A study of the effects on the ovarian cycle of athletic training in different sports

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Aim. The purpose of this research was to investigate the effects of sports training on the ovarian cycle of athletes of various disciplines, and of non-athletes, their participation and their performance in competition as well as the appearance of symptoms of discomfort pre and during the duration of menstruation.

Methods. Athletes from the disciplines of basketball, track athletics, gymnastics, swimming, synchronized swimming and water polo as well as non-athletes took part in this research. All the participants, both athletes and non-athletes were selected and completed a specially designed questionnaire.

Results. The results of the research showed that there are no significant differences in the menarche to the duration of the ovarian cycle and to the duration of the menstrual flow. Also, the involvement in different athletic disciplines appears to affect to different degrees the regularity of the cycle although this does not prevent the athlete from participating in training and in competition. The effects are sometimes beneficial to their performance and sometimes they could have a negative effect on their performance. Regarding the symptoms and the discomforts which occasionally appeared pre and during the duration of menstruation e.g. headache symptoms, these appear to be greatly decreased in the athletes of swimming, synchronized swimming and water polo and perhaps this is a result of the beneficial effects of the water. The percentage for abdominal pain appeared decreased for certain disciplines (such as swimming) or stable both pre and during the duration of menstruation. Concerning the pain in the thoracolumbar region, the percentages were different for every sport: a noticeable decrease was recorded for the athletes of swimming, gymnasts, synchronized swimming, water polo, track athletes and the non-athletes, but with an increase for the basketball players. For the symptoms of weakness and fatigue, the percentages were increased for all the athletic disciplines as well as for the non-athletic during the duration of menstruation compared with pre menstruation, although for the percentages for symptoms of nervousness, the picture was different, that is, the percentages appeared decreased during the duration of menstruation.

Conclusion. In conclusion, where problems appear in the function of the ovarian cycle, the assistance of a specialist gynaecologist is considered essential when we are sure that these problems are not caused by training, malnutrition or psychological factors.

Key words: Menstrual cycle - Menstruation - Sports.

Women have become involved in athletics in recent years for reasons of health, appearance and some with the aim of participating in competition. Differing reasons had previously prevented women from systematic involvement in athletics and competition. One of the main reasons was menstruation. In the past, this was considered to be a prohibiting factor in involvement, especially in water-sports such as swimming. Today, there are no medical objections and medical objections providing the swimming pool is properly and hygienically maintained. The problem is considered to be more psychological and social.

The normal reproductive years of the female are characterized by monthly rhythmical changes of secre-
The duration of the female hormones and corresponding physical changes in the ovaries and other sexual organs. The duration of the cycle which is called the monthly ovarian cycle averages 28 days. It may be as short as 20 days or as long as 45 days even in normal women. The ovarian changes that occur during the ovarian cycle depend completely on the gonadotropic hormones FSH and LH secreted by the anterior pituitary gland. At the age of 9 to 12 years, the pituitary does begin to secrete progressively more FSH and LH, which then leads to onset of normal monthly ovarian cycles beginning between the ages of 11 and 15 years. This period of change is called puberty, and the time of the 1st menstrual cycle is called menarche.1

The ovarian cycle can be affected by various external factors, one of which can be the kind of training or exercise or its intensity and duration. This results in the absence of menstruation (amenorrhea) or it can even stop for some days or even though menarche has proceeded. Some other less frequent disturbances are oligomenorrhea (duration of the ovarian cycle is 35-90 days) and short ovarian cycle (duration of ovarian cycle shorter than 23 days). Dysmenorrhea, that is painful menstruation, is also frequent. Disturbances of the ovarian cycle can appear in all women whether they are athletes or not. Nowadays the numbers of women, who are occupied with sports or even want to be champions, have greatly increased; the duration and intensity of training are at maximum levels and this results in disturbance of the hormone proportion. The reduction in estrogen and progesterone and the increase of prolactin in some athletes can cause amenorrhea or oligomenorrhea.2

The purpose of this research was to ascertain the effects of training on the ovarian cycle of female athletes in the following sports: basketball, gymnastics, swimming, synchronized swimming and water-polo, and also non-athlete school girls who only participated in physical education at school. Also, an attempt was made to record the conditions under which the athletes trained and competed in the above sports, their participation and performance in competition before and after the duration of their menstruation, and any symptom or discomforts which presented themselves before, and during the duration of menstruation.

Materials and methods

Different sports and the physical characteristics of subjects (mean±SD) are shown in Table I. The participating athletes and non-athlete schoolgirls completed a specially designed questionnaire.

<table>
<thead>
<tr>
<th>Sport</th>
<th>No</th>
<th>Age (y)</th>
<th>Height (cm)</th>
<th>Weight (kg)</th>
<th>Body fat (%)</th>
<th>BMI</th>
<th>Age starting the sporting (y)</th>
<th>Age starting systematic training (y)</th>
<th>Hours training per week</th>
</tr>
</thead>
<tbody>
<tr>
<td>Swimming</td>
<td>93</td>
<td>16.19±1.31</td>
<td>168.12±8.25</td>
<td>53.21±5.62</td>
<td>20.05±2.43</td>
<td>18.86</td>
<td>9.06±2.70</td>
<td>11.10±2.19</td>
<td>12</td>
</tr>
<tr>
<td>Basketball</td>
<td>62</td>
<td>18.70±2.17</td>
<td>173.45±12.57</td>
<td>62.34±9.43</td>
<td>19.87±2.21</td>
<td>20.84</td>
<td>11.03±2.40</td>
<td>12.71±2.47</td>
<td>10</td>
</tr>
<tr>
<td>Athletics</td>
<td>91</td>
<td>19.19±2.65</td>
<td>164.37±9.79</td>
<td>52.12±8.86</td>
<td>19.38±2.37</td>
<td>19.44</td>
<td>11.8±1.80</td>
<td>13.81±2.21</td>
<td>10</td>
</tr>
<tr>
<td>Gymnastics</td>
<td>34</td>
<td>15.23±2.34</td>
<td>160.26±8.62</td>
<td>45.09±5.55</td>
<td>16.34±1.85</td>
<td>17.61</td>
<td>6.69±1.84</td>
<td>7.76±1.43</td>
<td>14</td>
</tr>
<tr>
<td>Synchronized swimming</td>
<td>29</td>
<td>14.92±1.11</td>
<td>163.76±7.56</td>
<td>48.73±6.82</td>
<td>17.25±1.74</td>
<td>18.38</td>
<td>6.92±1.16</td>
<td>8.48±2.33</td>
<td>16</td>
</tr>
<tr>
<td>Water-polo</td>
<td>65</td>
<td>16.19±1.31</td>
<td>166.37±11.28</td>
<td>53.02±10.37</td>
<td>20.61±2.02</td>
<td>19.28</td>
<td>10.61±2.56</td>
<td>12.35±1.51</td>
<td>8</td>
</tr>
<tr>
<td>Schoolgirls</td>
<td>100</td>
<td>16.64±1.54</td>
<td>163.73±8.71</td>
<td>55.34±9.85</td>
<td>21.22±2.51</td>
<td>20.34</td>
<td>—</td>
<td>—</td>
<td>2</td>
</tr>
</tbody>
</table>

Results

The mean±SD results showed that:

The menarche of the swimmers ranged from 10 to 15 years (age 13.20±1.17), of basketball players from 11 to 16 years (age 13.42±1.29) of track athletes from 10 to 16 years (age 13.23±1.15), of gymnasts from 12 to 17 years (age 14.68±1.52), of synchronized swimmers from 11 to 16 years (age 13.64±1.47), of water-polo players from 10 to 16 years (age 12.88±1.35) and of schoolgirls from 12 to 15 (age 13.14±0.83).

The duration of the cycle ranged from 22 to 35 days for the swimmers (days 27.94±2.76), from 25 to 31 days for the basketball players (days 28.33±1.81), from 25 to 31 days for the track athletes (days 28.47±1.87), from 23 to 35 days for the gymnasts (days 29.68±1.56), from 24 to 33 days for the synchronized swimmers (days 29.81±1.48), from 25 to 34 days for the water polo players (days 28.21±1.80) and 24 to 32 days for the schoolgirls (days 29.05±1.56).

The duration of menstrual flow for the swimmers...
ranged from 2 to 10 d (days 4.88±1.33), from 3 to 7 for the basketball players (days 5.19±1.11), from 3 to 7 for the track athletes (days 5.13±0.96), from 2 to 9 (days 5.88±1.56) for the gymnasts, from 3 to 8 for the synchronized swimmers (days 5.52±0.97), from 3 to 9 for the water polo players (days 5.65±1.09) and from 3 to 8 for the schoolgirls (days 5.56±1.18). The ovarian cycle was normal for 62.3% of the swimmers, 58.1% of the basketball players, 58.1% of the track athletes, 52.2% of the gymnasts, 54.8% of the synchronized swimmers, 67.5% of the water polo players and 61.1% of the schoolgirls. During menstruation, 78.3% of the swimmers trained, 82.4% of the synchronized swimmers, 79.6% of the water polo players and 100% of the basketball players, track athletes and gymnasts. One hundred percent of the basketball players, gymnasts and track athletes took part in competitions, whereas for the swimmers, synchronized swimmers and the water polo players the figures were 98.4%, 95.8% and 98.8%, respectively. As regards performance, 66.3% of the swimmers, 67.7% of the basketball players, 80.6% of the track athletes, 71.3% of the gymnasts, 63.6% of the synchronized swimmers, 76.5% of the water polo players and 61% of the schoolgirls answered that they were not affected by the menstrual flow, and that their performance was satisfactory (Figure 1).

Also mentioned were headache symptoms by 6.5% of the swimmers for both pre and during menstruation, 9.7% and 16.1% pre and during by the basketball players, 9.7% and 19.4% pre and during by the track athletes, 10.1% and 13.6% pre and during by the gymnasts, 8.8% and 9.3% pre and during by the synchronized swimmers, 7.4% and 8.4% pre and during by the water polo players and 19.4% pre and 11.1% during by the schoolgirls.

Discomfort in the abdominal region was experienced by 47.8% of the swimmers pre menstruation and 52.2% during menstruation respectively, 67.7% both pre and during for the basketball players, 54.8% and 61.3% pre and during for the track athletes, 70.1% and 67.6% pre and during for the gymnasts, 52.5% and 47.4% pre and during for the synchronized swimmers, 49.8% and 48.5% pre and during for the water polo players, and 61.1% pre and 47.2% during for the schoolgirls.

Also mentioned was discomfort in the thoracicolumbar region by 54.3% and 48.9% pre and during the duration of menstruation by the swimmers, 58.1% and 71% pre and during by the basketball players, 61.3% pre and during by the track athletes, 76.3% and 70.2% pre and during by the gymnasts, 58.3% and 49.8% pre and during by the synchronized swimmers, 56.4% and 50.8% pre and during by the water polo players, and 61.1% both pre and during by the schoolgirls.

Concurrent with the above discomfort, also mentioned were symptoms of weakness and fatigue in
39.1% pre and 41.3% during the duration of menstruation by the swimmers, 48.4% and 61.3% pre and during by the basketball players, 32.3% and 51.6% pre and during by the track athletes, 44.4% and 56.7% pre and during by the gymnasts, 45.3% and 47.9% pre and during by the synchronized swimmers, 47.2% and 48.7% pre and during by the water polo players and 36.1% and 47.2% pre and during by the schoolgirls.

Symptoms of nervousness were mentioned by 47.8% and 43.5% pre and during the duration of menstruation respectively by the swimmers, 71% and 67.7% pre and during by the basketball players, 54.8% pre and during by the track athletes, 66.8% and 65.9% pre and during by the gymnasts, 50.3% and 48.5% pre and during by the synchronized swimmers, 48.6% and 48.8% pre and during by the water polo players and 50% and 52.8% pre and during by the schoolgirls (Figure 2).

**Discussion**

The results showed that there are no significant differences in the duration of the ovarian cycle (which ranges between 28 and 30 days) between the athletes in swimming, basketball, track athletics, gymnastics, synchronized swimming, and water polo, and, the non athlete schoolgirls.\(^3\)\(^5\) As regards the age of menarche, it ranged around the age of 13 y (which is considered normal for the white race and for the climatic conditions prevalent in Greece) for the athletes of the above disciplines and for the schoolgirls, the only exception being the gymnasts where a noticeable delay was observed around 14.7 years and a smaller delay for the synchronized swimmers of 13.6 years. This delay in the menarche could possibly be due to the nature of the athletic discipline which demands that the athletes of gymnastics and synchronized swimmers should have a lower percentage (%) of body fat and BMI too\(^6\)\(^7\) and could be due to the pre-occupation of the athletes with competition training\(^8\)\(^-\)\(^12\) or to greater fatigue.\(^13\)\(^-\)\(^20\)

Participation in training pre and during menstruation of basketball players, gymnasts and track athletes was to a high level reaching 100%, while the percentage participation for the athletes in swimming, water polo, and synchronized swimming was lower at 78.3%, 79.6% and 82.4%, respectively. The lower percentage of participation in water sports is due to the nature of the training which is carried out in the water and to the attire (swimsuit) as well as psychological, biological, social and personal factors.\(^21\)

In competition the participation of athletes of all disciplines reached 100% except in a few special cases, like for example, where painful menstruation made participation impossible. As regards the subjective estimation of performance of the athletes and the schoolgirls pre and during menstruation, this ranged...
round percentages which reached 60% to 80% with the track athletes claiming better performance in relation to the schoolgirls, the synchronized swimmers, the swimmers and the basketball players who all reported a lower percentage.3-5, 22, 23

Many athletes mentioned pre and during the days of menstruation symptoms and discomforts, like headaches, abdominal pain, pain in the thoracolumbar region, weakness, fatigue, nervousness and others, which had a negative effect on their performance.24 As regards the discomforts and symptoms in the athletes of the above disciplines, one can observe a tendency in some for this to decrease during menstruation in relation to pre, although it increases during the period of menstruation.

An increase was observed in headache symptoms in basketball players, track athletes, and gymnasts during menstruation, something which did not happen with the swimmers, the synchronized swimmers or the water polo players where the percentage remained approximately the same whether pre or during the duration of menstruation, whereas the percentages observed decreased for the non athletes during menstruation.

Here it was noticeable that in water sports (swimming, synchronized swimming and water polo) the headache symptoms appeared in lower percentages pre as well as during menstruation which is possibly due to the beneficial influence of water in which training takes place. The percentages which relate to the discomfort in the abdominal region remained the same, or showed a slight reduction in the swimmers, synchronized swimmers, water polo players, basketball players and schoolgirls during menstruation, with the only difference being that the percentages for the athletes of basketball, gymnastics, and track athletics in comparison with the percentages of the swimmers, synchronized swimmers and water polo players were higher.

As concerns the discomfort in the thoracolumbar region it was observed that the percentages were the same or lower during menstruation than before (pre), with a difference in basketball players and gymnasts who showed the opposite. With the symptoms of weakness and fatigue an increase was observed in the percentages during menstruation compared with pre for the athletes of all disciplines as well as the schoolgirls; although for the symptoms of nervousness, exactly the opposite occurred, i.e. the percentage had increased pre menstruation and decreased during menstruation for almost all the disciplines except for a small increase for the schoolgirls, a fact which indicates that athletics decreases stressful situations. The possible reasons for affecting and disturbing the ovarian cycle and menstruation are the intensity and duration of training,14-20 the lower percentage of body fat,7, 9, 25, 26 psychological stress and stressful situations,27-33 the age of starting training,8, 34-36 hormonal disturbances,37-40 the loss of weight,6, 41, 42 diet 11, 43-49 and others.

Conclusion

In conclusion, the most serious problems of the ovarian cycle should be treated because it has been prolonged amenorrhea. Except for sterility certain cases of scoliosis and an increased number of myoskeletal injuries have been referred to amenorrheic athletes.30 When amenorrhea has a prolonged duration there is a danger of osteopenia or premature osteoporosis.51 Moreover, it has been reported that amenorrheic athletes have an important decrease of bone density mainly in the lumbar region of the spinal cord.52-54 The rates of osteopenia in athletes with amenorrhea were found to be almost similar to women in menopause.54 The reduced level of estrogen in amenorrheic athletes can lead to increased level of lipids in the blood and can cause premature atherosclerosis. Finally, there is a danger of cancer of the genitals in amenorrheic women.55 Women athletes, when there is amenorrhea that is not the result of training, malnutrition or psychological factors should seek the assistance of a specialist gynaecologist.

References


