, 1.07) | 0.400   |
| Avoid smoking in the family       |                                |         |           |         |           |         |
| Total                             | 2.49±0.63                      | 2.63±0.61         | 0.87 (0.73, 1.04) | 0.119   | 0.90 (0.77, 1.03) | 0.131   |
| 8 years old                       | 2.64±0.47                      | 2.72±0.45         | 0.77 (0.39, 1.52) | 0.459   | 0.66 (0.33, 1.29) | 0.224   |
| 9 years old                       | 2.45±0.65                      | 2.70±0.50         | 0.79 (0.60, 1.03) | 0.077   | 0.75 (0.57, 0.99) | 0.039   |
| 10 years old                      | 2.45±0.68                      | 2.20±0.96         | 1.11 (0.90, 1.37) | 0.318   | 1.09 (0.93, 1.26) | 0.283   |

Table 5: Multivariable relationship of puberty onset with lifestyle

| Life style                         | The onset of puberty (Mean±SD) | Model I  | Model II |
|-----------------------------------|--------------------------------|----------|----------|
|                                   |                                | RR (95% CI) | P       | RR (95% CI) | P       |
| Total                             | 1.92±0.34                      | 1.88±0.35 | 1.19 (0.84, 1.68) | 0.340   | 1.17 (0.84, 1.64) | 0.359   |
| 8 years old                       | 1.96±0.36                      | 1.92±0.33 | 1.30 (0.45, 3.79) | 0.631   | 2.46 (0.75, 8.06) | 0.137   |
| 9 years old                       | 1.93±0.33                      | 1.88±0.39 | 1.16 (0.65, 2.06) | 0.619   | 0.91 (0.44, 1.89) | 0.910   |
| 10 years old                      | 1.91±0.34                      | 1.74±0.36 | 1.35 (0.92, 1.98) | 0.127   | 1.14 (0.84, 1.53) | 0.406   |

The results of the present study showed higher levels of BMI in girls with early puberty compared to their counterparts. The results of the study were also consistent with Khadgawat et al. (2016)[23] and Reinehr et al. [28] who showed that BMI was a triggering factor of early puberty.

There was a significant relationship between the age of puberty onset and physical health and nutrition among 8-year-old girls and denial of drug abuse among the 9-year-olds. Consistent with the present study, Hoyt et al. (2002)[29] reported that puberty age was related to physical health. Likewise, Diao et al. (2020)[30] also showed that sleeping less or staying up late triggered physical weakness, which in turn results in early puberty. In contrast to this study, Tehrani et al. (2014)[31] indicated that there was no significant relationship between physical activity and the age of menarche onset. Chen et al. (2018)[32] suggested that unhealthy foods like desserts, snacks, fried foods and sugar drinks were also related to early puberty. Likewise, the results of our study indicated a significant relationship between early puberty and nutrition among 8-year-old girls. Our results also confirmed the study results of Villamor and Jansen (2016),[25] in which they showed a significant relationship between consuming animal proteins and early puberty. In the present study, no significant relationship was found between early signs of puberty and denial of drug abuse; however, such a relationship was significant in the 9-year-old group. The results confirmed the fact that age...
was an important moderator for this. Brix et al. (2019) also reported that mothers’ smoking resulted in early pubarche and menarche in girls.

**Conclusion**

The total results of the study indicated that puberty signs were observed in 57% of the children. The mean puberty onset age was estimated to be 9.36 years old. Of demographic information, BMI was much higher in mature girls than in their counter peers. Among different lifestyle dimensions, physical health and nutrition among 8-year-old girls and denial of drug abuse among 9-year-old girls had significant relationships with puberty onset age. Findings also indicated that puberty signs were obvious in 57.5% of the children. Mean of puberty signs onset age in this study can be used as applicable guidelines for nurses and other medical staff for increasing their awareness to give better medical services in controlling factors influencing puberty signs prevalence. The results also serve as guidelines to promote family awareness of the puberty period and empower them to manage it better to decline adverse consequences of puberty disorders.

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**Conflicts of interest**

There are no conflicts of interest.

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