

# Menstrual Characteristics of Adolescent Athletes: A Study from West Bengal, India

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## ABSTRACT

*The present study investigates: (i) differences in menstrual characteristics of athlete and non-athlete adolescents; (ii) relationship between menstrual characteristics, anthropometric variables, athletic status and socioeconomic status. The present study was conducted among 159 unmarried adolescents (80 non-athletes and 79 athletes) of age 15 to 19 years. The study participants belong to Bengali speaking Hindu ethnic group of Kolkata, the capital city of West Bengal State of India. Data were collected on socio-demographic and menstrual characteristics using pre-tested questionnaires. Anthropometric measurements were taken following standard methods. Descriptive statistics were used to understand the differences in menstrual characteristics between athletes and non-athletes, stepwise linear regression analyses were carried out to predict age at menarche, menstrual cycle length and duration of menstrual discharge using socio-demographic and anthropometric variables as well as athletic status as independent variables. Logistic (binary) regression was carried out to assess the strength of association between menstrual characteristics (as dependent variables) and athletic status, socio-demographic and anthropometric variables, and other menstrual characteristics (independent variables). The study participants differ significantly ( $p < 0.05$ ) for certain menstrual characteristics such as age at menarche, cycle length, skipped cycle, premenstrual syndrome, heavy discharge when compared for their athletic status. Certain anthropometric and socioeconomic variables were found to be significantly associated with their menstrual characteristics. The study results demonstrate that menstrual functioning among adolescents is significantly influenced by their athletic status. The findings of this study would help health care professionals to devise future health care programs for adolescents in general and athletes in particular.*

**Key words:** adolescent, athletes, menstrual characteristics, India

## Introduction

The function of menstrual cycle is not only linked with woman's fecundity but it also affects the chronic disease risk factors<sup>1–4</sup>. Therefore, the clinicians and epidemiologists interested in women's health suggest that menstrual cycle patterns provide a view into female reproductive biology<sup>5</sup>. Despite the appeal of this paradigm<sup>6</sup>, only a handful of population-based studies have investigated »normal« menstrual function<sup>7–12</sup>.

The regular physical exercise with a drive of losing body weight is found to disturb reproductive function among women<sup>13,14</sup>. This is likely to be related to decreased percentage of body fat and/or minimal ovarian function as a consequence of diminished hypothalamic or pituitary hormone secretion<sup>15</sup>. Regular physical activity has also been reported to modify cyclic exposure to estro-

gen and progesterone<sup>16,17</sup>. The women engaged in strenuous physical activities may experience a shortened luteal phase, even when no other changes in the menstrual cycle are discernible<sup>18–23</sup>. The hormonal changes behind these alterations may include lower levels of follicular-phase estradiol, lower luteal-phase progesterone, and the absence of the midcycle luteal hormone surge<sup>20,21,23</sup>.

The athletes whose training involves strenuous physical activities have higher prevalence of amenorrhea or oligomenorrhea<sup>15,24–28</sup>. They have higher chance of anovulatory cycles<sup>29,30</sup> compared to sedentary women<sup>31</sup>. It is also noted that the prevalence of oligomenorrhea, amenorrhea and dysmenorrhea vary with nature of athletic practices<sup>32</sup>. Persistent amenorrhea that begins at an early age reduces the benefits of exercise on bone mass

and is also linked with increased risk of musculoskeletal injury, particularly repeated stress fractures during exercise<sup>33,34</sup>.

A late onset of menstruation is observed among athletes who begin their training before puberty, for the sports involving heavy physical activity<sup>25</sup>. Moreover, menstrual disturbances were relatively more common in athletes (43%) who began training before the menarche<sup>32</sup>. The existing body of literature reveals that the efforts to understand the relationship between menstrual characteristics and regular physical activities among adolescent athletes in India remained limited, perhaps owing to poor representation of females in athletic sports<sup>35</sup> though it has gradually increased in last few decades as a consequence of concerted efforts made by the Sport Authority of India (SAI) and other related sport bodies.

The present study investigates differences in menstrual characteristics of athlete and non-athlete adolescents. The other aim is to find out the relationship between menstrual characteristics and anthropometric indices, athletic status and socioeconomic status.

## Materials and Methods

The present study was conducted among 159 unmarried adolescents (80 non-athletes and 79 athletes) of age 15 to 19 years, who has not experienced any major gynecological problems which necessitated them for prolonged medical treatment or hospitalization. They belong to Bengali speaking Hindu ethnic group. The athletes, under training for various track and field events were selected from two of the sports centers under the aegis of the Sports Authority of India (SAI), located in Kolkata, West Bengal. All of these athletes had started practicing sports well before attaining menarche. The non-athlete participants were selected randomly from four schools where the athlete participants were receiving education. List of students from these schools was used as sample frame to select non-athletes randomly. It was ensured that the participants selected under non-athlete category were not involved in any sports that need rigorous physical activity.

The data were collected on (a) socio-demographic (participant's age and their level of education, parents' occupation, monthly income of household), (b) menstrual characteristics (age at menarche, irregular and skipped cycle, the symptoms related to premenstrual problems, characteristics related to menstrual discharge and to other gynecological problems), (c) anthropometric variables (height in cm., weight in kg., biceps, triceps, sub scapular and medial calf skin fold measures in mm. and mid upper arm and medial calf circumferences in cm.). All the anthropometric measurements were made following Lohman et al., (1988)<sup>36</sup>. Body mass index (BMI) was calculated using standard formula. Some additional information was collected exclusively from the athletes participants related to their sports practice such as years of practice, days of practice per week and hours of practice per day.

The age at menarche was ascertained by asking the participants to recall actual date of the incident, if not, then the nearest month. A few of the participants could recall their age at menarche by referring some landmark event or any eventful personal moments (like, her own birthday), which occurred around the time of menarche. The participants were asked to report their experience of irregular and skipped menstrual cycle (if they had any) during the last one year period, prior to the date of survey. However, data on episode of premenstrual symptoms, problems related to menstrual discharge and of »other gynecological problems« were collected for the last three months period prior to the date of interview in order to avoid recall lapse. The following are the definitions of some of the menstrual variables included in the present study: menstrual years of the participant – difference between present age and age at menarche; irregular period – when consecutive menstrual cycles do not take place at a similar interval of time; skipped cycle – when menstrual cycle skips during a particular month or for some months; PMS – women may encounter certain problems (e.g. pain in abdomen and/or back, flatulence and nausea) just prior to the days of menstrual discharge (flow); peak days of discharge (self-assessed) – number of days during which maximum amount of menstrual blood is discharged (flow); duration of discharge – number of days during which menstrual blood is discharged from the body; painful periods – experience of abdominal pain during the days of discharge; heavy discharge (self-assessed) – heavy amount of flow of menstrual blood; nature of menstrual discharge – whether the menstrual blood is fluid only or a mixture of fluid and clot; gynaecological problems – white discharge, burning sensation during urination, increased frequency of urination, leakage of urine and itching around genitalia.

Prior to collection of data, the nature of study was explained to the participants and to their respective authorities and verbal consent was sought from them. To minimize inter-observer bias the entire data (interview schedules and anthropometry) were collected from the participants in person, by one of the authors (PM) during the months of February 2009 to July 2009.

## Statistical analyses

Descriptive statistics were used to understand the trend in the socio-economic profile and variation in menstrual characteristics between athlete and non-athlete participants. Stepwise linear regression analyses were used to predict age at menarche, menstrual cycle length and duration of menstrual discharge using sociodemographic and anthropometric variables and athletic status as independent variables. Logistic (binary) regression was carried out to assess the strength of association between menstrual characteristics (as dependent variables) and athletic status, socio-demographic and anthropometric variables and other menstrual characteristics (independent variables).

The analyses of the data were carried out using the Statistical Package for Social Sciences version 11.0.1 (SPSS Inc., Chicago IL, USA).

## Results

Athlete and non-athlete girls did not differ significantly for socioeconomic characteristics except mean years of formal education (Table 1). Fathers of these girls were mostly engaged in business and in skilled or unskilled works whereas mothers of the girls were homemakers except a few who were engaged in other works. Higher proportion of these girls belonged to the households with monthly income more than Rs. 8000.

Table 2 depicts that athlete and non-athlete girls differed significantly for certain anthropometric variables such as skinfolds of biceps and medial calf, measures of fat distribution in body. Difference for body mass index was not found to be significant.

The study participants differed significantly for certain menstrual characteristics such as age at menarche, years after menarche (menstrual years), cycle length, skipped cycle, premenstrual syndrome, heavy discharge when compared for their athletic status (Table 3). Mean age at menarche was higher among athletes as compared to their non-athlete counterparts. A higher proportion of athlete girls reported to have skipped their menstrual cycle as compared to non-athlete ones. However, duration of menstrual discharge, problem of premenstrual syndrome and heavy menstrual discharge were higher among non-athletes as compared to athletes.

Athletic status and monthly income of the household were found to be significant predictors of age at menarche of these girls (Table 4). Skipping of cycle and premenstrual syndrome were found to be significant predictors of menstrual cycle length and duration of menstrual discharge respectively.

The menstrual characteristics considered in the present study were not found to be significantly associated with each other (results not presented). The results of logistic regression showed that irregularity in menstrual cycle was significantly associated with subscapular skinfold (OR=0.78), mid upper arm circumference (OR=0.70),

**TABLE 1**  
SOCIOECONOMIC PROFILE AND ATHLETIC PRACTICE OF THE PARTICIPANTS

| Variable                           | Non-Athletes (N=80) | Athletes (N=79) | t-value and $\chi^2$ values |
|------------------------------------|---------------------|-----------------|-----------------------------|
| Participants' age (in years)       | 17.03±1.32          | 17.15±1.37      | 0.59                        |
| Father's occupation                |                     |                 |                             |
| Business                           | 30 (37.5)           | 30 (38.0)       |                             |
| Service                            | 27 (33.8)           | 15 (19.0)       | 5.54                        |
| Skilled/unskilled work             | 23 (28.8)           | 34 (43.0)       |                             |
| Mother's Occupation                |                     |                 |                             |
| Homemaker                          | 76 (95.0)           | 78 (98.7)       |                             |
| Others                             | 4 (5.0)             | 1 (1.3)         |                             |
| Participants' education (in years) | 10.60±1.27          | 9.39±2.07       | 4.43**                      |
| Monthly household income           |                     |                 |                             |
| <Rs. 8000                          | 37 (46.25)          | 32 (40.50)      |                             |
| ≥Rs. 8000                          | 43 (53.75)          | 47 (59.49)      | 0.53                        |
| Athletic practice                  |                     |                 |                             |
| Years of practice                  | NA                  | 7.05±3.81       |                             |
| Days of practice per week          | NA                  | 5.27±1.20       |                             |
| Hours of practice in a day         | NA                  | 3.23±1.47       |                             |

\* Significant at 0.05 level; \*\* Significant at 0.01 level; NA – Not applicable

participant's age (OR=0.41) and with days of peak discharge (OR=0.14) (Table 5). Menstrual cycle length (OR=1.19) and duration of discharge (OR=1.68) were found to be significant predictors of skipped cycle. Days of peak discharge was significantly associated to subscapular skinfold (OR=0.86), age at menarche (OR=1.13) and irregularity in menstrual cycle (OR=4.56). Duration of discharge (OR=1.89) was found to be only significant predictor of premenstrual syndrome. The participants of higher monthly income of the household were less likely to report the problem of painful menstruation (OR=0.64). Mid upper arm circumference (OR=0.64) was significantly associated to nature of discharge among present study participants. Irregularity in menstrual cycle (OR=0.10) and days of peak discharge (OR=0.25) were found

**TABLE 2**  
DISTRIBUTION OF PARTICIPANTS FOR SOME ANTHROPOMETRIC VARIABLES (MEAN VALUES)

| Variable                             | Non-Athletes (N=80) | Athletes (N=79) | t values | Total (N=159) |
|--------------------------------------|---------------------|-----------------|----------|---------------|
| Body mass index (kg/m <sup>2</sup> ) | 19.97±2.54          | 19.86±3.85      | 0.211    | 19.91±3.25    |
| Biceps skinfold (mm)                 | 8.60±4.58           | 7.21±3.74       | 2.078*   | 7.91±4.23     |
| Triceps skinfold (mm)                | 11.92±5.71          | 10.86±4.06      | 1.34     | 11.39±4.39    |
| Subscapular skinfold (mm)            | 15.72±5.95          | 15.43±4.99      | 0.33     | 15.58±5.48    |
| Medial calf skinfold (mm)            | 31.95±2.83          | 29.40±4.74      | 4.12**   | 30.67±4.10    |
| Mid upper arm circumference (cm)     | 23.34±2.79          | 22.48±3.89      | 1.605    | 22.91±3.40    |
| Sum of skinfolds (mm)                | 65.65±17.45         | 65.47±12.49     | 0.07     | 65.56±15.14   |

\* Significant at 0.05 level, \*\* Significant at 0.01 level; units of measurements are given in parentheses against variables

**TABLE 3**  
DISTRIBUTION OF PARTICIPANTS FOR REPORTED MENSTRUAL AND GYNECOLOGICAL VARIABLES

| Variable                                      | Non-athletes<br>(N=80) | Athletes<br>(N=79) | t and $\chi^2$<br>values | Total<br>(N=159) |
|---|------------------------|--------------------|--------------------------|------------------|
| Mean age at menarche (years)                  | 12.34±1.34             | 13.66±1.33         | 6.22**                   | 12.99±1.49       |
| Menstrual years                               | 4.68±1.81              | 3.49±1.88          | 4.07**                   | 4.09±1.93        |
| Mean menstrual cycle length (days)            | 30.85±5.76             | 31.54±5.73         | 0.67                     | 31.12±5.74       |
| Mean duration of menstrual discharge (days)   | 5.26±1.25              | 4.49±1.08          | 4.14**                   | 4.88±1.22        |
| Skipped menstruation                          |                        |                    |                          |                  |
| No  | 74 (92.50)             | 49 (62.02)         | 21.07**                  | 123 (77.35)      |
| Yes   | 6 (7.5)                | 30 (37.97)         |                          | 36 (22.64)       |
| Irregular periods                             |                        |                    |                          |                  |
| No  | 68 (80.0)              | 65 (82.27)         | 0.21                     | 133 (83.64)      |
| Yes   | 12 (20.0)              | 14 (17.72)         |                          | 26 (16.35)       |
| Premenstrual syndrome (PMS)                   |                        |                    |                          |                  |
| No  | 12 (15.0)              | 27 (34.17)         | 7.89**                   | 39 (24.52)       |
| Yes   | 68 (85.0)              | 52 (65.82)         |                          | 120 (75.47)      |
| Types of PMS <sup>#</sup>                     |                        |                    |                          |                  |
| Abdominal and/or back pain                    | 55 (44.0)              | 43 (55.12)         |                          | 98 (61.63)       |
| Feeling of heaviness in the body              | 12 (15.0)              | 6 (7.59)           |                          | 18 (11.32)       |
| Acne  | 6 (7.5)                | 10 (12.65)         |                          | 16 (10.06)       |
| Headache                                      | 5 (6.25)               | –                  |                          | 5 (3.14)         |
| Diarrhoea                                     | 1 (1.25)               | 2 (2.53)           |                          | 3 (1.88)         |
| Painful periods                               |                        |                    |                          |                  |
| No  | 40 (80.0)              | 29 (36.70)         | 2.85                     | 69 (43.39)       |
| Yes   | 40 (80.0)              | 50 (63.29)         |                          | 90 (56.60)       |
| Heavy discharge                               |                        |                    |                          |                  |
| No  | 47 (58.75)             | 62 (76.92)         | 7.93**                   | 109 (68.55)      |
| Yes   | 33 (41.25)             | 17 (21.51)         |                          | 50 (31.44)       |
| Number of days of peak discharge <sup>μ</sup> |                        |                    |                          |                  |
| One day                                       | 49 (61.25)             | 55 (69.62)         | 1.30                     | 104 (65.40)      |
| More than one day                             | 29 (36.25)             | 22 (27.84)         |                          | 51 (32.07)       |
| Nature of discharge                           |                        |                    |                          |                  |
| Fluid   | 29 (36.25)             | 35 (44.30)         | 1.07                     | 64 (40.25)       |
| Fluid and clot                                | 51 (63.75)             | 44 (55.69)         |                          | 95 (59.74)       |
| Gynecological problem                         |                        |                    |                          |                  |
| No  | 17 (21.25)             | 23 (29.11)         | 1.30                     | 40 (25.15)       |
| Yes   | 63 (78.75)             | 56 (70.88)         |                          | 119 (74.84)      |
| Types of gynecological problems <sup>#</sup>  |                        |                    |                          |                  |
| White discharge                               | 59 (73.75)             | 54 (68.35)         |                          | 113 (71.06)      |
| Any problem(s) related to passage of urine    | 32 (40.0)              | 10 (12.65)         |                          | 42 (26.41)       |

Figures in the parentheses indicates percentages; # Percentages have been calculated on the basis of total number of participants reported these problems; \* Significant at 0.05 level, \*\* Significant at 0.01 level,  $\mu$  calculated for only 155 participants

**TABLE 4**  
RESULTS OF STEPWISE LINEAR REGRESSION FOR CERTAIN MENSTRUAL CHARACTERISTICS

| Dependant variables             | Significant predictor(s)    | B    | SE   | p-value | R <sup>2</sup> |
|---------------------------------|-----------------------------|------|------|---------|----------------|
| Age at menarche                 | Athletic status             | 0.98 | 0.31 | 0.04    | 0.14           |
|                                 | Monthly income of household | 0.31 | 0.12 | 0.01    |                |
| Menstrual cycle length          | Skipped cycle               | 0.48 | 0.15 | 0.00    | 0.09           |
| Duration of menstrual discharge | Premenstrual syndrome       | 0.60 | 0.27 | 0.03    | 0.11           |

**TABLE 5**  
LOGISTIC REGRESSION: PREDICTORS OF SOME MENSTRUAL AND ZOTHER GYNAECOLOGICAL PROBLEMS

| Variables                                   | Irregular cycle |              | Skipped cycle |               | Days of peak discharge |               | Premenstrual syndrome |               | Painful menstruation |               | Nature of discharge |              | Gynaecological problems |               |
|---|-----------------|--------------|---------------|---------------|------------------------|---------------|-----------------------|---------------|----------------------|---------------|---------------------|--------------|-------------------------|---------------|
|   | OR              | (95% CI)     | OR            | (95% CI)      | OR                     | (95% CI)      | OR                    | (95% CI)      | OR                   | (95% CI)      | OR                  | (95% CI)     | OR                      | (95% CI)      |
| Practicing athlete                          |                 |              |               |               |                        |               |                       |               |                      |               |                     |              |                         |               |
| No  | 1.00            |              | 1.00          |               | 1.00                   |               | 1.00                  |               | 1.00                 |               | 1.00                |              | 1.00                    |               |
| Yes   | 1.42            | (0.04-3.51)  | 0.27          | (0.01-3.22)   | 1.42                   | (0.04-2.51)   | 4.13                  | (0.66-7.58)   | 0.05                 | (0.01-2.66)   | 0.70                | (0.12-5.62)  | 2.16                    | (0.05-6.81)   |
| Years of practice                           |                 |              |               |               |                        |               |                       |               |                      |               |                     |              |                         |               |
| Frequency of practice per week              | 1.03            | (0.79-1.34)  | 0.73          | (0.42-1.27)   | 1.01                   | (0.82-1.25)   | 0.98                  | (0.81-1.18)   | 1.03                 | (0.87-1.21)   | 1.01                | (0.87-1.19)  | 0.86                    | (0.71-1.04)   |
| Hours of practice in a day                  | 1.60            | (0.31-6.14)  | 0.89          | (0.72-1.10)   | 1.10                   | (0.37-3.22)   | 1.93                  | (0.66-5.64)   | 0.47                 | (0.19-1.20)   | 0.69                | (0.28-1.70)  | 0.99                    | (0.35-2.82)   |
| Body mass index (kg/m <sup>2</sup> )        | 0.47            | (0.19-1.15)  | 2.10          | (0.67-6.57)   | 1.05                   | (0.60-1.85)   | 1.25                  | (0.67-2.34)   | 1.35                 | (0.83-2.18)   | 1.08                | (0.68-1.72)  | 1.32                    | (0.70-2.46)   |
| Biceps skinfold (mm)                        | 0.79            | (0.57-1.11)  | 0.95          | (0.71-1.25)   | 1.09                   | (0.84-1.22)   | 0.88                  | (0.70-1.12)   | 1.14                 | (0.96-1.36)   | 0.87                | (0.72-1.04)  | 0.99                    | (0.79-1.24)   |
| Triceps skinfold (mm)                       | 0.96            | (0.74-1.24)  | 1.07          | (0.84-1.43)   | 0.99                   | (0.82-1.19)   | 0.81                  | (0.69-1.14)   | 0.84                 | (0.68-1.04)   | 1.08                | (0.91-1.28)  | 0.83                    | (0.66-0.94)*  |
| Sub-scapular skinfold (mm)                  | 1.32            | (0.94-1.86)  | 1.09          | (0.84-1.43)   | 1.17                   | (0.96-1.41)   | 1.14                  | (0.86-1.24)   | 0.99                 | (0.82-1.19)   | 1.01                | (0.85-1.21)  | 1.03                    | (0.80-1.33)   |
| Medial calf skinfold (mm)                   | 0.78            | (0.62-0.97)* | 0.92          | (0.72-1.09)   | 0.86                   | (0.76-0.98)** | 1.03                  | (0.89-1.46)   | 1.03                 | (0.91-1.16)   | 1.06                | (0.93-1.20)  | 1.15                    | (0.97-1.37)   |
| Mid upper arm circumference (cm)            | 1.18            | (0.86-1.62)  | 0.87          | (0.69-1.11)   | 0.98                   | (0.80-1.19)   | 0.83                  | (0.65-1.05)   | 1.14                 | (0.95-1.37)   | 1.09                | (0.92-1.28)  | 1.07                    | (0.87-1.33)   |
| Participants' age (years)                   | 0.70            | (0.47-0.97)* | 1.08          | (0.79-1.48)   | 1.11                   | (0.86-1.43)   | 1.24                  | (0.89-1.71)   | 0.82                 | (0.55-1.04)   | 0.64                | (0.48-0.94)* | 0.91                    | (0.69-1.20)   |
| Participants' level of education (in years) | 0.41            | (0.21-0.81)* | 0.97          | (0.57-1.64)   | 0.82                   | (0.52-1.32)   | 1.46                  | (0.88-2.43)   | 0.81                 | (0.56-1.19)   | 0.90                | (0.61-1.31)  | 1.23                    | (0.74-2.04)   |
| Father's occupation                         | 0.86            | (0.49-1.53)  | 0.63          | (0.39-0.92)*  | 1.51                   | (1.01-2.31)*  | 0.71                  | (0.46-1.09)   | 1.11                 | (0.79-1.56)   | 1.09                | (0.78-1.52)  | 0.66                    | (0.41-1.05)   |
| Skilled and unskilled work                  |                 |              |               |               |                        |               |                       |               |                      |               |                     |              |                         |               |
| Business                                    | 1.00            |              | 1.00          |               | 1.00                   |               | 1.00                  |               | 1.00                 |               | 1.00                |              | 1.00                    |               |
| Service                                     | 0.46            | (0.07-2.95)  | 0.90          | (0.44-1.86)   | 1.45                   | (0.50-4.24)   | 1.64                  | (0.45-5.92)   | 0.43                 | (0.16-1.16)   | 1.13                | (0.69-1.85)  | 1.59                    | (0.78-3.23)   |
| Monthly income of family                    | 0.28            | (0.04-2.02)  | 0.84          | (0.38-1.67)   | 0.58                   | (0.16-2.10)   | 2.08                  | (0.49-8.71)   | 0.74                 | (0.23-2.35)   | 0.96                | (0.52-1.68)  | 1.62                    | (0.86-4.12)   |
| Age at menarche (years)                     | 1.01            | (0.11-1.11)  | 1.01          | (0.69-1.13)   | 1.01                   | (0.06-1.08)   | 0.86                  | (0.69-1.10)   | 0.64                 | (0.23-0.96)** | 0.92                | (0.61-1.28)  | 1.01                    | (0.63-3.69)   |
| Menstrual cycle length (days)               | 0.99            | (0.57-1.71)  | 0.70          | (0.42-1.19)   | 1.13                   | (1.02-1.59)*  | 0.93                  | (0.64-1.35)   | 0.92                 | (0.68-1.24)   | 0.89                | (0.65-1.22)  | 0.75                    | (0.50-1.12)   |
| Duration of discharge (days)                | 1.12            | (0.94-1.34)  | 1.19          | (1.03-1.37)** | 1.02                   | (0.94-1.11)   | 1.03                  | (0.94-1.13)   | 0.93                 | (0.86-1.02)   | 0.94                | (0.87-1.01)  | 0.92                    | (0.82-1.03)   |
| Irregular cycle                             | 1.21            | (0.64-2.28)  | 1.68          | (1.21-3.10)*  | 1.41                   | (1.05-2.10)   | 1.89                  | (1.12-3.22)** | 1.14                 | (0.79-1.63)   | 0.89                | (0.62-1.29)  | 1.16                    | (0.71-1.90)   |
| No  | NI              |              | 1.00          |               | 1.00                   |               | 1.00                  |               | 1.00                 |               | 1.00                |              | 1.00                    |               |
| Yes   | NI              |              | 2.44          | (0.35-6.74)   | 4.56                   | (1.46-7.54)** | 0.71                  | (0.14-3.56)   | 0.74                 | (0.20-2.72)   | 0.64                | (0.16-2.52)  | 0.10                    | (0.02-0.50)** |
| Skipped cycle                               |                 |              |               |               |                        |               |                       |               |                      |               |                     |              |                         |               |
| No  | 1.00            |              | NI            |               | 1.00                   |               | 1.00                  |               | 1.00                 |               | 1.00                |              | 1.00                    |               |
| Yes   | 3.52            | (0.49-5.47)  | NI            |               | 0.93                   | (0.25-3.53)   | 1.41                  | (0.33-5.99)   | 0.78                 | (0.24-2.49)   | 1.72                | (0.54-5.41)  | 0.46                    | (0.09-1.35)   |
| Painful discharge                           |                 |              |               |               |                        |               |                       |               |                      |               |                     |              |                         |               |
| No  | 1.00            |              | 1.00          |               | 1.00                   |               | 1.00                  |               | 1.00                 |               | 1.00                |              | 1.00                    |               |
| Yes   | 0.57            | (0.11-2.87)  | 1.09          | (0.31-3.82)   | 0.54                   | (0.21-1.39)   | 1.23                  | (0.41-3.71)   | NI                   |               | 2.14                | (1.03-5.02)* | 0.90                    | (0.30-2.71)   |
| Nature of discharge                         |                 |              |               |               |                        |               |                       |               |                      |               |                     |              |                         |               |
| Fluid                                       | 1.00            |              | 1.00          |               | 1.00                   |               | 1.00                  |               | 1.00                 |               | NI                  |              | 1.00                    |               |
| Fluid and clot                              | 0.93            | (0.20-4.39)  | 1.36          | (0.31-3.82)   | 1.70                   | (0.65-4.47)   | 0.84                  | (0.29-2.47)   | 2.09                 | (0.89-4.93)   | NI                  |              | 1.88                    | (0.61-5.75)   |
| Premenstrual syndrome                       |                 |              |               |               |                        |               |                       |               |                      |               |                     |              |                         |               |
| Yes   | 1.00            |              | 1.00          |               | 1.00                   |               | NI                    |               | 1.00                 |               | 1.00                |              | 1.00                    |               |
| No  | 0.36            | (0.06-2.17)  | 2.85          | (0.40-4.67)   | 0.50                   | (0.14-1.79)   | NI                    |               | 0.76                 | (0.26-2.19)   | 0.85                | (0.30-2.39)  | 0.91                    | (0.24-3.37)   |
| Days of peak discharge                      |                 |              |               |               |                        |               |                       |               |                      |               |                     |              |                         |               |
| One   | 1.00            |              | 1.00          |               | NI                     |               | 1.00                  |               | 1.00                 |               | 1.00                |              | 1.00                    |               |
| More than one                               | 0.14            | (0.03-0.69)* | 1.68          | (0.63-2.83)   | 0.47                   | (0.13-1.65)   | 0.59                  | (0.23-1.53)   | 0.58                 | (0.22-1.50)   | 0.25                | (0.06-0.95)* |                         |               |

NI: Not included; \* Significant at 0.05 level; \*\* Significant at 0.01 level

to be significant predictors of gynecological problems among them.

## Discussion

The present cross-sectional study about menstrual characteristics and its correlates among athlete and non-athlete adolescents show that athletic status significantly influences their menstrual functioning. Among athletes, menarche is significantly late and length of menstrual cycle and average duration of menstrual discharge are significantly higher and shorter respectively, compared with non-athlete adolescents. The prevalence of irregular and skipped cycles is comparatively higher among athletes whereas problem of heavy discharge is lower than their non-athlete counterparts. The results of the present study are consistent with the similar studies carried out in other parts of the world<sup>14,30,31,37</sup>.

Both athletic practice and monthly income of household are found to be significant predictors of age at menarche in the present study participants. The studies from other parts of globe have shown that age at menarche is comparatively late among athletes who begin training before onset of menarche<sup>38</sup>. Manila argues that intense physical activity and late age at menarche are strongly correlated<sup>39</sup>. It has been argued that hormonally driven physical and sexual maturation is affected by strenuous physical activity pattern which in turn affects age at menarche among athletes<sup>40,41</sup>. However, in other studies the effects of nutrition, ethnicity and heredity (which have not been investigated in the present study) are also found to determine age at menarche among athletes<sup>41–43</sup>.

The study results indicate that physical activity probably plays a protective role against heavy discharge, painful menstruation and premenstrual syndrome as the prevalence of these problems is significantly lower among athletes than non-athletes. Like other studies<sup>44,45</sup>, here irregular and skipped cycles are the major problems among athletes compared to their non-athlete counterparts. Multivariate analyses show that association between irregular cycle and certain anthropometric indicators remain significant even after controlling for socioeconomic and other menstrual characteristics. It is documented in various studies worldwide that gymnasts and sports-women take hormone pills to regulate their menstrual cycle<sup>46,47</sup>, although, no such behavior was reported among the present study participants.

The results of bivariate analysis suggest that none of the menstrual characteristics (considered in the present study) are significantly associated with each other. However, when controlled for socioeconomic, anthropometric measures and athletic status, relationship between some

of the menstrual characteristics are found to be significant. Hereby, it can be argued that the interplay between these variables has an important role in determining menstrual characteristics among adolescents, as reported in a few earlier studies too<sup>31,48</sup>.

Unlike many other studies, athlete and non-athlete girls do not differ significantly for body mass index<sup>31</sup>, but significant differences are noted for certain skinfolds thickness, the indirect measures of body fat. Proponents of critical fat hypothesis suggest that percent body fat plays a crucial role in initiation and maintenance of normal menstruation<sup>49,50</sup>, though few studies do not subscribe to this view<sup>51</sup>.

## Strength and limitations

The present study deals with an important, however, poorly addressed public health issue among adolescents of eastern India. Moreover, to the best of our knowledge no attempt has been made to understand relationship between physical exercise and menstrual characteristics. Inclusion of anthropometric measures, comprehensive information on menstrual characteristics and modest sample size, are other merits of our study. The study has certain limitations as well. We do not have data on their dietary practices which could provide a better insight into this issue. A study comparing girls who started athletic practice prior to menarche with those who started at post-menarche period and another control group of non-athletes would have been more comprehensive and informative. A study to understand variations in menstrual characteristics among athletes whose levels of practice differ with different athletic events would be worthwhile.

## Conclusion

The study results clearly demonstrate that strenuous physical activity among athlete girls affects their menstrual functioning and thereby may influence their overall future reproductive health. The findings of this study would help health care professionals to render counseling services, health education, and health care for adolescents girls in general and athletes in particular.

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## MENSTRUALNE KARAKTERISTIKE KOD ADOLESCENTSKIH SPORTAŠICA: STUDIJA IZ ZAPADNOG BENGALA U INDIJI

### SAŽETAK

Studija istražuje (1) razlike u menstrualnim karakteristikama adolescentnih sportaša i ne-sportaša, kao i (2) odnos između menstrualnih karakteristika, antropometrijskih varijabli, atletskog statusa i socioekonomskog statusa. Istraživanje je provedeno među 159 nevjenčanih adolescenta (80 sportaša i 79 ne-sportaša) starosti 15–19 godina. Sudionici studije pripadaju govornicima Bengalskog jezika, Hindu etničke grupe u Kalkuti, glavnome gradu Zapadnog Bengala u Indiji. Podaci su prikupljeni za socio-demografska i menstrualna obilježja koristeći prethodno testirane upitnike. Antropometrijska mjerenja su izvršena koristeći standardne metode. Deskriptivna statistika korištena je pri otkrivanju razlika u menstrualnim karakteristikama između sportaša i ne-sportaša, dok je postupna linearna regresija izvršena za predviđanje doba menarhe, menstrualnog ciklusa i duljine trajanja menstrualnog pražnjenja koristeći socio-demografske i antropometrijske varijable, kao i atletskog statusa kao nezavisne varijable. Provedena je logistička (binarna) regresija pri procjeni snage povezanosti između menstrualnih karakteristika (kao zavisne varijable) i atletskog statusa, socio-demografskih i antropometrijskih varijabla i ostalih menstrualnih karakteristika (kao nezavisnih varijabla). Sudionici studije značajno se razlikuju ( $p < 0,05$ ) za određene menstrualne karakteristike poput godina menarhe, duljine ciklusa, preskočenim ciklusima i predmenstrualnom sindromu, uspoređujući ih sa atletskim statusom. Utvrđeno je kako su određene antropometrijske i socioekonomske varijable značajno povezane sa njihovim menstrualnim karakteristikama. Rezultati istraživanja pokazuju kako je menstrualno funkcioniranje među adolescentima pod značajnim utjecajem njihovog atletskog statusa. Nalazi ovog istraživanja mogu pomoći zdravstvenim djelatnicima pri osmišljavanju budućih programa zdravstvene skrbi za adolescente, kao i za sportaše.