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Original Research Article

A study to determine age at menarche and its relationship with nutritional and socio-demographic status in selected government schools Belagavi, Karnataka: A cross-sectional study

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ABSTRACT

Introduction: Menarche is the occurrence of first menstrual blood flow or menses in a female adolescent. Nutritional status and socio-demographic status plays an important role in the attainment of menarche. Girls with good nutritional status will get menarche in proper age compared to malnutrition girls and overweight girls. Both excess nutritional intake and insufficient nutritional intake will greatly affect the age at menarche.

Objectives: To determine the age at menarche and to find the nutritional profile of adolescent school girls from selected government schools, Belagavi. It is to find an association between age at menarche and nutritional profile, and socio-demographic factors.

Materials and Methods: Cross sectional study done in 116 adolescent girls of age group between 11-16 years in selected government schools in Belagavi. 15 schools were selected by simple random sampling from each school 8 girls were selected using systematic random sampling. Data entry was done using the Microsoft office tools and analysis was done using IBM SPSS 21.

Results: The average age at menarche was 12.4±1.0 years. The majority of the participants' BMI was normal, i.e., 56 (48.28%), and 53 (45.69%) participants were underweighted. 99 (85.3%) of the participants are from an upper-middle-class family.

Conclusion: The present study concluded that the mean age at menarche was 12.4±1.0 years. There was no significant association between menarcheal age and sociodemographic status or anthropometric measurements, but there was an association between menarcheal age and body aches and nutritional status. Good nutritional status declines the age at menarche.

1. Introduction

Adolescence is a phase or a period of life where there is a difference between being a child and becoming an adult. This transition from childhood to adulthood is adolescence.[1,2] Adolescence is a phase of remarkable growth. During this phase, 20% of height, 50% of weight and 45% of body mass increase, and also red blood cell increases in size. According to WHO and many other studies adolescents' growth and development is closely related to dietary intake and nutritional status.[3] So, there is a high demand for nutrients that is both macronutrients like carbohydrates, proteins, fat and micro nutrients like vitamins and minerals, during adolescence there will be increasing need of nutrients compared to another life cycle because it is a growing period.[4] Adolescent growth and development are mainly affected by nutritional status. An adolescent who consumes more calories and protein will tend to have early menarche which is further implicated in

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diseases.[5]

Menarche is a crucial time in a girl's life that affects the reproductive life health and well-being of women.[6] Menstrual cycle is physiological changes, including the secretion of oestrogens from the ovaries it is an important indicator of women's reproductive health.[7,8] Menarche is the occurrence of first menstrual blood flow or menses in a female adolescent. When ovulation does not lead to fertilisation, menstruation ensues. It happens every 28 days, by a cycle length ranging from 21 to 35 days, most periods continue between 3 to 7 period, and also in some girl's menses last more than 10 days which is considered abnormal.[9] Early menarche is considered to be more vulnerable to psychosocial, physical as well as mental well-being problems like obesity, diabetes, risky sexual behaviour and breast cancer. So, it is critical to be aware of the variables which affect menarcheal age. These include genetic, socioeconomic status, diet, exercise, education, environment hereditary factor, psychological stress.[10,11]

Nutritional status and socio-demographic status become an important role in the attainment of menarche. Girls with good nutritional status will get menarche in proper age compared to malnutrition girls and overweight girls. In case of malnutrition in girls, the age of menarche will be delayed because of improper or decrease calories, protein and other micro and macro nutrients which then impact on the gonadotrophin hormone. The energy need of girls in the age of 10-19 years is 2050 to 2750kcal as per RDA. Good nutrition will help in the formation of gonadotrophin hormone and other hormones which affect upcoming menarche. So, both excess nutritional intake and insufficient nutritional intake will greatly affect the condition of the body.[12,13]

According to the studies lower socio-demographic status will delay the age of menarche, by this nutritional status is also affected because of lack of nutrition and poor knowledge about the food products. Because of low income they are unable to buy the food products which are essentially rich in vitamins and minerals which our body needs during the reproductive life. Even the area of living also matters because some areas will be far away from the city or the town where grocery shops are not available where they are living, because of difficulty in travelling they eat the food which is available in that area.[14–16]

After nutrition and socioeconomic status next comes BMI which is sensitive indicator which affects menarcheal age. BMI has linked to early onset of puberty and menarche. Early menarche was known to be a risk factor for disease, such as obesity, metabolic syndrome, cardiovascular disease, diabetes, breast cancer, as well as increased risk of death from ischemic heart disease. The health research community is paying attention to the declining age of menarche. Early menarche causes the epiphyseal plates to close prematurely, and as a result, women who attain menarche at a young age have a shorter final height than other women, as well as a higher risk of cancers related to female hormones, such as breast cancer and endometrial cancer, due to increased oestrogen exposure.[17]

Hence, the current study is planned to find the menarche age and how the nutritional status and socio-demographic status will affect the menarche age in the adolescent girls of selected government schools, Belagavi city, India.

2. Materials and Methods

2.1. Study design

A cross-sectional study.

2.2. Study area and period

This study was conducted at several schools of Belagavi city, Karnataka. This study was conducted for a period of 12 months from April 2021 to April 2022.

2.3. Sample size

116.

2.4. Inclusion criteria

1. Adolescent girls of age between 12 to 16 years.
2. Girls who will give assent form and those girls whose parents/guardian give consent was included in this study.

2.5. Exclusion criteria

1. Girls with mental and physical disabilities were excluded.
2. Girls who have not attained menarche.

2.6. Informed consent

Written Assent form was obtained from participants and informed consent was obtained from Head Master.

2.7. Confidentiality

Superior care was taken to maintain the privacy and confidentiality of the study participants.

2.8. Data collection tool

Self-administered questionnaire.

2.9. Data collection procedures

Ethical clearance was obtained from Institutional Ethical Committee for Human Subject's Research of J. N Medical College. Fifteen Schools were chosen using a lottery system and the Simple Random Sampling technique. Adolescent

girls of age between 12- to 16-year-old were included in research. Girls were selected from each school using systematic random sampling by the formula. Participants were allotted with numbers from that n^{th} number of participants was selected. Before data collection Principal of respective schools was informed about the study, Informed consent was obtained after informing all the subjects about the study and assent form was collected from the participants. Data collection was done by using pre-designed semi-structured questionnaire.

2.10. Data analysis

The data collected was entered into M.S. Excel and checked for its completeness, then coded and entered into the SPSS software 21.0 version for analysis. The data analyzed was expressed into percentage and mean. A chi-square test and Fisher's exact test was used to see the association between age at menarche and nutritional status, socio-demographic status, and BMI.

3. Results

Table 1 shows that mean age of menarche was 12.4±1.0 years.

Table 2 shows there was no association between age at menarche and socio-demographic status (P value 0.05).

Table 3 shows that there was association between age at menarche andmenarcheal characteristics i.e., body ache, amount of blood flow, days of blood flow (P value 0.05).

Table 4 shows there was no association between age at menarche and anthropometric measurements.

Table 5 shows that there was association between age at menarche and nutritional status of participants. (P value 0.005 & 0.01) There was Pearson correlation between energy, carbohydrate & fat.

Table 6 compares nutritional status of participants with RDA, only carbohydrates was associated with RDA when compared to other nutrients.

Table 1: Determination of age of menarche

Variable	Mean	Standard deviation
Menarcheal age	12.4	1.0

Among the study population, most of the participants attained menarche in 12.4 years of age and standard deviation was 1.0.

In the Table 2, socio-demographic factors were not associated with age of menarche. Socio-demographic status and age of menarche were statistically not significant (p value 0.05).

In the Table 3, body ache, amount of blood flow, and days of blood flow were associated with menarcheal age, while other symptoms were not associated with menarcheal age. (significant at the 0.05 level)

Table 2: Spearman correlation between age at menarche and sociodemographic factors

Variable	Correlation Coefficient (r)	p value
Occupation of the head of the family	-0.130	0.163
Education of the head of the family	0.031	0.745
Income of the head of the family	-0.024	0.800
Kuppuswamy socio-economic status scale 2021	-0.029	0.759
Birth order	0.125	0.180
Family type	-0.132	0.158
Family size	0.050	0.597
No. of siblings	0.064	0.492
Religion	0.001	0.993

In the Table 4, it showed that there was no association between menarcheal age and anthropometric measurements.

In the Table 5 correlation, nutritional status was associated with the age of menarche. As it shows that energy (0.05), carbohydrate (0.01), and iron (0.01) were significant at the age of menarche and there was a Pearson correlation between energy (Kcal), protein (g) and carbohydrate (g). Nutritional status and menarche age both were statistically significant factors (p values of 0.05, 0.01).

3.1. Association of nutritional status with RDA

In the Table 6, the majority of the participants' nutritional status was low. About 50% less nutritional status was seen in participants when compared to RDA.

In the Table 7, when compared to RDA, only carbohydrate was associated with menarcheal age (p value 0.05) and no other nutrients.

4. Discussion

Adolescence is a stage or era of life in which there is a distinction between being a child and becoming an adult. Adolescence is the transition from childhood to adulthood. Adolescence is a period of rapid development. Menstrual period is a major turning point in a girl's life that has an impact on her reproductive health and well-being. Menarche occurs when a female adolescent experiences her first menstrual blood flow, often known as menses. When ovulation is not followed by fertilisation, menstruation ensues. Menarche at a young age has been connected to an increased risk of obesity, diabetes, risky sexual behaviour and breast cancer, among other psychosocial, physical, and mental health issues. As a result, it's critical to understand the elements that influence menarche age. The present study was conducted among 116 school going girls aged 11 to

Table 3: Association between age at menarche and menarche symptoms

Variables		Menarche age			Total number of students	Fisher's Exact	p value
		8-11	11-13	>=13			
Dysmenorrhea	Yes	0 (0.0%)	24 (44.4%)	30 (55.6%)	54 (46.6%)	4.768	0.067
	No	3 (4.8%)	35 (56.5%)	24 (38.7%)	62 (53.4%)		
Irregular cycle	Yes	1 (3.8%)	12 (46.2%)	13 (50.0%)	26 (22.4%)	0.856	0.632
	No	2 (2.2%)	47 (52.2%)	41 (45.6%)	90 (77.6%)		
Amount of blood flow	Scanty	1 (12.5%)	2 (25.0%)	5 (62.5%)	8 (6.9%)	9.705	0.034*
	Moderate	2 (2.2%)	53 (57.0%)	38 (40.9%)	93 (80.2%)		
	Heavy	0 (0.0%)	4 (26.7%)	11 (73.3%)	15 (12.9%)		
Inter menstrual period	< 21 days	0 (0.0%)	5 (62.5%)	3 (37.5%)	8(6.9%)	2.44	0.655
	21-35 days	3 (3.2%)	49 (52.1%)	42 (44.7%)	94 (81.0%)		
	> 35 days	0 (0.0%)	5 (35.7%)	9 (64.3%)	14 (12.1%)		
Days of blood flow	< 3 days	1 (16.7%)	0 (0.0%)	5 (83.3%)	6 (5.2%)	9.330	0.041*
	3-5 days	2 (2.2%)	48 (53.3%)	40 (44.4%)	90 (77.6%)		
	> 5days	0 (0.0%)	11 (55.0%)	9 (45.0%)	20 (17.2%)		
Number of pads used	< 3	0 (0.0%)	1 (20.0%)	4 (80.0%)	5 (4.3%)	6.129	0.175
	> 5	0 (0.0%)	3 (27.3%)	8 (72.7%)	11 (86.2%)		
	3 - 5 days	3 (3.0%)	55 (55.0%)	42 (42.0%)	100 (9.5%)		
Body ache	Yes	0 (0.0%)	29 (46.0%)	34 (54.0%)	63 (54.3%)	5.401	0.044*
	No	3 (5.7%)	30 (56.6%)	20 (37.7%)	53 (45.7%)		
Abdominal pain	Yes	2 (2.4%)	40 (48.2%)	41 (49.4%)	83 (71.6%)	1.216	0.569
	No	1 (3.0%)	19 (57.6%)	13 (39.4%)	33 (28.4%)		
Irritability	Yes	0 (0.0%)	23 (48.9%)	24 (51.1%)	47 (40.5%)	2.029	0.333
	No	3 (4.3%)	36 (52.2%)	30 (43.5%)	69 (59.5%)		
Physical activity	Yes	1 (1.4%)	40 (54.8%)	32 (43.8%)	73 (62.9%)	2.120	0.346
	No	2 (4.7%)	19 (44.2%)	22 (51.2%)	43 (37.1%)		
Do you play sports	Yes	1 (1.6%)	32 (51.6%)	29 (46.8%)	62 (53.4%)	0.595	0.829
	No	2 (3.7%)	27 (50.0%)	25 (46.3%)	54 (46.6%)		

*significant 0.05 level
Fishers extract test

Table 4: Association between menarcheal age and anthropometric measurements

Variables		Menarche age			Total number of students	Fisher's Exact	p value
		8-11	11-13	>=13			
BMI	Underweight	1(1.9%)	28(52.8%)	24(45.3%)	53 (45.7%)	6.413	0.435
	Normal	2(3.6%)	26(46.4%)	28(50.0%)	56 (48.3%)		
	Overweight	0(0.0%)	4(100.0%)	0(0.0%)	4 (3.5%)		
	Obesity	0(0.0%)	1(33.3%)	2(66.7%)	3 (2.6%)		
Waist-hip ratio	Low	0 (0.0%)	16 (64.0%)	9 (36.0%)	25 (21.6%)	3.874	0.403
	Normal	2 (4.3%)	24 (52.2%)	20 (43.5%)	46 (39.7%)		
	High	1 (2.2%)	19 (42.2%)	25 (55.6%)	45 (38.8%)		
Body density	Low	0 (0.0%)	4 (66.7%)	2 (33.3%)	6 (5.2%)	1.734	0.794
	Normal	3 (2.9%)	50 (49.0%)	49 (48.0%)	102 (87.9%)		
	High	0 (0.0%)	5 (62.5%)	3 (37.5%)	8 (6.9%)		
Skin fold thickness	Lean	2 (2.1%)	51 (53.7%)	42 (44.2%)	95 (81.9%)	3.786	0.469
	Normal	1 (5.6%)	7 (38.9%)	10 (55.6%)	18 (15.5%)		
	Good	0 (0.0%)	1 (33.3%)	2 (66.7%)	3 (2.6%)		
Percentage of body fat	<18	0 (0.0%)	2 (50.0%)	2 (50.0%)	4 (3.4%)	2.553	0.706
	18-22	2 (5.3%)	18 (47.4%)	18 (47.4%)	38 (32.8%)		
	>23	1 (1.4%)	39 (52.7%)	34 (45.9%)	74 (63.8%)		

Table 5: Association between age at menarche and nutritional status

Variable	Correlation Coefficient (r)	p value
Pulses	0.103	0.273
Milk and its products	0.180	0.053
Green leafy vegetable	0.180	0.056
Other vegetables	0.074	0.436
Roots and tubers	-0.031	0.751
Fruits	-0.047	0.618
Meat and meat products	0.094	0.315
Egg	0.069	0.462
Chicken	0.066	0.484
Fish	0.028	0.766
Sugar and jiggery	0.139	0.136
Fats and oils	0.139	0.136
Nuts	0.066	0.482
Energy (Kcal)#	-0.204	0.028*
Protein (g)#	-0.061	0.517
Carbohydrate (g)#	-0.301	0.001**
Fat (g)	-0.108	0.247
Calcium (mg)	-0.066	0.482
Iron (mg)	-0.253	0.006**
* Significant at 0.05 level		
** significant at 0.01 level		
# Pearson Correlation		

Table 6: Comparison of energy, protein, calcium and iron with RDA

V ariables		Menarche age			Total number of students
		8-11	11-13	>=13	
Energy	Low nutrients	3 (2.6%)	59 (50.9%)	54 (46.6%)	116 (100.0%)
Protein	Low nutrients	3 (2.6%)	59 (50.9%)	54 (46.6%)	116 (100.0%)
Calcium	Low nutrients	3 (2.6%)	59 (50.9%)	54 (46.6%)	116 (100.0%)
Iron	Low nutrients	3 (2.6%)	59 (50.9%)	54 (46.6%)	116 (100.0%)

Table 7: Comparison of carbohydrate and fat with RDA

Variables		Menarche age			Total number of students	Fisher's Exact	p value
		8-11	11-13	>=13			
Carbohydrate	Low nutrients	1 (3.0%)	13 (39.4%)	19 (57.6%)	33 (28.4%)	9.034	0.032*
	Normal nutrients	2 (3.6%)	25 (45.5%)	28 (50.9%)	55 (47.4%)		
	Over nutrients	0 (0.0%)	21 (75.0%)	7 (25.0%)	28 (24.1%)		
Fat	Low nutrients	3 (3.1%)	48 (49.0%)	47 (48.0%)	98 (84.5%)	3.353	0.817
	Normal nutrients	0 (0.0%)	10 (58.8%)	7 (41.2%)	17 (14.7%)		
	Over nutrients	0 (0.0%)	1 (100.0%)	0 (0.0%)	1 (0.9%)		

16 years to determine the age at menarche and to find the age at menarche is associated with nutrition and socio-demographic status of individuals.

4.1. Correlation between menarcheal age, socio-demographic and economic position

In the present study, the majority of the participants were in the age group of 13-14 years. Most of the participants were from Hindu families (86.2%), while participants were from Muslim families (8.6%) and Christian families (5.2%). Nuclear families account for 77.6% of all participants, while joint families are less common. 80% of the participants belong to small families with 3-5 members. Most of the participants (85.3%) fall into the upper lower class socio-economic class. This showed that there was no association with age at menarche and sociodemographic status. These findings are different from a study conducted in Madhya Pradesh which showed the socio-demographic status of the participants, 93.3% of adolescent girls belonged to the Hindu community. Most girls (61%) come from nuclear family. The family size of most girls (50%) was small, with 3-5 members.[6]

In the present study, most of the girls attained menarche in lower socio-economic status. The average age at menarche was 12.1±1.19. The remaining participants' mean age at menarche was also similar, because this study was conducted in government schools. It shows that there was no association between age at menarche and socioeconomic status. A study conducted among 350 adolescent girls in Kerala showed higher socioeconomic status attained early menarche compared to lower socioeconomic status.[15]

4.2. Age at menarche

Most of the participants attained menarche in 12.4±1.0 years. Menarche occurred in 17 (14.0%) of the girls between 10–11 years of age, 98 (84.45%) of the girls between 12–14 years of age, and 1 (0.86%) of the girls between 15–17 years of age, with the minimum and maximum ages of menarche being 10.0 and 15 years. These findings are more or less similar to a study conducted in Kerala, where the majority (60.9%) reached menarche between the ages of 11 and 13 years. The average age of menarche was 12.1±1.19 years. The minimum and maximum age of menarche were 8 years, 10 months, and 16 years, 1 month.[15] The average age of menarche was 12.87±1.17 years.[18] It shows that there is a declining trend in the age at menarche.

4.3. Association between anthropometric measurements and age at menarche

In the present study, 45.6%, 48.2%, 3.4%, and 2.9% were underweight, normal weight, overweight, and obese, respectively. This study showed that there was no association with age at menarche and BMI (p value-0.121). This is similar to a study conducted in Mangalore, which also showed no association with age at menarche and BMI. A study conducted among 400 schoolgirls in the northwest of Iran showed that there was a positive correlation between age at menarche and BMI.[18] There was one more study conducted in two schools in Lahore, concluded that there was an association between age at menarche and BMI, menarcheal age falls as one's BMI rises. There was no association between anthropometric measurements and menstrual age. This inverse relationship has been demonstrated.[17]

4.4. Association between menarcheal age and nutritional status

In the present study, non-vegetarian participants were more prone to being overweight compared to vegetarians, and there was no correlation between menarcheal age and dietary pattern. This was similar to study conducted within Madhya Pradesh between the age groups of 19 and 25, but it showed non-vegetarians were more prone to being overweight compared to vegetarians.[6]

In the present study, energy, carbohydrates, and iron were significant (p values 0.05 and 0.01). They showed that nutritional status was strongly correlated with age at menarche; the higher the nutritional status, the lower the age at menarche. This was similar to a study conducted among 250 female adolescents in South Delhi, where it was also shown that nutritional status was associated with age at menarche.[13] But when nutritional status was compared with RDA, the majority of the participants fall underweight because of low calories, low protein, low fat, low calcium, and low iron, and only carbohydrate daily needs were normal in participants when compared to RDA. Most of the participants were anaemic in this study because of low nutritional requirements, especially iron.

4.5. Association between menarcheal age and menarche characteristics

In this study, body ache was strongly associated with menarcheal age when compared to other symptoms, and the amount of blood flow and days of blood flow were also associated with menarcheal age. A similar study was conducted in Nigeria among 450 adolescent girls. This showed that dysmenorrhea was associated with menarcheal age.

5. Limitation

The study's key drawbacks were that it was conducted only in government schools with a limited sample group, so it was only true in these observations, but it could be different in the urban population. This was a questionnaire-based study, so the results were solely dependent on the subjects'

responses. However, we should have double-checked with their parents. I was unable to complete it.

6. Recomendations

1. There was a need for information about menstruation, especially before the onset of menarche.
2. Mothers should be encouraged to discuss this with their daughters before reaching menarche to dispel the anxiety associated with menarche.
3. Facts about menstruation and its physiology.

7. Source of Funding

Not receive any funding.

8. Conflict of Interests

No conflict of interests.

9. Ethical Approval

Ethical clearance was obtained from Institutional Ethical and Research Committee, Jawaharlal Nehru Medical College, KAHER, Belagavi.

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