
# FORECASTING THE PROSPECTS OF 16-17 YEAR OLD HANDBALL PLAYERS OF VARIOUS PLAYING ROLES, TAKING INTO ACCOUNT INDICATORS OF PHYSICAL DEVELOPMENT AND FUNCTIONAL STATE

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**Abstract:** A comparative assessment of the physical development and functional preparedness of 16-17 year old female handball players was conducted, taking into account their playing style. Differences were revealed in the physique indicators of qualified handball players and girls not involved in sports, as well as representatives of game sports - basketball players. The obtained results indicate the need to make additions to the program, taking into account the game situation of the handball players in the training process, the need for timely correctional measures, which will be the basis for achieving a high level of physical fitness of the handball players.

**Keywords:** Handball players, physical development, functional diagnostics, component composition, physical performance, playing style, aerobic capabilities.

**Relevance:** The rapidly increasing competition in sports games requires a new, scientifically based approach, especially in women's handball, when solving the problems of sexual dimorphism, improving the physical, technical and tactical training of handball players. In this regard, in our republic, one of the priority areas still remains the urgent need to use scientifically based modern methods of managing the process of sports training, including the organization of comprehensive control in women's handball. The rapid growth of sports results among handball players in many countries of the world forces us to pay more and more attention to the problems of children's and youth sports, to look for new opportunities to intensify the process of physical and functional training of handball players.

**Degree of knowledge of the problem:** The main indicator of the effectiveness of training highly qualified athletes is their successful performance in competitions. The effectiveness of the educational and training process aimed at preparing highly qualified handball players is achieved through the optimal level of muscle work, varying the volume and intensity of the training load during classes. The age periodization of the development of strength qualities, taking into account the female gender, indicates that the age of 7-8 years is the period when the strength development of girls begins; According to Balsevich V.I., [1; 9-10] 6-10 years is the beginning of the period of development of a whole spectrum of development of physical qualities, including strength qualities. 9-12 years - the period of adolescence development with characteristic growth spurts; 13-16 years is the end of adolescence, and from the age of 16 girls begin adolescence, during which strength qualities sharply increase, since by the age of 15 the final formation of the muscular system is completed [5; 248 10; 353- 363]. Analysis of the literature indicates insufficient development of issues of scientific substantiation of women's sports, including in aspects of the development of physical abilities. When working with women's handball teams, coaches often simply copy the training of men, without taking into account the specifics of the female body, only by reducing the volume and intensity and is not associated with the playing

activities of handball players. Exercises on simulators lead to overwork of female athletes and have a negative impact on the development of motor skills, since they are not consistent with the basic dynamic characteristics of movements in handball. This is the period of maximum age-related development of strength, which accounts for the peak of pure body weight, and 16-21 years is the adolescence period for girls, 17-21 years for boys. To increase the physical fitness of handball players aged 15-16 years, it is necessary to focus on test tasks regarding the requirements of the children's sports school program for physical training. M.A. Petrova developed the features of physical fitness of handball players 15-16 years old with different body lengths. The study showed that in handball high results are achieved by athletes with heights ranging from 165 to 197 cm. Such a wide range of body lengths for female handball players must be considered separately as different categories of players, taking into account their body length [2; 25-28., 4; 140-143., 3; 288]. However, in the scientific literature there is no comprehensive data on the physical development of handball players based on anthropometric and somatotypological research methods. We should also not forget about the peculiarities of indicators of the functional status of handball players, which are a reflection of the physical preparedness of handball players, taking into account their playing role. To do this, it is necessary to know the features of the formation of motor qualities and the specific direction of the process of their improvement. This will allow coaches not only to repeat the recommended options for constructing training, but to consciously modify them based on individual abilities, as well as taking into account the playing role of the athletes. Therefore, when deciding on the transfer of athletes to the next stage of training, it is necessary to take into account not only the morphological, but also the functional capabilities of the athletes [6; 125., 7; 164., 8; 74-82], which was the rationale for conducting this study.

**Material and research methods:** At the first stage of the study, an assessment of general physical development was carried based on anthropometric research methods in athletes involved in handball and girls not involved in sports. The assessment of general physical development was carried on the basis of measurements of the total body dimensions of handball players of various playing roles, in particular, by body length, body weight, chest circumference and MRI - mass-height index. At the next stage, more comprehensive data on the physique structure of female athletes in two compared groups of related specializations - handball and basketball - is presented. The component composition of body weight with the diagnosis of the category of somatotypes of female athletes was carried out on the basis of the Heath-Carter method, 1989, which made it possible for the first time to analyze the similarities and differences in the physique of handball and basketball players. Determination of types of constitutions using the Heath-Carter method, 1989 [9; 256], is one of the universal methods of somatotypology, since it has uniform quantitative approaches for determining the variants of constitutions in people of all nationalities and races, of any age and gender.

Somatotyping was carried on qualified 37 basketball players and 40 handball players aged 16-17 years. Initially, standard measurements were carried out on 7 dimensional characteristics: body length, diameter of the distal part of the shoulder, hip, shoulder circumference in a tense state, calf circumference were determined, and skin-fat folds were measured with a caliper in 4 regions of the body.

The somatotype was diagnosed based on of three components:

I F – fat component of endomorphy; II M – muscular component – mesomorphy; III - P/L – height and weight index. The weight-height index, g/cm, was determined. The endomorphic component was calculated using the formula

F=Σ /sum of fat folds on the back surface of the shoulder, under the shoulder blade, superior iliac, on the lower leg. Mesomorphy component M = Σ (sum of deviations) diameters of the condyles of the shoulder, femur, tibia; 4 and 8 constant. The ectomorphy component was determined using the formula $L^3/P$ of the height-weight index. The X coordinate is calculated as X = III – I components.

The sum of the component evaluation scores does not have arbitrary limits: the sums can be below 3 and above 12. The final assessment of the somatotype is based on a combination of anthroposcopic examination and weight-height index. **Methods of mathematical statistical data processing** To calculate statistical indicators, the following dependencies were used. Arithmetic mean, general formula for ungrouped data: **δ =** standard deviation, x – size of features in the sample, n – sample size. Among the functional indicators, CV - systolic volume, MVB - minute volume of blood circulation, power of 1 and 2 physical activities, physical performance according to PWC -170, an informative indicator according to DMO-determination of maximum oxygen consumption to assess the aerobic capabilities of handball players were studied. Research results and discussion:

**Table 1**

**Comparative assessment of the physical development of handball players and girls not involved in sports**

| Total sizes | Options | Handball n=40 - female athletes | Control n =30 - girls |
|---|---|---|---|
| Body length - cm | M+m (cm) RMS open.. - σ | 165.04±1.6 σ **-7.0** | 162.0± 2.2 - σ -6.0 |
| Body weight - kg | M+m (kg) RMS deviation - σ | 65.0 ±1.93 σ **-10.0** | 58.50±1.4 - σ - 6.63 |
| Girth - see chest | M+m (cm) RMS deviation - σ | 80.6±0.90 σ - 4.88 | 77.5±1.01 σ -7.04 |

Thus, in the Table 1 gives an assessment of general physical development and presents anthropometric measurements taken on 40 qualified basketball players aged 16-17 years, and indicators of the morpho-status of 30 girls not involved in sports served as control. The analysis of total body dimensions revealed differences in length, body weight, and chest girthgroups under consideration, the tallest girls are handball players - body length -165.04±1.6, (σ -7.0), body weight -60.53±1.93, σ -10, and among girls not involved in sports, body length was - 162.0± 2.2 (σ -6.0), the difference was 3.4 cm in favor of handball players, cf. the square deviation - σ was -7, which indicates that the growth of length dimensions will continue. The body weight of non-athlete girls was - 58.50 ± 1.4 kg, with a square deviation σ -6.63, with $p < 0.05$, and for handball players - 65.0 ± 1.93 kg, which is 2.05 kg more. The standard deviation - σ was -10 - this is a high sigma value, which indicates further variability of the trait. (Table 1). In terms of

chest girth with indicators of - 80.6 ± 0.90 cm, with σ -4.88, female handball athletes are ahead of non-athlete girls by 3.1 cm, the chest value was - 77.5 ± 1.01 - with σ -7.04. It is necessary to point out that the sigma indicator for chest girth among non-athletes compared to handball players turned out to be higher and σ -7.04, which is higher; in terms of chest girth, handball players are 3.1 cm ahead of girls. Assessing the physical development of athletes and girls who do not go in for sports, it is clear how much sport has a positive effect on the processes of growth and development, however, for girls who do not go in for sports, the growth processes are not over and will actively continue. It is necessary to pay attention to the values of sigma deviations. The largest value of σ - sigma deviation is expressed by such an indicator as body weight - σ-10.0, which indicates that this indicator will still change, that is, the processes of individual development are not completed. The chest girth of handball players showed an average degree of variability, since the standard deviation was σ-4.88. By generally characterizing the general physical development of the two groups being compared, one can be convinced of how sport has a positive effect on the physique indicators of female athletes, in particular, among qualified handball players.

The results of somatotyping confirm the anthropometric indicators of female athletes in team sports. Thus, both handball players (3.0 points) and basketball players (3.0 points) have the highest degree of ectomorphy (weight-height indicator). The degree of severity of the endomorphic (fat) component is - for handball players - 2.5 points; basketball players have -2.3 points. In all studied specializations, the degree of development of the mesomorphic (muscular) component is high among handball players and reaches 3.8 points, and among basketball players it is lower and amounts to 3.3 points (Table 2). The fact we have identified suggests wide possibilities for trainability of the mesomorphic (muscular) component. Sports performance can be increased through the use of training programs in which, in addition to technical readiness and special performance, attention is paid to strength training, aimed not only at general physical development, harmonious muscle development, but also at strengthening the functioning of the musculoskeletal system of female athletes.

**Table 2**

**Degree of severity of the component composition of body weight of handball and basketball players (n-29)**

| | n =29 | Endomorphy points | Mesomorphy points | Ectomorphy points |
|---|---|---|---|---|
| Handball | 15 | 2.5 | 3.8 | 3.0 |
| Basketball | 14 | 2,3 | 3,3 | 3,0 |

It is known that handball is a team game, therefore handball players are divided according to their playing role: wingers, midfielders, centers, and linemen are distinguished. In this study, we carried out an integrated approach, including not only methods that allow us to assess the characteristics of the physique, but also the functional state, reflecting and predicting the level of development of physical fitness of female athletes, taking into account their playing role.

Analysis of research results makes it possible to conduct a comparative assessment in terms of body composition. In the surveyed sample of athletes, the tallest are the welterweights, whose body length is 167.6±6.22 cm, while low body weight is noted - 56.8±5.98 kg, and a low value of MHI - mass-height indicator equal to -338.31±30.96 g/cm. The most massive are the

"center" ones, whose chest circumference was 84.4 ± 4.4 cm, body weight was 60.6 ± 10.34 kg; MRI - 368.98±53.88 g/cm.

**Table 3**

**Comparative assessment of the total size of handball players, taking into account their playing role**

| **Total body measurements** | Role of players - **($\bar{x} \pm \sigma$).** | | | |
|---|---|---|---|---|
| | Welterweight-10 | Central -10 | Linear-10 | Extreme -12 |
| Body length | 167,6±6,22 | 163,8±5,09 | 165,7±8,89 | 163,1±6,01 |
| Body weight | 56,8±5,98 | 60,6±10,34 | 59,9±7,61 | 58,2±9,1 |
| Chest circumference | 81,1±4,2 | 84,4±4,4 | 83,6±4,93 | 80,9±5,65 |
| MHI – weight-height index g/cm | 338,31±30,96 | 368,98±53,88 | 360,4±32,2 | 358,0±54,67 |

It was revealed that the body lengths are almost the same for the extreme and center ones with low indicators of 163.8 ± 5.09 cm and 163.1 ± 6.01 cm, respectively. It should be noted that the extreme ones have a poorly developed chest, that is, they appear narrow-chested and the chest girth is 80.9 ± 5.65 cm (Table 3). At the next stage of the study, the functional aspects of sports training in women's handball were studied, taking into account the playing role of handball players. As physiological studies have shown, the most significant signs influencing an athlete's results are the functional capabilities of female athletes. Table No. presents aerobic and anaerobic capabilities, the specifics of physical performance, hemodynamic indicators presented in the results of the informative cardio-respiratory system. Thus, before training it is considered mandatory to monitor the state of the cardiorespiratory system; first of all, heart rate and blood pressure - that is, heart rate and blood pressure, and only if the standard indicators are allowed to start training. Here are the results of testing handball players, taking into account their playing specialization: so, at the first load, the value of IOC = minute blood circulation volume for the extreme players was 12.655 ± 2.46 l/min, at the second load - 14.589 ± 2.72 l/min. However, the MIC was 55.1±5.01 ml/kg/min, which can be assessed as "above average" (Table 5). This means that for girls handball players of the "extreme" gaming specialization, for further growth in sports, it is necessary to recommend aerobic loads for the development of respiratory function in the form of running over various distances, which will ultimately lead to the development of the muscles of the lower extremities. It should be noted that in 17-year-old girls who do not engage in sports, the maximum oxygen consumption is 2.19 l/min. or 38 ml/min/kg. Physical performance according to PWC-170 for "line" handball players was -981.4±155.56 kg/m/min; so for healthy women PWC-170 is - 422 – 900 kg/m/min, for men -850 – 1100 kg/m/min. However, taking into account that the examined contingent of handball players is female athletes, these IPC and PWC-170 indicators should be assessed positively.

**Conclusion:** The highest values of the MHI-mass-height index were -368.98±53.88 g/cm, chest circumference was 84.4±4.4 cm, with a body length of 163.8±5.09 cm, with a body weight of 60.6±10.34 kg, found in the center. The lowest MHI value was 338.31±30.96 g/cm. detected in welterweights. For linear and extreme ones, as indicated above, approximately equal MHI values were established - 360.44 ± 32 g/cm and 358.0 ± 54.67, respectively.

**Table 4**

**Comparative assessment of the physical performance and aerobic capabilities of handball players aged 16-17 years, taking into account the playing role ($\bar{x}\pm\sigma$) (n=42)**

| Indicators of physical performance handball players | | Role of players | | | |
|---|---|---|---|---|---|
| | | welterweight | central | linear | extreme |
| CO | I load | 80,1±8,83 | 90,02±14,36 | 85,1±20,74 | 98,7±19,88 |
| | II load | 77,9±8,79 | 89,02±15,64 | 100,94±13,65 | 93,03±38,47 |
| IOC | I load | 10,212±2,17 | 11,340±4,07 | 12,249±2,46 | 12,655±3,09 |
| | II load | 11,569±2,17 | 12,966±3,76 | 14,589±2,72 | 14,956±4,2 |
| Work power | $N_1$ | 647,1±111,68 | $_{754,9}$±178,35 | 701,8±84,59 | 693,6±109,16 |
| | $N_2$ | 778,27±131,51 | $_{1033,9}$±250,7 | 858,8±130,15 | 828,5±70,22 |
| PWC-170 | kg/m/min | 957,4±212,82 | 1234,4±213,03 | 981,4±155,56 | 1072,1±189,74 |
| | Watts | 160,2±34,65 | $_{204,5}$±36,16 | 163,5±25,93 | 178,6±31,63 |
| MOC maximum oxygen consumption | Abs l/min | 3,206±0,64 | $_{3,962}$±0,68 | 3,231±0,34 | 3,423±0,44 |
| | Rel ml/kg/min | 58,8±10,68 | $_{58,9}$±7,01 | 55,1±5,01 | 60,3±9,28 |

As can be seen from the summary table №5, quantitative information indicators are given that reflect the functional readiness of female athletes, in particular, physical performance, aerobic capabilities, as well as hemodynamic indicators of female athletes. The values of MOC, PWC-170, MPC depend on their gaming role. The results for MOC - minute blood circulation volume - show that the surveyed sample of handball players is generally characterized by high performance, which indicates a high level of training. IOC values range from 11.571 ml to 18.699 ml. For the "centers," the average IOC value was 12.966 ± 3.76 ml, which can be considered an excellent indicator of the activity of the cardiorespiratory system. According to PWC-170 - physical performance, the highest FR was found in the centers - 1234 k/m/min, then in the wings - 1072.1 kg/m/min; linear and welterweight athletes are slightly lower, in particular, 981.4 and 957.4 kg/m/min. Accordingly, however, the data corresponds to indicators characteristic of men. MOC is the main indicator reflecting the level of training and aerobic capabilities of the body of female athletes - the highest for extreme athletes and the lowest for linear ones. Thus, the values of MOC, PWC-170, MPC depend on the playing role of handball players and vary widely. All this together requires taking into account the playing role of handball players in the training process, timely implementation of corrective measures, which will be the basis for achieving a high level of physical fitness of handball players.

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