ABSTRACT OF THE DOCTORAL THESIS

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TITLE OF THE THESIS:

OPTIMIZATION OF HANDBALL JUNIOR PLAYERS' PERFORMANCE CAPACITY BY APPLYING OPERATIONAL MODELS SPECIFIC TO THE PHASES OF THE GAME

Key words: *performance, handball, juniors, phases of the game, operational models*

Background

Changes in the world handball confirm again the need to find effective ways for optimizing and supporting the performance capacity.

The evolution of the game proposes a new model of *dynamic* and *anticipate* handball the details of which should be reflected in the training. This is necessary to ensure the player a high functional capacity in order to allow expression of technical and tactical potential.

Based on the theoretical analysis drawn from the specialized literature and from the practical experience gained as a player and as a coach, I believe that it is absolutely necessary to optimize the performance capacity of handball player starting with children and juniors.

In this sense, the work subscribes to the topics related to "optimize the performance capacity" and all our actions determine whether the use of operational models on the phases of the game - we developed and implemented to prepare juniors IV – leads to optimizing the motor and adaptive ability, to increasing the players' motricity and to expand the expression capacity during the game, meaning to optimize the performance capacity within the imposed limits and appropriate to the age junior level IV.

The paper is structured in three parts. The first part aims to delimit and define the field of interest. It includes a summary on the performance capacity and its components, the generating factors of handball training, the technical and tactical game and the benchmarks concerning the game and training specific to the junior handball player. The research has two stages: the preliminary experimental (presented in the second part of the paper) and the experiment itself (presented in the third part).

The purpose of research

The research aimed at optimizing the performance capacity of juniors IV by applying operational models specific to the training phases of the game.

The research premises

To achieve the objectives of the research, we started from the following premises:

- performance capacity - can be the subject of optimization by improving its components;

- the optimization strategy of motor capacity requires knowledge and "reproduction" in preparing the features of the game specific to each competitive level game;

- the reconsideration of the methodology for training the future high performance handball players must be achieved starting with children and juniors, aiming at improving the operational strategies based on the development of indicators of the final model of the the game and on the player.

Research Hypotheses

1. Use of operational models during the phases of the game can lead to optimization of motor and adaptive capacity of juniors within the pattern.
2. Acquiring tactical and technical structures specific to all the phases of the game from the junior level IV leads to increasing the sportsmen motricity and to expand the expression capacity during the game.
3. Approach technical and tactical training from juniors IV folded on all the phases of the game can provide an increase of the junior handball players' performance capacity based on the age level.

Methods

The experimental was conducted between September 2012 - June 2013 and had as main objective the validation of the new approach of optimizing the juniors IV's performance capacity by applying operational models specific to the phases of the game. A comparative evolution of the two groups included in the survey was done: the experimental group - made up of players from LPS (Sport High School) Targu Jiu (n = 14, with a mean age of 12.33 years) – to whom was applied the new training program and the control group - represented by the players from CSS Craiova (n = 13, with a mean age of 12.25 years) - which followed a classic training program.

The operational models used in the experimental group included exercises for learning and strengthening the phases of the game specific to the attack (counterattack, sustained counterattack, organizing the attack, the attack in the system) and to the defense (muster, temporary zone, defense organization, defense system), and means for developing the motor capacity (speed, strength, coordination abilities and power).

The complete image of the sportsmen's adaptive process was achieved by anthropometric measurements, samples of effort and motor testing.

Results

Regarding the somatic profile of the subjects and its dynamics, a natural development can be noticed, within the appropriate age level, but also within the specific FRH model for 11-12 years. These are confirmed by the evolution of the following parameters:

Height. This parameter shows that the averages of the two groups increase significantly from one test to another (to 2.85% - the experimental group, with 2.47% - the control group), and the differences of the groups' averages are not significant in either of the two tests.

Weight. The recorded averages increase significantly from one test to another (with 1.55% - the experimental group, with 3.73% - the control group) and the differences between the groups' averages are not significant in any of the two tests.

Amplitude. Between the two tests the value of the amplitude increases (with 2.40% - the experimental group, with 1.88% - the control group), and the differences between the groups' averages are not significant at the initial testing or at the final testing.

Palmar longitudinal diameter. In terms of progress between the two tests, it appears that the groups' averages increase significantly from one test to another (with 4.80% - the experimental group, with 3.60% - the control group) and the differences between groups' averages are not significant in any of the two tests.

Biacromial and bitrohanterian diameter. In both cases the averages of the two groups evolve positively, the recorded differences (2.87% - for the experimental group, 2.18% - the witness group, 3.14% - for the experimental group, 2.35% - for the witness group) were significant. However, differences between the groups's averages are not significant in any of the two tests.

The body mass index. This indicator depending on the weight and size of subjects shows that the two groups belong to the category of normal ponderal as the averages of the tests are within the indicator that defines this situation (from 18.50 to 24.90 kg/m2). Dynamically, the averages of BMI increase significantly from one test to another (4.03% - the experimental group, with 1.23% - the control group), and the differences between the groups' averages are not significant in any of the two tests.

Thoracic perimeter. The recorded increase for this perimeter was of 1.17% in the experimental group and 0.73% in the control group - for determination during the rest 1.23% in the experimental group and 0.53% in the control group – for the thoracic perimeter in inspiration for the chest area and 0.97% in experimental group and 0.21% in the control group – for the thoracic perimeter in expiration. Differences from one test to another are significant, except for the control group registered at the thoracic perimeter in expiration. Differences between the groups' averages are not significant in the initial testing or the final testing.

Thoracic elasticity index. Resulted from measuring the thoracic perimeters in dynamics, the average of the index increases by 28.21% in the experimental group, the difference between the tests' averages are significant and by 10.19% in the control group, the difference is not significant. No significant differences between the averages of the two groups were noticed.

Erismann Index. It reflects the thoracic robustness and has a positive evolution, registering significant differences between each group's average (24,52% 24,78%) and insignificant between the initial and final testing averages.

Palmar force. Concerning the data reflected by dynamometry, a positive development of the two groups from one test to another and a better performance obtained by the experimental group can be noticed. The right palmar force increases by 23.01% - the experimental group and by 10.52% - the control group and the left palmar force increases by 20.45% - the experimental group and 14.10% - the control group in both groups significant differences being registered. Both the initial testing (in both cases) and the final testing (in both cases) present no significant differences.

Shoulder strength. In this case, the progress of experimental group - 27.54% is higher than that of the control group - 16.54%, the differences being significant. There are no significant differences between the groups' averages.

Evaluation of spirometry (*Microlab 3300 spirometer*)

Forced expiratory volume recorded in 1s (FEV1). Dynamically this perimeter evolves positively, the experimental group registering an increase of 30.05% and at the final testing the average falls within the recommended range. The average of the control group increases by 13.66%, but this does not ensure the reaching of the lower limit of the range. Both groups register significant differences between the averages of the tests, and if the difference recorded between the averages of the two groups at the initial testing is not significant, it is at the final testing ($p < 0.05$).

Peak expiratory flow (PEF). The initial status of the two groups in terms of the maximum flow is correlated with FEV1 and is characterized by values of the averages below the lower limit of the intervals. In the final testing, the experimental group reaches the interval limit (average increased by 40.13%), but the average increased with 19.49% does not ensure the fullfilment of the condition for the control group. Groups register significant differences between the testing averages. The difference recorded between the averages of the two groups at the initial testing is not significant, but it is significant at the final testing ($p < 0.05$).

Vital capacity. If at the beginning the groups' averages have values less than the lower limit of the expected range, at the final testing, the recorded progress (41.01% - experimental group, 13.92% - control group) ensures the compliance with the limits of the average only for the experimental group. The differences between the obtained averages are significant for each group. The difference between the averages of the two groups at the initial testing is not significant, but it is significant at the final testing ($p < 0.05$).

Forced vital capacity (FVC). In the initial testing, the groups have a similar situation, so their averages are not within the provided interval. This is closely related to the evolution of FEV1 indicating a severe respiratory disability that justifies the need to introduce specific exercises for trunk muscle development in the training programme. At the final testing only the average of the experimental group fits the recommended interval. Differences between the two groups are significant. The difference between the averages of the two groups recorded at initial testing is not significant, but it is significant at the final testing ($p < 0.05$).

Tiffneau Index FER. It expresses the ratio FEV1/FVC and falls in age-appropriate normal values (70-100) in both tests, both for the experimental group and the control group, which argues that the values of the two parameters, FEV1 and FVC, have no pathological

significance, in our case, these results are explained by the muscle and kinetic insufficiency of the chest which is specific to the evaluated subjects' age.

Schellong test. In the initial testing, the results of this test showed a good cardiovascular neurovegetative reactivity to changes in position in both groups. This balance allowed a training program in accordance with the research, while the sportsmen were in a period of endocrine-metabolic instability. In the final testing both groups showed a normal reaction to this test, but the experimental group presented a better neurovegetative adaptation of the cardiovascular system, the variation being much less (variation FCC FCO is 5.57 b / min - the experimental group and 8.92 b / min - the control group, the variation TASc-TASo is 1.78 mmHg - the experimental group and 9.23 mmHg - the control group, the variation TADc-Tado is 2.85 mmHg – the experimental group and 8.08 mmHg - the control group).

Jump test (Myotest Pro). It is used to assess anaerobic capacity, the test allowed to observe the state and evolution of specific parameters. Analysis of the measured parameters confirm the existence of a favorable evolution of explosive muscle strength in the experimental group (33.08% - Fmax, 34.91% - Fmed) than the control group (12.77% - Fmax, 12.65% - Fmed). These are evident in the speed of execution, where the progress of the experimental group is higher (33.15% - Vmax, 33.12% - Vmed) than the control group (11.76% - Vmax , 12.18% - Vmed), and even of the the height on the vertical (hmax - 33.86% hmed - 36.68% - 12.15% hmax; hmed - 11.64%). Concerning the stiffness it is observed that its dynamics is similar to the mentioned parameters, the increase of the experimental group (35.49%) being higher than that of the control group (12.80%).

The increases of the general and specific motor skills are reflected in the progress obtained in the tests related to: speed (progress: 8.22% - the experimental group, 5.88% - the control group); force of arms (51,56% - experimental group, 24.91% - control group); explosive power of the lower limbs (29.51% - experimental group, 12.42% - control group); strength in the abdominal muscles (18.24% - experimental group, 10.08% - control group), the back muscle strength (20.35% - experimental group, 11.95% - control group), resistance (15.34% - experimental group, 9.30% - control group) and implementation capacity with an increase of efficiency indices and of specific content elements in handball game: dribbling among milestones (5.82% - experimental group 3.40% - control group); triangle movement (14,26% - experimental group, 8.74% - control group); handball throwing (25.42% - experimental group, 15.92% - control group).

Regarding the ability to execute the content elements specific to the game, it is noticed that the progress of the experimental group is higher than at each of the four phases of the attack and at the four phases of the defense, as follows: 22.65% for experimental group group and 12.63% for control group- in counterattack, 33.05% and 12.59% - supported counterattack, 27.86% and 16.49% - organizing the attack, 28.85% and 13.00 % - attack in the system, 28.13% and 16.14% - muster, 27.74% and 12.72% - temporary area, 35.17% and 13.44% - defense organization, 25, 50% and 15.99% - defense in the system.

Conclusions of the experimental

Hypothesis 1, which implies that "the use of operational models during the phases of the game can lead to the juniors' optimization of motor and adaptive capacity within the limits of the model" is confirmed taking into account the following:

Increases of general and specific motricity can be noticed for both groups included in the survey, but progress is higher in the experimental group. For samples related to *general motricity*, the differences between the averages of the groups, in the final testing, are significant at $p < 0.01$, where indices of: speed (2.29%), back muscles power (5.09%) and strength (6.14%) and $p < 0.05$ for: strength in arms muscles (12.57%), force of the abdominal muscles (5.23%) and the manifestation indexes of explosive strength in legs (4.01% - in long jump test and 13.34% - height jump). Regarding the *specific motricity*, the differences in the final testing are significant $p < 0.01$ at: manifestation of throwing force (9.01%) and the specific movement speed (4.24%), and $p < 0.05$ for coordinative ability (skill) in speed (1.97%), thereby the index improving to the preliminary research.

Observing *the dynamics of the respiratory parameters* obtained after using the spirometry assessment, there is a positive development of groups, but only the experimental group's results in the final testing fit the recommended interval for the age and the development stage. The value of parameters and especially the differences between groups at the final testing (15.45% - the forced expiratory volume recorded in 1s, 13.42% - peak expiratory flow rate, 13.33% - the vital capacity; 12 14% - the forced vital capacity) - differences that have been significant at $p < 0.05$, confirms that the training program has been effective from this point of view too.

Also from functional and adaptive point of view, Schellong test shows that the experimental group has a better neurovegetative adaptation of the cardiovascular system.

Another indicator that shows *the evolution of anaerobic capacity* - The *Jump test* applied using Myotest Pro equipment - reflects the improvment of the evaluated parameters, namely force, speed, height separation both in their 'maximum' (obtained in one jumping) as below the "average" values (average of all jumps), and the stiffness. The progress of the experimental group is higher than that of the control group, the differences of the groups' averages at the final testing (17.40% - maximum force, 18.02% - average force, 17.22% - maximum speed , 17.14% - at medium speed, 16.71% - the maximum height of the detachment, 18.85% - the average height of detachment, and 19.73% - muscular elasticity) being significant at $p < 0.0$ which confirms that the program is effective.

The comparative analysis of the results obtained by the experimental group and the control group in evaluating the phases of the game, allows us to conclude that, hypothesis 2, that the acquisition of specific technical and tactical structures of all phases of the game since the junior IV level leads to increased motor skill of athletes and to the expansion of the expression capacity during the game, it is confirmed in practical terms, as follows:

The progress of the experimental group allowed superior performance to the control group, even if at the initial testing the control group experienced better results. From the point of view of the differences between the averages of the two groups recorded in the final testing, we can notice the following:

- In the attack phases, the differences recorded in counterattack (8.07%), sustained counterattack (15.43%) and organization (9.32%) are significant at $p < 0.01$, and the attack in the system (6.90%) is significant at $p < 0.05$;

- Concerning the defense phases, the differences in the temporary zone (13.01%) and the defense organization (15.54%) are significant at $p < 0.01$, while the muster (6.55%) and defense in the system (6.50%) are significant at $p < 0.05$.

In conclusion, the results obtained in the research emphasize the improvement of somatic functional, general and specific indices and so hypothesis 3 that "approach the technical and tactical training to the juniors IV folded on all the phases of the game can provide an increase of the handball junior players' performance capacity within appropriate age level "is confirmed.

General conclusions

- Analysing the specialized literature we can note that the most important factor in increasing the performance capacity, at individual and team level, is the quality of training, and therefore, the means and methods of training which ensure the production of specific adaptive changes on the skills.
- Increasing and maintaining the rhythm of the game during the game overwhelme the body. Therefore lifting the handball player's performance capacity is a priority since children and juniors. This is confirmed in the present research by the results of the survey.
- In both stages of the research, the purpose and objectives were achieved. The analysis of the obtained data confirm that the approach of tactical and technical content by specific operational models to the phases of the game for juniors IV contributes to the development of motor and adaptive ability (general and specific), and thus to the expansion of expression capacity during the game.
- Based on the results and especially on the experimental group's progress when assessing the functional parameters, the general and specific motricity's parameters (including those of the phases of the game), we state that "approaching technical and tactical training to juniors IV folded on all the phases of game can provide an increase of junior handball players' performance capacity within the appropriate age level."

Summary of the Personal Contributions

From a theoretical perspective, the paper aimed at achieving a synthesis of information related to the performance capacity, the training regarded as a shaping factor of performance capacity in handball, the technical and tactical game content and the landmarkers concerning the model and the training of junior handball player, filling up with new ideas the approach of technical and tactical training.

From practical point of view, the personal contribution arises from the fact that by designing and implementing operational models directly oriented on the phases of the game in training the junior IV handball players led to a better process of training and to optimization of performance capacity - within the level age, creating a favorable conjuncture for achieving superior athletic performance. Also, the Jump Test with support of Myotest Pro equipment was used for the first time research was first used in assessing the anaerobic capacity of junior handball players.