

Original Paper

Effects of Multimedia-based Puberty Health Education on Knowledge, Practice, Self-esteem and Emotion Regulation of Adolescent Girls

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ABSTRACT

Introduction: Studies have reported that Iranian adolescent girls have low self-esteem and emotion regulation and recommended education to help improve them.**Objective:** This study aimed to assess the effects of multimedia-based puberty health education on knowledge and practice of puberty health, self-esteem and emotion regulation in girls aged 11-14 years in Iran.**Materials and Methods:** This quasi-experimental study was conducted on 100 adolescent girls aged 11-14 years from Saveh City, Markazi Province, Iran in 2022. They were selected randomly from two public middle schools and divided into two groups of intervention (n=50) and control (n=50). The intervention group participated in five multimedia-based educational sessions about physical and psychological health during puberty, while the control group did not receive any education. The data were collected using the puberty health knowledge and practice scales, the emotion regulation questionnaire (ERQ) and the coopersmith self-esteem inventory (CSEI). All adolescent girls completed the study questionnaire three times (before, immediately after, and three months after the intervention). The collected data were analyzed using independent t-test, chi-square, Fisher's exact test, repeated measures ANOVA and logistic regression analysis. In all statistical tests, the significant level was set at 0.05.**Results:** The majority of participants were 13 years old and had moderate socioeconomic status. The pre-test, post-test and follow-up scores of the puberty health knowledge in the intervention group were 23.56±3.7, 38.56±6.9 and 38.6±6.91, respectively (P=0.01) and in the control group, the scores were 23.9±3.12, 23.44±3.82 and 23.74±3.4. For the practice variable, the scores were 37.98±6.93, 68.94±4.84, and 71.68±5.93 in the intervention group (P=0.01) and 38.86±6.25, 38.18±6.82 and 38.88±6.26 in the control group, respectively. For the CSEI, the scores were 29.92±7.25, 35.8±7.28 and 36.38±6.93 in the intervention group (P=0.01) and 29.04±3.77, 29.12±4.01 and 28.86±5.13 in the control group, respectively. For the ERQ, the scores were 44±8.6, 56.5±11.83 and 58.08±8.74 in the intervention group (P=0.01) and 44.04±10.48, 44±10.45 and 43.36±9.39 in the control group, respectively; therefore, all four variables in the intervention group increased immediately and three months after the education, while no significant changes were observed in the control group. The knowledge factor had a significant association with emotion regulation ($\beta=0.32$, 95% CI; 0.22%, 0.45%, P=0.001) and self-esteem ($\beta=0.54$, 95% CI; 0.32%, 0.84%, P=0.001) in the post-test phase. In addition, knowledge had a significant association with self-esteem ($\beta=0.09$, 95% CI; 0.01%, 0.12%, P=0.04) and practice had a significant association with emotion regulation ($\beta=0.39$, 95% CI; 0.26%, 0.54%, P=0.001) in the follow-up phase.**Conclusion:** Education about physical and psychological puberty health can improve the emotion regulation and self-esteem of adolescent girls. The girls with high self-esteem and proper emotion regulation can better adapt to body changes and obtain better social status in the future compared to their peers.

Keywords:

Puberty, Health, Self-esteem, Emotional regulation

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Highlights

- Education about physical and psychological puberty health can improve the emotion regulation and self-esteem of adolescent girls in Iran.
- Multimedia-based teaching can improve puberty health knowledge and practice of adolescent girls in Iran.
- Puberty health knowledge is a predictor of emotion regulation and self-esteem in Iranian adolescent girls.

Plain Language Summary

Studies have reported that Iranian adolescent girls have low self-esteem and emotion regulation and they need educational interventions. The present study demonstrated that multimedia-based puberty health education had a positive effect on Iranian adolescents' knowledge, practice, self-esteem and emotion regulation. The scores of these four variables in the intervention group increased immediately and three months after the education, while no significant changes were observed in the control group. The puberty health knowledge had a significant association with self-esteem and emotion regulation after intervention. Adolescents with high self-esteem and proper emotion regulation can better adapt to body changes and obtain better social status than their peers.

Introduction

Adolescence is one of the most important and critical stages in life, a transition phase from childhood to adulthood that includes physical, mental and social changes in the person. Globally, about 9-12% of adolescents experience high emotional distress, which negatively affects their daily functioning [1]. It is important to identify the factors that trigger emotional problems in adolescents and consider how they are developed, which suggested that emotional distress is caused by complex interactions of multiple personal and contextual factors [2]. Individual factors include genetic makeup, temperament, cognitive skills, self-esteem, social cognition and moral development. Contextual factors include attachment, parenting styles, parent-child cohesion, family functioning, school environment, relationships with peers, and the broad socio-cultural context [3]. Growing evidence shows that emotional abilities are associated with prosocial behaviors such as stress management and physical health [4]. Teaching adolescents about pubertal changes can help them experience greater self-esteem and better emotional regulation [5]. High self-esteem in individuals, especially adolescents, creates a sense of self-confidence that enables them to adapt to difficult situations in life [6]. Low self-esteem leads to isolation, anger, and anti-social behaviors [7]. One of the most important abilities to improve self-esteem is emotion regulation skills, which are developed in infancy and childhood and continue into adolescence [8]. Physical changes during puberty can intensify low self-esteem and increase anxiety, leading to decreased emotion regulation ability [2].

Adolescents have a limited knowledge of the physical and mental changes during puberty. They get information about these changes mostly from their friends or the internet, who usually share their own experiences or perceptions that are mostly incorrect or incomplete [9]. Qualitative studies on identifying Iranian adolescents' experiences during puberty have demonstrated that most of the adolescents do not receive any special education on physical and sexual changes in puberty; hence, they get information from their peers [10]. Since conversations about body changes and puberty are taboo among adolescents and in society in Iran, and it is difficult to find a proper source of information about them, many of the changes are ignored. Education to adolescents about how to adapt to the physical and mental conditions during puberty can increase their self-esteem, social, relational, and emotional regulation skills, and satisfaction with life [11]. Modern teaching methods, such as multimedia, have some advantages over traditional teaching methods, such as being more productive, more interesting, more diverse content, and having a higher learning speed [12]. Multimedia-based education can increase the quality of education and students' ability to put their knowledge into practice. It not only provides a good chance for access to more participants and inhibits the feeling of shame for learning about the body changes, but also develops proper conditions to perceive a substantial amount of information about puberty. A study showed that multimedia-based education increased adolescents' knowledge of puberty [13].

There is a need to pay attention to the physical and mental health education of adolescent girls in Iran due to their insufficient knowledge. In addition, most of the previous studies have used traditional teaching methods, and a few studies have used educational programs based on modern teaching methods, such as multimedia-based methods, to promote the self-esteem of adolescents in Iran. Therefore, in this study, we aim to assess the effects of multimedia-based physical and psychological puberty health education on self-esteem and emotional regulation of adolescent girls aged 11-14 years in Iran.

Materials and Methods

This is a quasi-experimental study with pre-test/post-test/follow-up design that was conducted on 100 adolescent girls aged 11-14 years in Saveh, Markazi Province of Iran, from May to December 2022. The inclusion criteria were: At least two or more symptoms of puberty, being unmarried, no any medical complications, not using any medication, and willingness to participate in the study. Exclusion criteria were absent from two or more sessions or the return of incomplete questionnaires. By considering the mean score of self-esteem before (28.37 ± 2.57) and after (32.17 ± 1.64) educational intervention in Alimohammadi et al.'s study [13], a test power of 95% and a 99% confidence interval, the sample size was estimated at 36.5 per group. Then, considering 40% sample dropout, it increased to 51 per group. The samples were selected from two public middle schools in Saveh City. One of them was randomly selected to recruit students for the intervention group, and the other school was chosen for the control group. Next, 51 eligible adolescent girls were selected randomly from each school. They were randomly divided into two intervention and control groups using the random number table. The parents of students were invited to attend an introduction meeting in which the study objectives and methods were explained entirely to them, and informed consent was obtained from all girls and their parents. Figure 1 shows the CONSORT diagram for the study procedure.

Four questionnaires were used to collect data before, immediately after, and three months after educational intervention, which included a researcher-made puberty health knowledge scale, a researcher-made puberty health practice scale, the Coopersmith self-esteem inventory (CSEI) and the emotion regulation questionnaire (ERQ). The questionnaires were prepared using the Google Forms. Furthermore, a sociodemographic form with 6 items (age, father's age, mother's age,

socio-economic status, number of family numbers and source of information about puberty) was completed with the help of parents before the intervention.

The knowledge scale had 12 items scored as 0 (I do not know or no) and 1 (I know or yes), and the practice scale had 20 items rated on a five-point Likert scale from 1 (strongly disagree) to 5 (strongly agree). The higher scores in both questionnaires indicated higher knowledge and practice of puberty health. For calculating their content validity ratio (CVR) and content validity index (CVI), the opinions of an expert panel consisting of 10 specialists in midwifery, reproductive health, and health education were used. The CVI and CVR values for both questionnaires were up to 0.90 and Cronbach's α coefficient for the knowledge and practice scales was 0.922 and 0.814, respectively, indicating their high validity and reliability.

The ERQ is a 10-item self-report scale designed to assess the habitual use of two commonly used strategies to regulate emotions: Cognitive reappraisal and expressive suppression [14]. Participants respond to each item using a 7-point Likert scale ranging from 1 (strongly disagree) to 7 (strongly agree) [15]. The CSEI is a self-report tool designed to measure the attitudes toward the self in a variety of areas including family, peers, school and general social activities for adolescents and adults [16]. The CSEI consists of 50 items and yields a global score and four separate scores representing more specific aspects of self-esteem, viz. general self, social self-peers, home parents, and school academic (or professional for adult form). Additional items constitute a lie scale (defensive responses; 8 items). The CSEI items require the participant to report feelings about the self directly and are typically scored using a dichotomous scale ("like me" vs "unlike me"). Thus, CSEI scores can range from 0 to 50, with higher scores reflecting higher self-esteem. A score below average (<25) shows low self-esteem, and a score above average (>25) indicates high self-esteem [17].

After collecting the baseline data, the educational sessions were held for the intervention group using an Iranian application called "SHAD", developed by the Iranian Ministry of Education. The students had this app on their computer or smartphone, which is free for all users. By pressing/tapping on the "Student" key button after completing the requested information, they can connect to their classroom. In total, five educational sessions (Table 1) were held (every Saturday at 4:00 PM for 90 minutes). Between each educational session, the researchers designed educational posters with content

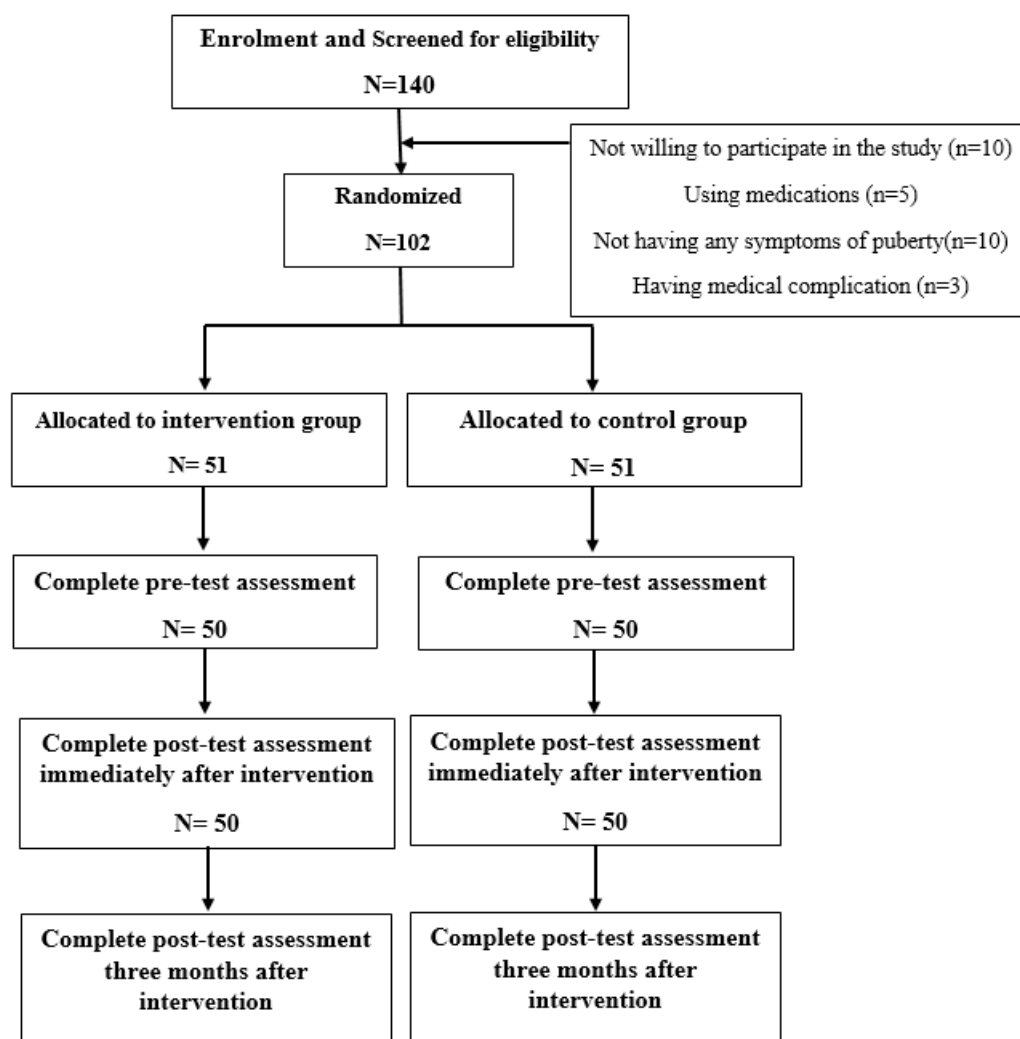


Figure 1. Flow diagram of the sampling and allocation processes

and pictures about the physical and mental puberty health and sent them to the students in a social network group created on [WhatsApp](#). This group included all participants in the intervention group. No intervention was done for control group.

The SPSS software, version 24 was used for data analysis. Participants' characteristics were compared using chi-square test. To measure the difference between the two groups in the pre-intervention phase, Fisher's exact test was used. Repeated measures of ANOVA and multiple regression analysis were used to compare the mean scores of knowledge, practice, self-esteem and emotional regulation at the pre-test, post-test and follow-up phases. The Greenhouse–Geisser test was used if Mauchly's test result was significant and the sphericity assumption was applied if Mauchly's test was not significant. It should be noted that the analyses were per-

formed with the intention-to-treat (ITT) approach. The significance level was set at 0.05.

Results

There was no significant difference between the intervention and control groups in demographic characteristics ([Table 2](#)). The majority of participants were 13 years old and had moderate socio-economic status. In the control group, the mean scores of physical and psychological knowledge and practice, ERQ and CSEI and their dimensions were not significantly different over three time periods (pre-test, post-test and follow-up). However, in the intervention group, the mean scores of these variables were significantly different over time ($P < 0.05$) ([Table 3](#)).

Table 1. The protocol of the puberty health education program

Session	Content
1	Basic physiological information about the female genital system and puberty and its signs and symptoms
2	Physical and mental changes during puberty, individual hygiene during puberty, and menstruation
3	Nutrition and physical activity
4	Introduction of premenstrual syndrome and physical and mental disorders during puberty and menstruation; and discussing the methods to confront the physical and mental disorders in puberty
5	Explaining Islamic and Sharia rules such as ritual washing, praying, etc. after puberty and during menstruation

Table 2. Sociodemographic characteristics of the participants in the intervention and control groups

Variables		No. (%)		P*
		Intervention Group (n=50)	Control Group (n=50)	
Age (y)	14	2(4)	2(4)	0.211
	13	22(44)	28(56)	
	12	26(52)	20(40)	
Father's age (y)	35-39	11(22)	19(38)	0.085
	40-44	0	0	
	45-49	22(44)	21(42)	
	50-55	17(34)	10(20)	
Mother's age (y)	35-39	18(36)	11(22)	0.088
	40-44	14(28)	22(44)	
	45-49	17(24)	15(30)	
	50-55	1(2)	2(4)	
Socioeconomic status	Good	8(16)	11(22)	0.068
	Moderate	25(50)	30(60)	
	Poor	17(34)	9(18)	
Number of family numbers	≤3	50(100)	49(98)	0.091
	>3	0	1(2)	
Source of information about puberty	Mother or sister	30(60)	38(76)	0.084
	Friends	1(2)	3(6)	
	Books	2(4)	1(2)	
	Internet	8(16)	4(8)	
	TV or radio	9(18)	4(8)	

*Chi square.

Table 3. Comparison of the scores of knowledge, practice, ERQ, and CSEI between and within groups

Variables		Groups	Mean±SD			P*
			Pre-test	Post-test	Follow-up	
Knowledge	Physical health	Intervention	12.52±3.22	19.36±3.67	19.52±3.61	0.01
		Control	12.56±2.49	11.18±2.3	12.66±2.67	0.41
		P**	0.24	0.02	0.01	
	Psychological health	Intervention	12.78±2.29	19.02±5.01	19.52±1.08	0.01
		Control	12.66±1.86	12.26±1.86	11.27±2.3	0.24
		P**	0.38	0.01	0.03	
	Total	Intervention	23.56±3.7	38.56±6.9	38.6±6.91	0.01
		Control	23.9±3.12	23.44±3.82	23.74±3.4	0.22
		P**	0.47	0.01	0.01	
Practice	Physical health	Intervention	19.24±4.51	33.06±7.84	37.1±5.78	0.01
		Control	20.52±4.21	20.36±4.56	20.14±4.42	0.44
		P**	0.09	0.01	0.02	
	Psychological health	Intervention	19.41±3.17	35.88±9.22	36.58±5.89	0.01
		Control	20.96±3.86	19.82±3.89	20.74±3.81	0.21
		P**	0.16	0.01	0.01	
	Total	Intervention	37.98±6.93	68.94±4.84	71.68±5.93	0.01
		Control	38.86±6.25	38.18±6.82	38.88±6.26	0.32
		P**	0.26	0.03	0.02	
ERQ	Expressive sup-pression	Intervention	14.96±4.14	24.38±8.45	24.08±6.14	0.01
		Control	15.28±5.62	15.32±5.65	15.02±5.83	0.09
		P**	0.31	0.01	0.01	
	Cognitive reap-praisal	Intervention	28.78±6.38	32.12±4.47	34±6.09	0.01
		Control	28.71±6.91	28.68±6.88	28.34±7.45	0.31
		P**	0.09	0.01	0.01	
	Total	Intervention	44±8.6	56.5±11.83	58.08±8.74	0.01
		Control	44.04±10.48	44±10.45	43.36±9.39	0.12
		P**	0.33	0.01	0.02	

Variables	Groups	Mean±SD			P*
		Pre-test	Post-test	Follow-up	
CSEI	Intervention	5.84±1.05	9.24±1.02	9.32±0.97	0.01
	General self				
	Control	5.12±1.22	5.62±1.35	5.64±1.33	0.11
	P**	0.35	0.01	0.02	
	Intervention	9.14±3.47	13.83±1.28	14.34±0.47	0.01
	Home parents				
	Control	9.24±1.47	9.2±1.1	9.2±1.86	0.35
	P**	0.26	0.01	0.01	
	Intervention	7.88±2.56	12.3±4.94	12.94±6.51	0.01
	Social self-peers				
	Control	7.08±1.78	7.08±2.33	6.96±1.04	0.31
	P**	0.28	0.01	0.01	
	Intervention	7.42±3.95	17.4±1.29	18.78±2.82	0.01
	School academic				
	Control	7.5±2.78	7.22±2.98	7.06±2.82	0.25
	P**	0.22	0.01	0.01	
	Intervention	29.92±7.25	35.8±7.28	36.38±6.93	0.01
	Total				
	Control	29.04±3.77	29.12±4.01	28.86±5.13	0.72
	P**	0.17	0.02	0.03	

*Repeated measures ANOVA, **Fisher's exact test.

The repeated measure ANOVA results showed that the total puberty health practice scores in the intervention group in the post-test and follow-up phases (68.94±4.84 and 71.68±5.93, respectively) were significantly higher than in the pre-test phase (37.98±6.93) ($P=0.001$). The scores of ERQ and CSEI in the intervention group also significantly improved in the post-test (56.5±11.83 and

35.8±7.28, respectively) and follow-up (58.08±8.74 and 36.38±9.39, respectively) phases ($P=0.01$) compared to the pre-test phase. However, in the control group, the ERQ score (44±10.45 in the post-test phase and 43.36±9.39 in the follow-up phase; $p=0.12$) and CSEI score (29.12±4.01 in the post-test phase and 28.86±5.13 in the follow-up phase; $P=0.72$) did not change significantly.

Table 4. The association of puberty health knowledge and practice with ERQ and CSEI scores in the post-test and follow-up phases

Dependent Variables	Time	Independent Variables	β	SE	95% CI (Lower, Upper)	P
ERQ	Post-test	Knowledge	0.32	0.058	0.22, 0.45	0.001
		Practice	0.02	0.012	0.001, 0.05	0.07
	Follow-up	Knowledge	0.11	0.244	0.05, 1.01	0.66
		Practice	0.39	0.071	0.26, 0.54	0.001
CSEI	Post-test	Knowledge	0.54	0.132	0.32, 0.84	0.001
		Practice	0.32	0.124	0.001, 0.49	0.12
	Follow-up	Knowledge	0.09	0.028	0.01, 0.12	0.04
		Practice	0.15	0.066	0.001, 0.26	0.13

The between-group comparisons showed no significant difference between the two groups before intervention in ERQ ($P=0.33$) and CSEI ($P=0.17$) scores, but these scores were significantly higher in the intervention group compared to the control group in the post-test ($P=0.01$ and 0.02 , respectively) and follow-up ($P=0.02$ and 0.03 , respectively) phases.

The independent variables, including knowledge and practice in the three time periods, were entered into the logistic regression model using the forward LR approach. The coefficients of the final regression model are presented in Table 4. The knowledge factor had a significant association with emotion regulation ($\beta=0.32$, 95% CI; 0.22%, 0.45%, $P=0.001$) and self-esteem ($\beta=0.54$, 95% CI; 0.32%, 0.84%, $P=0.001$) in the post-test phase. In addition, knowledge had a significant association with self-esteem ($\beta=0.09$, 95% CI; 0.01%, 0.12%, $P=0.04$), and practice had a significant association with emotion regulation ($\beta=0.39$, 95% CI; 0.26%, 0.54%, $P=0.001$) in the follow-up phase. According to these findings, for every one unit increase in the knowledge score, the ERQ score increases by 68% and the CSEI score increases by 46% immediately after intervention. Moreover, for every one unit increase in the puberty health practice, the ERQ score increases by 61% three months after the intervention.

Discussion

The results of this study showed that the Iranian adolescent girls' knowledge and practice of puberty health (physical and psychological) are not at a desirable level. However, their levels increased significantly after educational intervention. A review study on the menstrual health and hygiene knowledge of adolescent girls in low and middle-income countries concluded that girls in these countries are often uninformed and unprepared for puberty [18]. Our results are consistent with the results of studies in Bangladesh [19], Thailand [20] and Iran [10]. The effectiveness of educational interventions about puberty health on knowledge, attitude and practice has also been confirmed in previous studies [9, 21].

In the pre-test phase, self-esteem and emotion regulation did not differ between control and intervention groups. After the intervention, the self-esteem and emotion regulation of the intervention group improved significantly compared to the control group, which did not show significant changes. A study showed that puberty knowledge and practice affected the psychological stress of adolescent girls and concluded that psychological stress management during menstruation should be con-

sidered in the health education programs for adolescent girls. During adolescence, healthcare providers should not only pay attention to the physical changes of adolescent girls but also teach them stress management skills to help them cope with menstruation-related concerns [22]. Emotion regulation helps adolescents to flexibly respond to the current situations and needs that lead to new emotions. This flexibility is highly correlated with mental health. Adolescents with effective emotion regulation show better social skills. In contrast, adolescents with difficulty regulating emotions have impaired social functioning and, therefore, receive less social support [23]. Studies have also shown that, by increasing adolescents' knowledge of puberty health, the adverse effects of body changes on adolescents' self-esteem can be reduced [11]. Studies have shown that puberty, if ignored, has an adverse impact on adolescents' self-esteem and emotional regulation. Therefore, teaching puberty-related issues and increasing adolescents' knowledge in this field is very important for their self-esteem and positive emotional regulation [24]. Alimohammadi et al. showed that multimedia-based puberty health education could increase the self-esteem of adolescent boys [13]. Ning examined the effects of puberty mental health education and stated that the education could solve various psychological problems through emotional communication, emotional guidance and other activities [25]. In line with the present study, a qualitative study from Iran showed that most adolescent girls needed education on how to address issues related to puberty, as puberty was an unpleasant experience for them [10] which can cause psychological stress and reduce adolescents' emotion regulation and self-esteem.

In the present study, in addition to education about physical and psychological changes during puberty and the strategies to cope with them, the religious rules during puberty and menstruation were taught to the girls, since the studies in Iran have shown that the lack of knowledge of religious rules has an adverse effect on the psychological well-being of adolescent girls [10]. However, the effect of the puberty-related religious rules education on emotion regulation and self-esteem of the girls was not examined separately. It is recommended that the effect of the knowledge and practice regarding puberty-related religious rules be assessed on these variables, especially in Islamic countries where these rules are mandatory.

This is the first study that assesses the effectiveness of multimedia-based puberty health education on self-esteem and emotion regulation of adolescent girls in Iran. One of the limitations of this study was the use of vir-

tual education, which may have affected the quality of teaching and the attendance of adolescents. However, the educational topics were interesting for participants due to the lack of a reliable source of information, which motivated them to participate actively in the sessions. Also, this teaching method eliminates the feeling of shame for asking questions about body parts and puberty that may exist in face-to-face education. Another limitation was that some families prevented the girls' participation in the training sessions despite their initial informed consent.

The knowledge and practice of puberty health can predict better emotion regulation and self-esteem in adolescent girls. The findings in this study confirm the importance of puberty health education for adolescent girls, especially in Iran, due to the lack of a reliable information source and their shame in seeking the information because of cultural norms. Therefore, health professionals and planners should be aware of and develop puberty health educational programs for improving adolescent girls' physical and psychological health. This can provide appropriate guidance to foster a healthier lifestyle in girls, particularly those at risk. Further studies are needed to explore the risk and protective factors that can mediate or moderate the adverse developmental problems before implementing educational interventions that are more suitable for local/social contexts.

Ethical Considerations

Compliance with ethical guidelines

The girls and their parents were informed about the study objectives and were free to leave the study anytime. They signed a consent form to participate in the study. The study was conducted according to the principles outlined in the Declaration of Helsinki and approved by the Ethics Committee of the [Islamic Azad University, Arak Branch](#), Arak, Iran (Code: IR.IAU.ARAK.REC.1401.007).

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Authors' contributions

Project administration, and writing: Maryam Moridi; Data collection: Fatemeh Mirbagheri and Fatemeh Heidari; Study design, statistical analysis, literature review and final approval: All authors.

Conflict of interest

The authors declared no conflict of interests

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