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Structured Health Education Intervention on Knowledge of Pubertal Changes among Rural School Going Adolescent Girls in India: A Quasi Experimental Study

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ABSTRACT

Aim: This study aimed to assess the impact of a structured educational intervention on the knowledge of rural school-going adolescent girls regarding pubertal changes. Puberty involves a complex interplay of hormonal, emotional, and physical changes, including breast development (thelarche), pubic hair growth (pubarche), genital maturation, voice modulation, accelerated linear growth, and the onset of menstruation (menarche).

Study design: A cross-sectional study design was employed, incorporating an educational intervention administered to the experimental group.

Place and duration of study: The study was conducted in the Nashik district of Maharashtra over a period of one year.

Methodology: A total of 240 adolescent girls aged 12 to 18 years was selected from five villages in Nashik district using purposive sampling. Data were collected using a pretested, self-structured interview schedule. The intervention, focused on pubertal and reproductive health awareness, included lectures, group discussions, and educational videos delivered over a three-month period in selected schools. Statistical analysis was conducted using paired t-tests to evaluate the effectiveness of the intervention.

Results: Baseline findings revealed inadequate knowledge among respondents regarding menstruation, male and female reproductive anatomy, the development of primary and secondary sexual characteristics, and both internal and external bodily changes during adolescence. Post-intervention analysis demonstrated a statistically significant improvement ($p < 0.05$) in knowledge levels among participants in the experimental group across all measured domains.

Conclusion: School-based educational interventions are effective in significantly enhancing the knowledge of adolescent girls regarding pubertal changes. These programs are critical for empowering young girls with accurate information during a crucial phase of their physical and emotional development.

Key words: Adolescence; Intervention; Puberty; Health

INTRODUCTION

Adolescents represent a significant proportion of India's population, accounting for approximately 21% or around 268 million individuals. This transitional stage of life is characterized by rapid physical, psychological, emotional, and social development and requires appropriate guidance and education to ensure healthy progression into adulthood [1,2]. Among adolescents, girls are particularly vulnerable due to prevailing socio-cultural norms that often impose restrictions on their autonomy in areas such as education, marriage, and healthcare.

Several studies have highlighted a lack of awareness and inadequate knowledge among adolescent girls regarding the physiological and psychological changes that occur during puberty. These knowledge gaps contribute to increased susceptibility to various health risks, including poor reproductive health outcomes, substance abuse, and psychosocial issues [3-5]. Hormonal changes during puberty can significantly affect adolescents' moods, self-image, and interpersonal relationships. Despite marked biological developments, many adolescents lack scientific and reliable information about reproductive health, often due to societal taboos and inadequate communication within families and schools.

A review by Bej (6) reported that awareness levels regarding sexuality and reproductive health issues among adolescents ranged between 40% and 50% [6]. This lack of access to **authentic** information can lead to anxiety, misinformation, and risky behaviors. Cultural silence around topics such as menstruation and sexual development is often misinterpreted as a means to preserve modesty, leading to confusion and misconceptions among young individuals.

Santhya and Jejeebhoy (7) noted that although multiple national-level programs exist to address adolescent health needs, many young people remain ill-equipped to navigate the complexities of a rapidly globalizing society [7]. Educational institutions, which play a crucial role in shaping young minds, often avoid topics related to adolescence and reproductive health. Teachers frequently skip curriculum chapters on puberty and the reproductive system due to discomfort or perceived sensitivity, resulting in students seeking information from unreliable sources.

Research in Maharashtra and other parts of India has emphasized the pivotal role of schools in imparting accurate knowledge regarding puberty and promoting positive health behaviors [5,6]. Evidence suggests that improving adolescents' knowledge and attitudes about pubertal changes can enhance their preparedness, support their physical and mental health, and promote informed decision-making. Based on this context, the present study was undertaken to assess the existing knowledge among school-going adolescent girls regarding pubertal changes and to evaluate the impact of a structured educational intervention on improving this knowledge.

MATERIALS AND METHODS

Study design

The present study employed a cross-sectional approach with an experimental design. The participants were divided into experimental and control groups, with the experimental group receiving a structured educational intervention over a period of three months.

Study area and sample

The study was conducted in government secondary schools in the Nashik district of Maharashtra. A multi-stage stratified random sampling technique was used. One district was selected from the state, followed by the selection of a block and subsequently, government schools within that block. A total of 240 adolescent girls aged 12–18 years were selected from grades 8 to 12. The final sample was distributed evenly across four schools (60 participants per school).

Schools were chosen based on the enrollment of more than 100 girls at the secondary level. After obtaining permission from school principals and informed assent from the participants, data collection was initiated. Baseline assessment revealed that two of the selected schools had the highest percentage of girls with low knowledge levels regarding puberty. These two schools were assigned to the experimental group (n=120), and the

remaining two were designated as the control group (n=120) [8].

Data collection tools

Data were collected using a self-structured interview schedule, developed and pre-tested to ensure clarity and relevance. The schedule included sections on demographic details and knowledge about pubertal changes, including menstruation, physical development, and reproductive health. Each participant was interviewed individually in a confidential setting within the school premises.

Intervention

The intervention for the experimental group included a series of participatory educational sessions over three months. These sessions utilized lectures, visual aids (video presentations), and group discussions to disseminate information on topics such as adolescence, physical and emotional changes during puberty, menstruation, and the significance of reproductive health.

Post-intervention assessment

A follow-up assessment was conducted one month after the completion of the intervention using the same interview schedule administered during the baseline. This post-test aimed to measure changes in knowledge levels among participants.

Data analysis

All collected data were coded and entered into SPSS software (version 17.0) for statistical analysis. Descriptive statistics were used to summarize demographic information. Paired t-tests were applied to evaluate the effectiveness of the intervention by comparing pre- and post-test knowledge scores within the experimental group, while independent t-tests compared outcomes between experimental and control groups [9,10].

RESULTS AND DISCUSSION

Socio-demographic profile

The socio-demographic profile of the respondents is presented in Table 1, and it can be seen that the majority of them were between the age groups of 15 and 16 years and were studying at 11th and 12th standards, i.e., above high school level. The majority of the parents were educated up to the upper primary level. The maximum percentage of girls had medium-sized families with five to eight members and a monthly income in the range of Rs 5000 to Rs 10000. The caste composition of the rural families revealed that about 39.02 percent were in the OBC group (Table 1&2).

Table 1: Socio-demographic profile of rural respondents.

Sl. No.	Categories	Sample (n=240)
1	**Age**	
	12 to 14 years	25.3
	15 to 16 years	45.8
	Above 16 years	28.9
2	**Education**	
	Below High School	35.8
	High School	24.3
	Above High School	45.9
3	**Education of mothers**	
	Illiterate	25.1
	Primary	18.8

	Upper primary	35.5
	High school	18.1
	Intermediate	2.5
	Graduate & Above	4.5
4	**Education of Father**	
	Illiterate	1.8
	Primary	3.2
	Upper primary	34.8
	High school	30.2
	Intermediate	18.9
	Graduate & Above	14.8
5	**Family size**	
	Small (1 – 4 members)	5.0
	Medium (5 to 8 members)	60.8
	Large (Above 8 members)	35.8
6	**Caste**	
	General	22.5
	SC	38.8
	ST	-
	OBC	39.8
7	**Monthly income of families**	
	Upto Rs 5000/-	2.2
	Rs 5001/- to Rs 10000/-	35.4
	Rs 10001/- to Rs 15000/-	32.2
	Above Rs 15000/-	30.4
Note: All figures in percentage		

Table 2: Awareness of respondents regarding meaning of reproductive system before and after intervention.

Responses	**Rural**							
	Exp (n=120)				**Con (n=120)**			
	Pre		**Post**		**Pre**		**Post**	
No Knowledge	112	93.3	22	18.3	119	99.2	101	84.1

A system where new individuals are produced	0	0	36	30	0	0	0	0
Reproductive organs of body	0	0	70	58.5	1	0.8	6	5.0
Child birth process	8	6.6	0	0	0	0	15	10.8

The distribution of respondents according to their awareness regarding the meaning of menstruation is depicted in Table 2. It can be seen that most of the respondents among both groups (93.3%: experimental and 99.2%: control) did not know about the meaning of the reproductive system during the pre-test. The whole reproductive system of males and females was explained during the sessions of intervention, and the post-testing data showed a gain in knowledge, as evident from the increase in percentage from 0 (pre-test) to 30 percent (at the time of the post-test) who related the meaning to a system where new individuals are produced and 0 (during the pre-test) to 57.5 percent (during the post-test) for reproductive organs of the body among the experimental group. No such change was observed among the control group respondents. Thus, intervention resulted in a gain in knowledge with respect to the meaning of the reproductive system. The results of the present study are supported by the findings, who found a similar kind of situation where poor knowledge on reproductive organs and its meaning was reported by study participants during the pre-test which increased after providing education intervention to the adolescent girls (Table 3).

Table 3: Knowledge of respondents on reproductive organs and their functions before and after intervention.

Responses	Respondents							
	Exp (n=120)				Con (n=120)			
	Pre		Post*		Pre		Post	
	F	P	F	P	F	P	F	P
Male reproductive organs								
Testes	0	0	55	45.2	0	0	0	0
Function (production of sperms)	0	0	55	45.3	0	0	0	0
Penis	0	0	58	48.7	0	0	1	0.8
Function (release of urine & semen)	0	0	58	48.7	0	0	0	0
Scrotum	0	0	30	25.0	0	0	0	0
Function (holds testes)	0	0	28	25.3	0	0	0	0
Female reproductive organs								
Ovaries	1	0.8	70	58.3	1	0.8	1	0.8
Function (production of eggs)	0	0	48	40.0	0	0	0	0
Uterus	2	1.7	59	50.2	5	4.2	5	4.2
Function(baby develops)	1	0.8	36	30.0	5	4.2	6	5.0

Fallopian tube	0	0	32	25.8	0	0	0	0
Function	0	0	25	20.2	0	0	0	0
Vagina	2	1.7	60	50.0	0	0	0	0
Function	0	0	60	50.0	0	0	0	0
Note: * The total percentage may be more than 100 due to multiple responses.								

Respondents were enquired about the various male and female reproductive organs present in the body, along with their functions (Table 3), and the pretest data showed a complete lack of knowledge among the respondents. It was surprising to note that none of the girls could actually name any male reproductive organ. Although topics related to reproductive organs were included in their textbooks, in spite of that, a dismal picture prevailed. There was a huge gain in knowledge (over 40% at the time of post-testing) among the respondents pertaining to the names of male reproductive organs. Over 40 percent of the girls in the girls in the experimental group could identify and name certain male reproductive organs, such as the testes (44.2%) and their functions (43.3%), the penis (46.7%) and its functions (46.7%), and the scrotum (25%), along with their functions (23.3%), during the period after intervention.

Control group respondents did not show an increase in their knowledge about the female reproductive organs. Thus, a lack of knowledge with respect to male and female reproductive organs and their functions was observed during the period of pretesting where adolescent girls were less aware of male and female reproductive organs. A study reported that over 80 percent of adolescent girls were unaware of the appearance of secondary sexual characteristics in both genders (Table 4).

Table 4: Distribution of adolescent girls on the basis of their knowledge of primary and secondary sex characteristics during adolescence before and after intervention.

Responses	Respondents							
	Exp (n=120)				Con (n=120)			
	Pre		Post*		Pre		Post	
	F	P	F	P	F	P	F	P
Primary sex characteristics								
Changes in male reproductive organs	0	0	65	54.2	0	0	0	0
Changes in female reproductive organs	0	0	101	84.2	0	0	0	0
Secondary sex characteristics								
Appearance of moustache in boys	0	0	75	62.5	0	0	0	0
Appearance of beard in boys	0	0	85	71.7	0	0	0	0

Appearance of under-arm hair in boys	0	0	47	39.2	0	0	0	0
Appearance of pubic hair in boys	0	0	40	33.3	0	0	0	0
Appearance of under-arm hair in girls	0	0	70	58.3	0	0	0	0
Appearance of pubic hair in girls	0	0	47	39.2	0	0	0	0
Breast development in girls	0	0	57	47.5	0	0	0	0

Respondents were asked about the primary and secondary sex characteristics and changes occurring during adolescence in boys and girls, and the data pertaining to this have been presented in Table 4. It was shocking to see that none of the respondents among the experimental and control groups could name a single primary or secondary sex characteristic; even simple characteristics like the appearance of a moustache or beard in boys were also not known to them. The most interesting fact was that all the girls were in the stage of adolescence and were experiencing such changes, yet none of them perceived those changes as primary or secondary sex characteristics. The education given to them during the intervention showed a gain in knowledge in all aspects among the experimental group. The majority of them became aware of primary sex characteristics during post-testing, such as changes in female reproductive organs (84.2%), that is, the uterus, ovaries, and vagina, and changes in male reproductive organs of the testes, penis, and scrotum (54.2%). The secondary sex characteristics known to them during post-testing were appearance of beard in boys (71.7%), appearance of underarm hair in girls (58.3%), appearance of moustache in boys (62.5%), breast development in girls (47.5%), appearance of pubic hair in girls (39.2%), and appearance of pubic hair in boys (33.3%). A study concluded that the intervention program benefited the adolescent girls in terms of gaining proper knowledge about pubertal changes and the reproductive system (Table 5).

Table 5: Distribution of respondents on the basis of awareness of external changes occurring during puberty in boys and girls before and after intervention.

Responses	Respondents (N= 240)							
	Exp (n=120)				Con (n=120)			
	Pre*		Post*		Pre*		Post	
	F	P	F	P	F	P	F	P
Girls								
Increase in height	36	30.0	75	62.5	52	43.3	54	45.0
Changes in weight	16	13.3	65	53.3	4	3.3	10	8.3
Changes in breast proportions	14	11.6	50	41.7	8	6.7	8	6.7
Changes in body proportions	2	1.6	45	34.2	1	0.8	1	0.8
Being slim	8	6.6	35	27.5	13	10.8	13	10.8
Other changes (hair in other body parts)	14	11.6	75	65.8	12	10.0	11	9.2

Menarche	15	12.5	75	60	16	13.3	20	16.7
Difference in facial appearance /skin changes	15	12.5	38	31.7	11	9.2	13	10.8
No knowledge	84	70.0	45	37.5	68	56.6	66	55.0
Boys								
Increase in height	30	25.0	48	40.0	28	23.3	30	25.0
Changes in weight	8	6.5	45	33.3	3	2.5	4	3.3
Changes in voice	20	14.5	45	38.3	11	9.2	14	11.7
Appearance of moustache &beard	20	16.5	58	46.7	22	18.3	28	23.3
Other changes (hair in other body parts)	3	2.5	78	60.8	5	4.2	6	5
Broadening of chest & shoulders	3	2.5	80	66.7	2	1.7	13	10.8
No knowledge	90	75.0	45	33.3	92	76.6	90	75.0

A lot of improvement was seen among the experimental group participants in rural areas during post-testing, which was due to the interactive educational sessions during the intervention period. An increase in responses was seen in all categories of awareness of changes occurring in boys during puberty, and the highest among them was in the response of broadening of chest and shoulders (2.5% at pre-test to 66.7% at post-test), followed by other changes (2.5% at pre-test to 60.8% during post-testing) and changes in weight (6.6% at pre-test to 33.3% at post-test). A higher percentage of girls were aware of the changes, like an increase in height, voice changes, and the appearance of their moustaches and beards. Significant improvement in knowledge about physical changes in their study on determining the effectiveness of a health education intervention program in adolescent girls. According to the findings of a study on awareness regarding pubertal changes in school-going adolescent girls, the most common knowledge perceived by one-third of girls was the growth of pubic hair, an increase in weight and height, and menarche. Post-testing showed a sharp increase in awareness pertaining to all major changes occurring in girls during puberty among the experimental group, while not much difference in responses was seen among the control group girls. A higher percentage of girls knew about changes like an increase in height, weight differences, changes in breast and body proportions, the occurrence of menarche, as well as other changes. External bodily changes during any phase of life, especially during adolescence, are easier to observe than internal ones. Certain peculiar changes, like an increase in height or weight during puberty, are most likely to be perceived and should be known to the people in that cohort. However, it was surprising to note that simple variations in height and weight and the occurrence of menarche as an external change during puberty in girls were not known to the respondents. This suggests a clear ignorance on the part of these youngsters for not realizing important changes in themselves. The findings of the present study are supported by the results of research on knowledge and information about psychological and physiological problems among adolescent schoolgirls, who concluded that adolescent girls had poor knowledge about puberty and pubertal problems. Sandhya and Panthee5, in their study on awareness and attitude toward pubertal changes among adolescents in Nepal, also revealed unfavorable attitudes and knowledge regarding changes occurring during puberty and a negative attitude towards changes in terms of fear, sadness, etc.., (Table 6).

Table 6: Awareness of girls regarding internal changes occurring among girls and boys during puberty before and after intervention.

Responses	Rural (N = 240)							
	Exp (n=120)				Con (n=120)			
	Pre*		Post*		Pre		Post*	
	F	P	F	P	F	P	F	P
Girls								
Maturation of organs	0	0	23	19.2	0	0	0	0
Aggression	2	1.8	25	20.8	0	0	0	0
Emotional changes	4	3.5	28	23.3	1	0.8	1	0.8
Interest in boys	4	3.4	18	15	1	0.8	1	0.8
Interest in fashion	1	0.8	18	15	1	0.8	1	0.8
Increase in mature thinking	10	8.3	68	55.8	2	1.7	8	6.7
No knowledge	110	91.4	84	70	115	95.8	113	94.2
Boys								
Maturation of organs	0	0	25	20.8	0	0	1	0.8
Aggression	1	0.8	33	27.5	0	0	4	3.4
Emotional changes	1	0.8	14	9.5	0	0	4	3.4
Interest in girls/ affairs	5	4.2	49	36.8	0	0	4	3.4
Interest in fashion	0	0	0	0	0	0	0	0
Increase in mature thinking	7	5.8	45	33.3	2	1.7	6	5
No knowledge	115	95.8	75	63.3	118	98.3	114	95

Table 6 provides details of the distribution of respondents according to their knowledge of various internal changes occurring among boys and girls during puberty. It was observed that more than 90 percent of the respondents in the experimental and control groups (91.7% and 95.8%) did not know anything about the internal changes occurring during adolescence in girls. Only 8.3 percent of the girls in the experimental group were aware of the increase in knowledge and mature things in girls as internal changes at the time of the pre-test. An equal percentage of the experimental group (3.3%) and the control group (0.8%) in rural areas felt that emotional changes among adolescent girls and boys were something that happened internally. This lack of knowledge pertaining to emotional changes on the part of girls in the present study is validated, who found that only seven percent of adolescent school-going girls were aware of any kind of emotional change occurring during the period of adolescence. Internal changes during adolescence are difficult to observe, but one can always feel the changes in mood or emotions. The most obvious change that can be felt is the emotional variation occurring in the form of mood changes or an increase in aggression or anger. If people are sensitive towards themselves, the changes can be felt by them. On the whole, it was seen that respondents in the present study were less aware of the internal changes in boys during adolescence than in girls, which was obvious as they must have felt some of the changes within themselves. The present findings are in congruence with the results of a study by Abajobir and Seme 19, which concluded that most of the rural adolescents did not know about the changes taking place in boys and girls during puberty (Table 7).

Table 7: Perception of girls on behavioral changes of the family members during adolescence.

Responses	Rural			
	Exp (n=120) *		Con (n=120) *	
	F	P	F	P
Restriction in overall movement	8	6.6	26	21.5
Not allowed to play	46	38.3	3	2.5
Don't let go alone /don't let go anybody's house	16	13.3	21	18.5
Planning about marriage	11	9.2	4	3.4
More household responsibilities	8	6.6	8	6.8
Expects to take care of siblings	0	0	0	0
Understands our behaviour	13	10.8	6	5.0
No knowledge	50	41.6	77	64.2

Table 7 depicts the distribution of respondents according to their perceptions of the behavioral changes of their family members during the period of adolescence across the two settings. It can be seen that the majority of the respondents in the experimental and control groups (41.6% and 64.1%) did not have any knowledge on this aspect. Respondents perceived many behavioral changes, especially in their parents, during their process of 'growing up.' A higher percentage of girls in the experimental group (38.3%) were not allowed to play than the control group (2.5%), while respondents in the control group complained more about restrictions outside their house (21.6%) and were not allowed to go alone or sleep alone (17.5% as against 13.3% of experimental group girls). An equal percentage of respondents in both groups (6.6%) expressed an increase in sharing of household work or responsibilities, while a little less than one-tenth of them realized that their parents took more care of them ("*dhyandetehain*") and understood their changing behavior. Respondents also felt that their parents have started to discuss their marriages (9.1%: experiment and 3.3%: control group). It is clear that respondents definitely felt a change in the behavior of parents during the adolescent years, especially after their menarche, and were expected to behave like mature adults.

Certain issues, like security, marriage, and restrictions on movements outside the home, were seen. As can be seen from the perceptions of the girls, parents were more concerned about these aspects. This may be because of the concern for the safety of girls and women in rural areas, as young girls are more vulnerable to various kinds of atrocities (Table 8).

Table 8: Difference in mean scores of puberties related knowledge of rural and tribal respondents before and after intervention.

Area	Groups	No.	Mean	SD	t cal	P
Rural region						
Puberty related knowledge scores	Pre Experimental	60	6.53	5.65	35.55**	0.000
	Post Experimental	60	29.93	7.65		
	Pre Control	60	5.45	4.48	0.56 NS	0.570
	Post Control	60	5.55	4.15		
Note: ** Highly Significant, NS: Non-Significant.						

Table 8 depicts the statistical difference in mean scores between the experimental and control groups. The mean scores related to knowledge of puberty aspects of both groups were calculated before and after intervention, and it can be observed that there was a highly significant difference between the respondents of the experimental group before and after intervention ($t = 35.55$; $p = 0.000$). Thus, the adolescent girls of the experimental groups were able to identify the various external and internal changes during adolescence, name the male and female reproductive organs, and discuss related aspects of puberty after the intervention. The findings of the present study are supported by the results of a study done by Deshmukh *et al.* and Sandhya and Panthee et al, who found poor pretest knowledge among adolescents regarding growing up, which improved significantly after the intervention [5]. This validates the point that if a better understanding of the changes occurring during puberty is developed, it will help in laying a good foundation for reproductive health, especially for girls. Also, a review study by Bhanu and Anuradha[21] revealed that adolescent girls should be equipped with the right information regarding pubertal changes, which would eventually lead to better reproductive health as well as future motherhood.

CONCLUSION

The adolescent years are one of the most important years of life and pose significant challenges in the lives of boys and girls, specifically more for girls due to societal and cultural expectations. Puberty is one of the central aspects of this phase, as it facilitates the adolescent's move into the world of adulthood. In Indian societies, especially in villages, the discussion about pubertal changes is generally not done, which results in unawareness about the changes taking place in their bodies and the reasons for these changes. In addition, the chapter on adolescence in the school curriculum is skipped by the teachers in the schools due to embarrassment among teachers to discuss these issues openly. This leads to a lack of knowledge among girls and boys. The present study concluded that there was a that there was a lack of knowledge about changes during puberty and restrictions on adolescent girls. Educational intervention provided to the adolescent girls in the schools brought a significant change in knowledge and attitude and thus contributed in terms of better understanding of their bodies and laid implications for their future health.

DECLARATIONS

Conflict of interest

The author declares that there are no competing interests.

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Authors contributions

The author solely contributed to the conception, design, analysis, interpretation, and writing of this manuscript.

Ethical approval

Not applicable. This study did not involve human participants or animals, and no ethical approval was required.

Consent for publication

Not applicable. The manuscript does not contain any individual person's data in any form (including images, videos, or personal details).

Availability of data and materials

All data generated or analysed during this study are included in this published article. Additional information can be provided by the corresponding author upon reasonable request.

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