

A Study of Age at Menarche of Girls in Mumbai City: Association of Physical Activity, Dietary Pattern and Anthropometry

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Abstract

Hundred girls of aged 13 years and above from schools, sports academies and dance institute from city of Mumbai were selected to examine association between age at menarche (AAM) and its three important determinants namely physical activity, dietary pattern and anthropometry. These parameters were assessed through tools such as case record form, 24 hour dietary record and food frequency questionnaire. Physical activity index was developed as a cumulative factor of intensity*duration*frequency and tested in two experimental groups- girls who had attained menarche (AM) recently at the time of data collection and perimenarcheal girls (PM). The results showed that physical activity was not significantly correlated to AAM in total study population who showed varied physical activity but in sub sample selected as subjects based on high physical activity this factor showed statistically significant influence (with P value 0.000 sig.2-tailed). Protein, fat and iron intake was not found to be statistically significantly associated with AAM. Anthropometrical parameters like weight, BMI and waist circumference showed a statistical significant association with P values 0.010, 0.015 and 0.034 respectively. To conclude in this study AAM was influenced by some anthropometrical parameters and physical activity but not so much by nutritional intake.

KEYWORDS: Menarche, Physical Activity, Diet, Anthropometry

INTRODUCTION

Puberty is defined as the time period of onset of sexual maturity and is manifested between 8 and 14 years of age, by growth of breasts and initiation of menstruation and by the development of pubic and axillary hair. Menarche a milestone in women's life is the first menstrual period, an indicator of reproductive capacity in the girl. The age at menarche as reported in most developed countries is between 12-13 years of age (**Karapanou O. & Papadimitriou A., 2010**). A majority of Indian girls also achieve their menarche by the age of 12-14 years. (**Bagga and Kulkarni, 2000**)

Early age of menarche has significant health consequences. It is associated with cardiovascular incidents and cancer especially of the breast (**Karapanou O. & Papadimitriou A., 2010**). Age at menarche is known to be regulated by factors surrounding the time of puberty, such as genetics, body composition, physical activity and nutrition etc. Nutrition has always been considered a major influential factor in pubertal growth period. Not only the quantity but also quality of food intake is seen to influence puberty. **Berkey et al (2000)** has demonstrated that high animal versus vegetable protein ratio at the age of 3-5 years is associated with menarche, after controlling for BMI.

Along with energy intake, the energy expenditure has been considered as an essential factor influencing the AAM. Too less physical activity leads to increased fat percent in the body that result in early menarche and higher levels of physical activity found to be associated with delayed menarche (**Merzenish et al, 1993**). A cross sectional study performed in a group of Colombian university women demonstrated that age at menarche was positively associated with at least 2 hours daily physical activity (**Chavarro J, 2004**).

Body composition also has an effect on AAM. It is found that anthropometrical parameters, such as weight, height and BMI are strongly correlated with AAM.

A number of western studies have been conducted in the past as well as present however studies in India have been limited. The study was therefore undertaken with the following objectives –

- To identify the girls who have not attained menarche even after age of 13 years and study their physical activity and food consumption pattern.
- To record weight, height and waist circumference of these girls and to calculate their BMI and to see the relationship of these 3 determinants with AAM.

MATERIALS AND METHODS:

This retrospective study was jointly approved by the Departmental Research Committee of S.N.D.T Women's University and Inter System Biomedical Ethics Committee Vile Parle, Mumbai.

Selection of the Samples:

100 Girls above 13 years of age were selected as subjects for the study from the different sports academies, dance institute and schools in the city of Mumbai by Purposive sampling technique. This was done to test the null hypothesis that girls who are physically active experience late menarche. So, physical activity of those girls above 13 years of age was an important parameter for our study.

After receiving official approval from the respective institutes, approximately 400 girls were identified and given an elementary talk. Following this, a pre questionnaire was addressed to identify the girls who had recently attained menarche i.e. after September 2012 as well as girls who had not attained menarche yet. 50 girls who had attained their menarche and 50 girls who had still not attained their menarche were finally selected for the study.

Tools of data collection:

Case Record Form: Case Record Form was used to find out: Name, Date of birth, Age, Family history, Medical history, Type of physical activity with its duration and frequency. Subject's intensity scores were devised on the basis of calories expended per hour for that activity as given by **Mudambi S.R. and Rajagopal M.V. (2007)** and **Oxford Food and Fitness Dictionary (2012)**.

Accordingly the calorie expended per hour in moderate walking is 139, cycling 165, basketball 240, moderate swimming 242, moderate dancing 183 etc. Hence, intensity scores for walking were allotted as 1, cycling as 2, dancing as 3, swimming as 4, basketball as 4 etc. The intensity scores (Table 1) along with duration of physical activity and frequency together were used to calculate the physical activity index for each sample. The formula is given as follows:

$$\text{Physical Activity Index} = (\text{Intensity Factor}) * (\text{Duration}) * (\text{Frequency})$$

Table I: Duration of the activity along with its frequency was with allotted scores

Duration		Frequency	
Time	Score	Frequency	Score
Less than 30 minutes	1	Twice/ day	6
30 minutes	2	Daily	5
45 minutes	3	Alternate days	4
1 hour	4	Twice/week	3
1 ½ hour	5	Weekly	2
More than 2 hours	6	Once in 15 days	1

Food Frequency questionnaire (FFQ): Food frequency questionnaire was designed to record daily consumption of various foods such as Plant and Animal protein, Protein supplements, Cereals and its products, Milk and its products, Fried foods and Chocolates. Paper models of chapatti, phulka, paratha etc. were shown to them along with standard cups, spoons and plates for recording accurate portion sizes and precise quantities.

24 Hour Diet record: This was used to validate the data filled in FFQ. The forms were given to the students and they were instructed to enter the amounts of the foods with the help of household measures and paper models shown to them.

Anthropometric measurements:

Anthropometric measurements such as height, weight, waist circumference were measured. Body mass index was calculated using height and weight measurements Waist to height ratio (WHtR) was calculated by dividing waist size by height.

Statistical Analysis

Statistical analysis was done using frequency, mean and standard deviation for the general questionnaire and the Karl Pearson’s co-efficient correlation for the FFQ.

RESULTS AND DISCUSSION:

Physical Activity:

So far as physical activities of the girls were concerned there was not major difference in the overall activity pattern. This was especially true for duration and frequency of activity as seen from all the four figures given below.

Figure I, II: Duration of physical activity of AM girls and duration of physical activity of PM girl

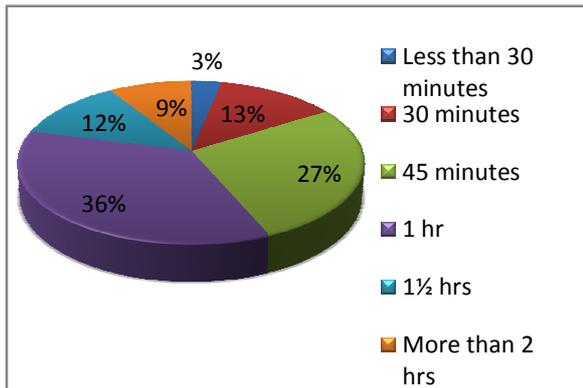


Figure I

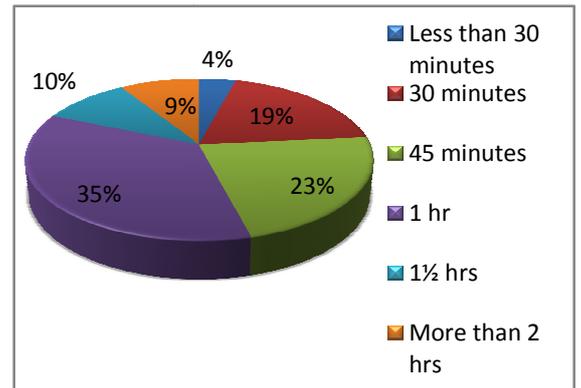


Figure II

Frequency of physical activity of AM girls and PM girls is shown in the following Figure III, IV:

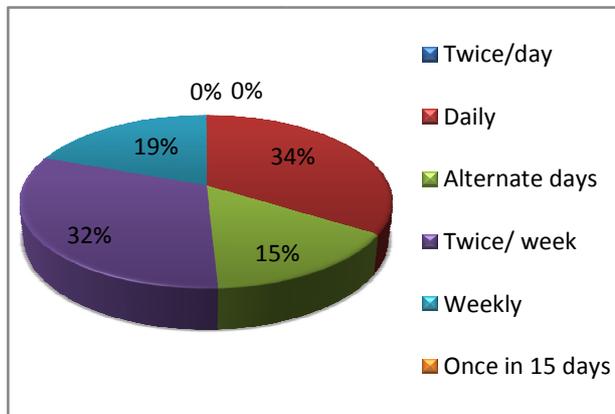


Figure III

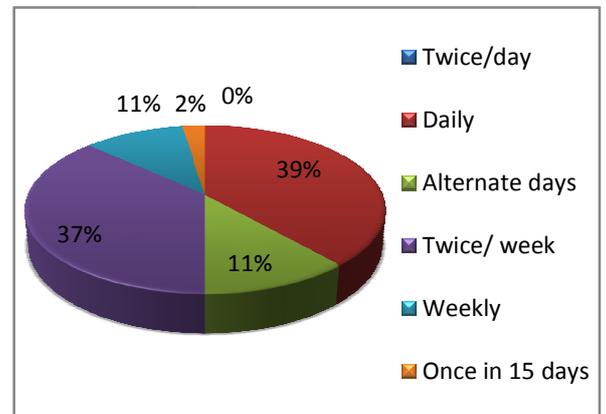


Figure IV

Even though this was so there was measurable difference found in the type of activity undertaken by the subjects of both groups. Girls in PM group were more involved in heavy activities like athletics, basketball and dancing where as girls who had AM showed more indulgence in activities such as walking, jogging and cycling. Therefore logically physical activity index (a cumulative factor of intensity*duration*frequency) should have been much higher in PM group due to their intense activities compared to AM group. In reality it was not so. This probably was seen as its effect was brought down by duration and frequency. [P value= 0.249 for sig. (2-tailed)]

When we further subdivided subjects from both the groups based on volume and rigorousness of total physical activity and conducted t test following results are obtained:

Table II: Mean physical activity index in athletes

Group Statistics				
	Group	N	Mean	Std. Deviation
Physical Activity Index	AM girls	17	93.4706	58.84526
	PM girls	17	314.2941	28.90018

As seen from the above table there was a significant difference in the means of physical activity index of both the group subjects in the sub samples. [P value 0.000 Sig. (2 tailed)]. This shows that physical activity has definite effect on AAM.

Dietary Pattern:

As seen from FFQ overall 68% girls from the total population were consuming milk and milk products daily. Consumption of non vegetarian protein sources such as egg, chicken, mutton and fish was found to be 46.8%. The study group being young students consumption of fried foods was moderately high (67.2%) along with chocolates (58.85%). When both the groups were observed separately it was found that girls who had AM had higher consumption of plant as well as animal protein sources along with fried snacks and chocolates than girls who had yet to attain menarche.(Table III)

Table III: Total consumption of different foodstuff in both groups

Foodstuff	Total consumption (%)	
	AM girls	PM girls
Non vegetarian protein	26.5%	14.5%
Plant protein Pulses, legumes, soya bean	19.3%	12.6%
Fried snacks	13%	9.6%
Chocolates	21.8	15.6

All the above listed foods are rich in fats along with proteins and may contribute to higher fat intake in a diet. This trend makes us think that higher proteins and fat present in the above foods may be contributing to early menarche by accelerating the process of puberty.

24 hour Dietary Record: Mean protein, fat and iron intake did not show major significant difference in these two experimental groups with respective P values 0.811, 0.756 and 0.270 at sig.2-tailed.

Anthropometry:

Height: The average mean height of girls from AM group was 154.17cm ± 7.013 and for PM group, it was 152.26 cm±7.918.

Weight: The average mean weight for the girls from AM group was 45.69 kg \pm 9.132 whereas for PM group it was 40.62 kg \pm 10.251.

BMI: The average mean BMI for the girls from AM group was 19.137 kg/m² \pm 2.9621 whereas for PM group it was 17.447 kg/m² \pm 3.8083.

Waist Circumference: The average mean waist circumference for girls from AM group was 77.903 cm \pm 7.2567 whereas for the PM group it was 74.360 cm \pm 9.0728.

Ratio of Waist to height circumference: The results showed that the average mean waist to height ratio for girls from AM group was 0.5044 \pm 0.04006 and for PM group it was 0.4882 \pm 0.05865.

From the t-test for equality of means it was found that there was no significant difference found in the height and ratio of waist circumference to height in both AM and PM groups of girls. On the other hand significant difference was seen in the anthropometric measurements such as weight (Sig.2-tailed 0.010), BMI (Sig.2-tailed 0.015) and waist circumference (Sig.2-tailed 0.034) in both groups of girls.

Conclusion:

The study conducted showed that there was some association between AAM and physical activity, dietary pattern and anthropometry as determinants of this phenomenon. The relationship between these determinants was not very strong. Physical activity was not significantly correlated to AAM in total study population who showed varied physical activity whereas in subsamples selected from those subjects based on volume and rigorousness of total activity was contributing to AAM. Majority of anthropometrical parameters were positively correlated with AAM whereas dietary pattern did not significantly contribute to menarcheal age.

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