

Title: Women's Handball: Study and Analysis of the Characteristics Of Sexual Somatotypes in Different Age Groups

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Received Date: January 18, 2025; Accepted Date: January 22, 2025; Published Date: January 27, 2025

Citation: Konstantin Anatolyevich Bugaevsky. (2025) Women's Handball: Study and Analysis of the Characteristics Of Sexual Somatotypes in Different Age Groups. *Biomedical Research and Clinical Reviews*, 10(1); Doi: 10.31579/2692-9406/197

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Abstract

In the presented article we considered the results of the conducted research concerning the features of sexual somatotypes in female handball players. In order to study the features of the values of sexual dimorphism index, we first measured a number of anthropometric indicators. As a result of the obtained data analysis, we noted that the greatest number of female athletes with inverse sexual somatotypes was revealed in groups of adolescents and the first reproductive age. The obtained data revealed the presence in each of the three groups of female handball players those who had a transitional, mesomorphic sexual somatotype. Inverted sex somatotypes were recorded in the older groups of athletes (adolescents and the first reproductive age), where the athletes had the greatest sports experience, and the highest (in terms of time and intensity of training) physical and psycho-emotional loads. The obtained data, indicating the dominance of athletes with mesomorphic and andromorphic sex somatotypes, can be explained by the intensive adaptive somatic changes occurring in female athletes.

Keywords: female athletes; handball; pubertal age; adolescence; first reproductive age; sexual dimorphism index; sexual somatotypes; morphofunctional changes; inversion; adaptation

Aim of the article

The aim of the article is to present the obtained indicators indicating altered anatomical-anthropometric and morphofunctional changes in the somatic components of sexual dimorphism, identified sexual somatotypes, in female athletes of different age groups involved in handball.

Hypothesis of the article

ABBREVIATIONS

- **SDI** - sexual dimorphism index;
- **SW** - shoulder width;
- **PW** - pelvic width;
- **CMS** - candidates for master of sports;
- **MS** - masters of sports.

Methods and means of research

The study was conducted on the basis of sports sections and clubs where female athletes of puberty (n=25), youth (n=27), and the first reproductive age (n=22) trained and played handball. A total of 74 female athletes took part in the study. The level of sportsmanship of the female handball players who took part in the study ranged from the first sports category to candidates for master of sports (CMS) and masters of sports (MS). In conducting this study, we used the following research methods: anthropometric measurements (body length, shoulder width (hereinafter SW), pelvic width (PW). Also, after receiving these anthropometric values, mathematical recalculations were carried out to determine the sexual dimorphism index (SDI) indicators, in accordance with the formula for its calculation proposed by J. Tanner and W. Marshall (1996, 2004) [1, 2, 6, 8, 11, 12].

Introduction

The problems of modern women's sports and the medical and biological problems associated with them are constantly in the center of attention of scientists, coaches, sports doctors, psychologists, physiologists and, naturally, the athletes themselves [1, 3, 4, 5, 9]. Many diverse scientific studies have been conducted concerning various aspects of somatic and psychological changes in the body of female athletes. In any sport involving female athletes, it is necessary to study a variety of morphofunctional changes. The processes of adaptive transformations in female athletes at different ages, in our opinion, have not yet been fully studied and require further, multi-vector research [3, 4, 7, 8]. This also concerns the process of studying the inversions of the sexual dimorphism index (hereinafter SDI), which is directly related to intensive physical and psychological changes in female athletes, both during training and competitions.

Thus, according to the opinion of the majority of researchers of this problem, the process of inversion of the IPD towards masculinization of female athletes increases the likelihood of improving their athletic performance [1, 2, 5, 6, 8, 11].

When analyzing the available domestic scientific and research literature concerning the consideration of issues of sexual dimorphism in women's sports, with the study of the problems of morphofunctional changes in sexual somatotypes in athletes of different age groups, a sufficient number were revealed. However, we practically did

not reveal any research works by domestic and foreign researchers devoted to morphofunctional changes and inversions of the values of sexual somatotypes in female handball players of different age groups. Among the works devoted to the issues of SDI indicators and their study in sexual somatotypes, as well as morphofunctional values and their changes in athletes, the following should be included: Yu.V. Koryagina, S.V. Matuk, 2010; T.P. Zamchiy, Yu.V. Koryagina, 2011; S.Ya. Nadeina, V.M. Zvyagintseva et al., 2011; I.A. Graetz, G.N. Gretz, I.M. Silovanova, 2013; YES. Zaitsev, Yu.P. Ivonina, 2013; N.D. Nenenko, O.A. Abramova, N.V. Chernitsyna, R.V. Kuchin, 2014; V.B. Mandrikov, R.P. Samusev, E.V. Zubareva, E.S. Rudaskova, G.A. Adelshina, 2015; K.A. Bugaevsky, 2013-2018. Issues related to the characteristics of morphofunctional indicators and adaptive changes in female handball athletes in different age groups were dealt with by such researchers as: M.A. Peretryakhina, I.V. Petracheva, 2003; E.A. Oleynik, 2013; M.A. Petrova, 2015; K.A. Bugaevsky, M.V. Mikhalchenko, 2017.

Adaptive processes and their relationship with the level and intensity of the complex of loads in female athletes in their ontogenesis, inversions of a number of morphofunctional indicators and psychological values - this is the area of research interests that can be attributed to the still not fully resolved problems of modern women's sports, requiring close study [3, 4, 5, 6, 7, 11, 12]. The issues of studying morphofunctional changes and inversions of SDI values in women's handball are no exception [1, 10, 11, 12].

Results of the study and discussion

Using the obtained values of the SDI, we conducted somatotyping of the athletes in all three study groups. All athletes in the pubertal age group (n=25) had an average age of 14.25 ± 0.85 years, with experience in this sport ranging from 2 to 4.5 years. The intensity of training was 4-5 times a week, 2-2.5 hours. Their body length was 167.43 ± 0.77 cm, body weight was 59.23 ± 0.45 kg ($p \leq 0.05$) kg. The WP indicators in this group had the following values - 26.74 ± 1.07 cm, BT - 31.78 ± 0.96 cm ($p \leq 0.05$). In the group of female handball players of adolescent age (n=27), we obtained the following data: the average age of the athletes was 18.47 ± 0.78 years. The average body length of the athletes was 171.24 ± 0.76 cm, body weight was 63.59 ± 0.41 kg ($p \leq 0.05$). Anthropometric indicators of the SW were 32.45 ± 1.03 cm ($p \leq 0.05$), the PW was 26.88 ± 1.09 cm ($p \leq 0.05$). The length of practice in this sport was from 4 to 7 years. The intensity of training was at least 5 times a week, from 2 to 3.5 hours.

In the group of female athletes of the first reproductive age (n=22), the following data were obtained: the average age was 23.48 ± 1.18 years. Body length was 174.56 ± 1.07 cm ($p \leq 0.05$), body weight was 67.53 ± 1.26 kg ($p \leq 0.05$). The length of training was from 5.5 to 10 years. The intensity of training was 5-6 times a week, for at least 3 hours. This group of female athletes had the highest level of training in terms of intensity, as well as significant competitive experience. The anthropometric measurement of the SW was 34.47 ± 0.79 cm ($p \leq 0.05$), the PW was 27.13 ± 0.67 cm ($p \leq 0.05$).

The analysis of the obtained results of measuring the shoulder width and pelvis width in all three groups of female handball players shows that in girls the SW significantly exceeds the PW. Moreover, these ratios increase as the athletes grow older. In all three groups, the anthropometric indicators of the pelvis width are less than its anatomical norm of 28-29 cm [1, 7, 8, 10], which is a sign of an anatomically narrow pelvis [1]. At the same time, the body type of most athletes has the form of an inverted trapezoid, which, together with the ratio of the WW/PW indicators we obtained, indicates a masculine body type in female athletes.

After determining the values of shoulder width and pelvis width, all the athletes of the three study groups were divided into sex somatotypes, according to the IPD indicators according to the classification of J. Tanner and W. Marshall (2004) [1, 7, 8, 10]. The results of the conducted somatotyping and the distribution of athletes by sex somatotypes are presented in Table.

Names of the indicator	Gynecomorphic sexual somatotype	Mesomorphic sexual somatotype	Andromorphic sexual somatotype
Pubertal female athletes (n=25)	18 (72,00%) female sportsmens	7 (28,0%) female sportsmens	—
Adolescent female athletes (n=27)	5 (18,52%) female sportsmens	18 (66,67%) female sportsmens	4 (14,82%) female sportsmens
Female athletes of 1st reproductive age (n=22)	2 (9,09%) female sportsmens	15 (68,18%) female sportsmens	5 (22,73%) female sportsmens

Table. Results of the distribution of female athletes by sex somatotypes

As can be seen from the data presented in the table, in the group of female athletes of pubertal age (n=25), athletes with a biologically determined gynecomorphic sexual somatotype dominate. However, a transitional, mesomorphic sexual somatotype is already being formed, more than in every 4th handball player, with a complete absence of representatives of the andromorphic sexual somatotype in this group. In the group of adolescent handball players (n=27), with only 5 female athletes with a physiological gynecomorphic somatotype, there are already 22 (81.48%) athletes with inverse (mesomorphic and andromorphic) sexual somatotypes, dominant in this group.

An even more altered dynamics of the distribution of sportswomen by sexual somatotypes was noted in the group of sportswomen of the first reproductive age (n=22). In this group, only 2 sportswomen still retained the gynecomorphic sexual somatotype, while the inverse mesomorphic and andromorphic somatotypes were already determined in 20 (90.91%) handball players.

The obtained data for all three studied age groups revealed the presence in each of the three groups of female handball players, athletes who had a transitional, mesomorphic sexual somatotype. Its presence in each of the groups is as follows: in the pubertal age group (n=25), it was detected in 7 (28.0%) female athletes, in adolescent athletes (n=27), already in 18 (66.67%) athletes, in the group of handball players of the first reproductive age (n=22) - in 15 (68.18%) female athletes. In all three studied groups of handball players (n=74), the proportion of female athletes with an inverse mesomorphic sexual somatotype was 40 (54.05%), i.e. it was determined in more than every second athlete who took part in the study.

As for the presence of an obvious inversion for female athletes, andromorphic sexual somatotype, its prevalence in all three age groups of handball players is as follows: it was determined in 9 (12.16%) of all athletes. This sexual somatotype was determined by us in athletes of youth (14.82%) and the first reproductive age (22.73%), who had the longest sports experience and most actively participated in the training and competitive process. The total number of young handball players from different age groups, in whom altered, pathophysiological inversion sexual somatotypes (mesomorphic and andromorphic) were determined, was 49 (66.22%) female athletes.

We also established through interviews that the vast majority of female handball players with inverse sexual somatotypes have various, including combined, menstrual cycle disorders, as well as psychological problems manifested both in hostility and aggression, and intermittent manifestations of depression. At the same time, most of the existing reproductive changes are determined in young female handball players who began their intensive sports activities before their first menstruation. These somatic and psychological changes, as well as the identified violations in the manifestations of sexual somatotypes, were assessed by us as the result of adaptive processes in athletes, and are the result of intense physical and psychological stress. The study of disorders on the part of the reproductive system of female athletes and psychological changes will be the goal of subsequent studies in the same age groups of female athletes.

Conclusions

1. Inverse sexual somatotypes were revealed in all the studied age groups – mesomorphic and andromorphic.
2. The presence of inverse sexual somatotypes in all three groups of female athletes was revealed in a total of 49 (66.22%) female athletes.
3. Inverse sexual somatotypes were recorded in groups of female athletes (adolescent and first reproductive age), where the athletes have the longest sports experience and the highest (in terms of training time and intensity) physical and psycho-emotional stress.

4. The numerous inversions of sexual somatotypes revealed in all the studied groups are assessed by us as a result of intense (and perhaps sometimes inadequate) physical and psychological stress.

5. The obtained results of the study fully confirmed the hypothesis put forward by the author of this study.

The prospects for further research in this area consist of studying a number of psychological indicators (levels of aggressiveness, situational and personal anxiety, determination of gender identification of personality type) in this group of female athletes.

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