MENSTRUAL DYSFUNCTION IN INDIAN SPORTSWOMEN-PHYSICAL AND HORMONAL CHARACTERISTICS

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SUMMARY

This study was conducted among 250 Indian Sportswomen at the National Games held in January 1994. The physical and hormonal characteristics of the athletes were compared with an age matched control of 246 student nurses. There was a 40.1% incidence of menstrual irregularity among the sportswomen who had an average age of 19.48 + 3.96 yrs. The age at menarche was 13.9 + 2.09 yrs. and the gynaecologic age was 5.59 + 3.23 yrs. The Body Mass Index and the Percentage Body Fat of the athletes was significantly higher than the controls at 19.63 + 3.49 ($p<0.05$) and 24.99 + 3.99 ($p<0.05$) respectively. 103 out of 203 athletes with a gynaecologic age >=3 yrs had menstrual irregularity with the commonest being a shortened luteal phase (65.04%). The Body Mass Index of the menstrually irregular athletes (19.65 + 2.23) was not significantly different from the menstrually regular athletes (19.97 + 2.27) but significantly higher than the controls (17.8 + 2.5). The Percentage Body Fat of the menstrually irregular athletes (24.90 + 2.53) was however lower than that of the menstrually regular athletes (25.78 + 2.42) but higher than the controls (23.7 + 3.5) and the difference was significant. 146 athletes complained of pain, 85 of mood changes such as depression, 28 of weight gain and 21 of breast tenderness in association with their periods. The serum Follicle Stimulating Hormone (FSH) in 10 athletes from the study group (10.74 + 2.09) was not significantly different from 10 of the controls (11.8 + 2.5). However the serum Luteinising Hormone (LH) levels in the athletes (18.70 + 3.79) was significantly lower than those of the controls (23.54 + 4.92).

INTRODUCTION

The increasing participation of Indian women in competitive sports is encouraging because exercise is an integral component of a healthy life-style. However literature has shown that intense physical training may alter the Hypothalamopituitary (HPO) axis leading to delayed menarche, anovulatory cycles, oligomenorrhoea and amenorrhoea. In addition female athletes may be subject to long term hazards such as infertility and osteoporosis leading to an increased susceptibility to fractures. In recent years, peak performance conditioning has required more physical training than previously and has meant more stress. Consequently the incidence of menstrual dysfunction and its long term effects have increased.

Current literature on this issue is divided with contradictory claims being made by different workers.

The National Games held in 1994 was an opportunity to study 250 female athletes and to compare their various physical and hormonal characteristics with those of a control group of 246 student nurses.

AIMS AND OBJECTIVES

To determine the following:-

1). The incidence of menstrual dysfunction of Indian sportswoman.

2). The effect of age, body weight, body fat and psychological stress on their menstrual cycles.

3). The hormonal profiles (FSH and LH) of 10 of the atheletes compared with those of age, height and weight matched controls.

MATERIALS AND METHODS

Essentially two groups were studied. The control group consisted of 246 student nurses while the study group was made up of 250 Indian sportswomen.

Information regarding age, height, weight and menstrual pattern was obtained through questionnaires.

The Body Mass Index was calculated by the formula,

BMI = WT. (kg) /HT.m)2

The Percentage Body Fat was calculated by the Mellitis and Cheek equation,

Total Body Water (TBW) = 0.252 Wt.(kg) + 0.154 Ht.(cms) -10.313,

Percentage Body Fat (PBF) = 100 - [(TBW/Wt)/0.72) x100].

Serum FSH and LH levels were estimated from the morning (9:00 a.m.) blood samples taken in the pre-ovulatory phase of the cycle in 10 athletes and 10 eumenorrhoeic cases of the control group.

The mean and standard deviation were calculated for each variable. Differences between groups were evaluated by the paired 't' test. A system for the follow-up of the athletes has been established to study the long term effects of intense physical training on menstrual function and fertility.

The following groups have been made:-

-Group A : study group of 250 sportswomen.

-Group B : cases in the study group with a gynaecologic age (i.e. age since menarche) of more than or equal to 3 years.

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-Group Br : cases in Group B with regular menstrual cycles.

-Group Bi : cases in Group B with irregular cycles.

-Group C : control group of 246 student nurses.

ANALYSIS AND DISCUSSION

Athletes with a gynaecological age of less than three were excluded from the analysis because menstrual cycles immediately after the menarche tend to be anovulatory due to the immaturity of the HPO axis.

According to Frisch (1979) menarche and the maintainence of menstrual cycles require a critical level of body fat. Thus Baker (1981) feels that one can use weight and height to determine the PBF and hence predict when a woman might develop menstrual dysfunction. In our study, as seen in TABLE I, the height and weight of the female athletes were both significantly higher and consequently the BMI

TABLE I
PHYSICAL CHARACTERISTICS OF CONTROL AND STUDY GROUP

Physical Characteristic	Control Group (C) n = 250	Study Group (A) n = 250	P Value
Chronologic age (yrs)	18.08 + 3.22	19.48 + 3.96 (12-34.6)	
Age at menarche (yrs)	14.01 + 1 99	13.9 + 2.09 (10-18)	
Gynaec. age (yrs)	4.43 + 2 34	5.59 + 3.23 (0 - 19.6)	
Height (cm)	146.90 + 20.01	157.39 + 23.42 (100-179)	
Weight (kg)	41.40 + 7.33	50.28 + 8.43 (35 - 74)	
B M I	17.80 + 2.5	19.63 + 3.49 (15.62 - 27.51)	< 0.05
P B F	23.70 + 3.5	24.99 + 3.99 (15.25% - 35.21)	< 0.05
Incidence of menstrual irregularity	18.5%	40.1%	

and the PBF were higher than the controls. This probably relates to the degree of physical fitness of the sportswomen and the fact that they represent a cross section of the country's athletes. However the reports of Feicht et al (1928) and Russel et al (1984) have not supported the Frisch 'Critical Fat' hypothesis.

The gynaecologic age of the athletes (TABLE I) was higher than those of the controls on account of their being older.

A causal relationship between athletic activity and menstrual dysfunction has been reported in the range of 39-50% in various studies (TABLE II). In the present study we found a 40.1% incidence of menstrual dysfunction among 250 Indian sportswomen. Factors predisposing some women athletes to menstrual dysfunction include menstrual dysfunction prior to the onset of training, nulliparity, stress, hours of training per week, diet, weight loss and alteration of body fat percentage (2).

As seen in TABLE III, 100 sportswomen had regular cycles (Br) and 103 had irregular cycles (Bi). The commonest irregularity seen was a shortened cycle length (20-28 days) seen in 67 athletes (65.04%). Studies

TABLE II
INCIDENCE OF MENSTRUAL DYSFUNCTION IN ATHLETES

Study	Incidence
Rougier et al (1962)	Variable
Feicht et al (1978) Marathon runners	50%
Baker (1981)	39%
Present study	40.1%

TABLE III
MENSTRUAL CYCLE DURATION INGROUP B

Cycle Length (Days)	No.
28	100
20 - 28	67
28 - 40	35
41 - 60	1
> 60	0

by Bonen et al (1981) show that low levels of exercise may first lead to a reduction in luteal progesterone levels. At increasing levels of activity there are occasional and then frequent anovulatory cycles, shortened cycle length, oligomenorrhoea and finally amenorrhoea. We observed no cases of amenorrhoea in our study group.

The physical characteristics of Group C were compared with those of Group Br and Group Bi and the results are tabulated in TABLE IV. From here it can be seen that the BMI and the PBF though being higher in Group Bi than the controls, it was significantly lower than the menstrually regular athletes ($p<0.05$).

TABLE V shows the complaints associated with the menstrual cycle in Group A. 146 women complained of pajn, 85 had mood changes such as depression, 28 experienced weight gain and 21 had breast tenderness in relation to their menstrual cycles. This was found to affect peak performance in their respective sport as

TABLE IV
PHYSICAL CHARACTERISTICS IN GROUP Br AND GROUP Bi COMPARISON WITH GROUP C

Physical Characteristics	Group Br n = 100	Group Bi n = 103	Group C n = 246
Age at menarche (yrs)	14.27 + 0.89	13.61 + 0.91	13.9 + 2.09
Gynaec. age (yrs)	6.1+1.64	6.84 + 1.96	5.59 + 3.23
B M I	19.97 + 1.27	19.65 + 2.23	17.8 + 2.5
P B F	25.78 + 2.42	24.9 + 2.53	23.7 + 3.5

TABLE V
COMPLAINTS ASSOCIATED WITH THE MENSTRUAL CYCLE IN GROUP A

Complaint	No.
Pain	146
Mood changes	85
Weight gain	28
Breast tenderness	21

TABLE VI
MEAN FSH AND LH VALUES IN THE STUDY AND CONTROL GROUP

Hormone Estimated	Control Group (n = 10)	Study group (n = 10)
FSH	11.8 + 2.5 (4.4 - 26.0)	10.74 + 2.09 (7.7 - 11.8)
LH	23.54 + 4.92 (10.2 - 42.0)	18.70 + 3.79 (10.2 - 31.0)

TABLE VII
EFFECT OF EXERCISE ON GONADOTROPHINS

Study	LH	FSH
Shangold et al (1979)	slight decrease	no effect
Dale et al (1979)		
- 50% Ovulatory	no effect	no effect
- 50% Oligomenorrhoeic	decrease	decrease
Present study	decrease	no effect

repoted by 70 athletes. Out of these 70, 21 had sought medical help for relief from the associated complaints and had received it in the form of Allopathy in 16 cases, Homoeopathy in 14 cases and Ayurvedic treatment in one case.

The hormonal profiles (FSH and LH) of 10 controls and 10 athletes is shown in TABLE VI. The serum FSH levels in both the study and control groups was not significantly different. However we found the serum LH values to be Significantly lower ($p<0.05$) in the athletes as compared with the controls.

These results are comparable to those of other investigators as seen in TABLE VII.

Adashi et al 1980 have shown that as the percentage of body fat decreases, estrogen metabolism shifts from 16 hydroxylation to 2 hydroxylation leading to the formation of Catechol estrogens.

Catechol estrogens have been shown to decrease LH in women. Exercise has

been shown to increase beta-endorphin Colt et al (1981) and catecholamines Dimsdale et al (1980) in women. Increased levels of beta-endorphins and catechol estrogens have been reported Parvizi et al (1980) to decrease LH whereas catecholamines have been implicated in the regulation of LHRH from the median eminence of the hypothalamus. (Russel et al 1984). This could explain, in part, the low levels of LH seen in the athletes.

CONCLUSION

The present study has been conducted on a large scale in Indian sportswomen. Certain conclusions can be drawn regarding the incidence of menstrual dysfunction in the athletes, their physical characteristics and their hormonal profiles. This area of reproductive medicine needs more work and the follow up of these sportswomen should reveal important information on the effects of chronic exercise on the female reproductive and skeletal system.

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