



## **Physical condition in high performance team handball (requirements)**

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**Abstract:** the paper presents a proposition for a discussion concerning the understanding of the notion of physical condition, its component elements and the requirements concerning the level of physical condition of the high performance handball players. The paper has as a final objective the building of a handball player model from this point of view.

**Key words:** physical condition, abilities (skills), effort, adaptation, movement ability, state of health, somatic features, mental and motion abilities, fitness.

### **Motivation**

In performance and high performance sport, a great importance is given to the physical condition. It is in fact the preoccupation for the adaptation of the sportsman's body to growing physical and mental efforts, to which all the parts of the human body participate.

The very different way of presenting the physical condition needs a higher preoccupation for its study when we refer to performance and high performance sport.

The very limited number of papers concerning this problem of the handball game implies the stimulation of the researches for studies concerning this game.

Physical condition is a notion used with different meanings:

- It is compared to the physical fitness, as a condition of the state of health;
- As a factor of performance in the high level sport;
- As being a term which emphasizes the degree of development of the mental and movement skills or of the work ability;
- As general resistance (endurance) or aerobic fitness.

The term is mostly used as fitness, in order to emphasize the function level of the cardiovascular system, the maximum O<sub>2</sub> consumption, the effort ability, the energetic supply and the performance ability of the individual, when we refer to the whole population.

The limitation in meaning of the notion of physical condition, when we refer to performance sport, only to the general physical condition (fitness) or only to the mental and movement abilities can determine an incomplete understanding of this notion.

As to the things mentioned above, we think it is time to start a discussion having two main objectives: to give a complete definition of the notion of physical condition when we refer to performance sport and to determine the requirements for each component of the physical condition concerning the handball game.



## **Hypotheses**

The thorough study of the notion of physical condition as a component of the play model may lead us to the conclusion that important differences can appear between the meaning of this notion in performance sport and the one which defines fitness.

A complete analysis of the elements which make up the physical condition could make us attribute to it a more comprising range and maybe the attribute of the most important factor for performance and high performance handball.

## **Method**

The scientific work is based on the data obtained on the occasion of the great international handball competitions, data included in the works of some other well-known researchers (see the bibliographic list). A significant number of the abroad researchers' papers have been studied, as well as materials of some Romanian authors. The respective parameters and indicators have been analyzed and compared in order to make up some data which would contribute to achieving the objectives of this work.

For the confirmation of some data we have also used the investigation method by means of a verbal questionnaire, carried out with the coaches of the National League teams.

## **Data presentation and discussion**

### **Delimitation of the terms**

Initially, the generic notions have been delimited: condition, physical condition, conditioned, physical, ability (Explanatory Romanian Dictionary).

Terms from the specialty literature referring to the physical condition presented by the following researchers have been analyzed: (9, 12, 16, 17, 23, 24, 25, 28, 29).

Critically analyzing the data of the above mentioned researchers, we consider that the following definition of the physical condition would be appropriate, definition which belongs to us:

The physical condition represents the whole potential of a particular sportsman in a particular sports field, potential on which depends the adaptation to a certain effort in order to obtain high performance. This refers only to performance and high performance sport and includes the following elements or components, among which there are certain internal and external interactions: the state of health or the medical health condition, the somatic abilities of the player, the mental and movement abilities or the physical ability, the functional ability, the energy resources, the movement skill or the movement technique, the mental ability, the recovery ability, the skills, the movement agility, the knowledge.

Applying the above mentioned elements of the physical condition to the handball game by means of concrete data and numbers represents the model of physical condition for the performance handball game, model to which we would like to add a modest contribution. The stages of the physical condition which are developed from the point of view of the didactical technology will be included in the present work.



## Delimitation of the physical condition elements reported to the performance handball game

### The state of health

The medical condition implies visits to the physician during which a general physical checkup, an orthopedic checkup, laboratory tests, nutritional analyses, the determination of the fat percentage, mobility, force and aerobic power tests, etc are done.

The biochemical tests will reveal a series of data about the supplies of A.T.P., CP, transfer speed of the CP + ADP, ATP, CP, the anaerobic glucose decomposition process, the appearance of the lactic acid in the blood, the ability to adapt to accumulations of lactate. Laboratory tests do not show the quantity of substance in the total serum which is reported to the normal concentrations. All these data will contribute to determining the health level which should be inexorable (1, 2, 4, 5, 11, 13).

### The somatic abilities of the (male) handball player

The somatic type helps or stops the physical condition and the following must be known: size, shape, proportions, composition, degree of maturity, some functions. The following are measured: body mass (weight), stature (height), thickness in different parts, length of the body, circumferences and diameters. From the data obtained, proportionality and nutrition indices can be derived.

**Table 1. Somatic requirements for the high performance male handball teams**

Parameters	Place in the team					
	X	Goal keeper	Wings right/left	Pivot	Back right/left	Center
Height	196,6	195	191	194	208	195
Weight	95,2	95	91	99	99	92
Proportionality index	2,0	2,0 A	2,0 A	1,9 FP	2,1 PD	2,1 PD
Nutrition index	484,4	487 R	475 R	510 FR	475 R	475 R
Span	202,2	204+9	193+2	197+3	212+4	205+10
Palm opening	24,5	-	22	25	26	25

The following somatic types match best with the requirements of the handball game:

- Muscular – bony – mesomorph for pivots and wingmen;
- Endo – meso – octo – morph for 9 meter players.

In the hierarchy of the favoring predispositions, stature and body harmony are on the first places.

If muscles are also included in the somatic type, it is better to explain that there are two main types of muscular fibers: with quick contraction (Fast twitches - FT), which perform better the anaerobic energy and the fibers with a slow contraction (Slow twitches



ST) which perform better the aerobic energy. The muscle is the central element in the structure of the body (6, 7, 10, 14, 25).

### **Mental and motion abilities needed during the practice of the handball game**

#### **Conditional abilities**

- maximal-dynamic force: in the fight with the opponent;
- static force: in defense situations;
- sprint endurance force: counterattack - regrouping;
- throwing endurance force: passes – goal throw;
- fight endurance force: 1 to 1 fight;
- power endurance force: defense, dribbling past the opponent, jumps;
- long-term endurance: 2 halves of 30 minutes with a 10-minute break;
- power endurance: for a large number of actions during the fight with the opponent, acceleration, deceleration, changes of direction, and others.

#### **Coordination abilities**

During the handball game, coordination appears in all its forms:

- control ability: the evaluation of the information (teammate – ball – opponent) and the accurate estimation of the following movement;
- rhythm ability: integrating the actions in time and free-will actions;
- differentiation ability: kinesthetic, the movement action is distinguished and evaluated under the influence of the nervous system;
- balance ability: to insure a correct position of the body during the motion actions (technical-tactical methods);
- reaction ability: should react as quickly as possible during the technical-tactical game actions;
- ability of combining and matching the movements: performance of complex actions made up of many tactical methods or situations;
- space orientation ability: temporal, determination of the court area, of the teammate's position, of the moment when the opponent takes action;
- anticipation ability: to foresee the actions that are going to follow;
- ability of changing the movements: the quick transition from some gestures and actions to others (even before the first one has finished).

#### **Elasticity – suppleness – joint and muscles flexibility**

As a variable index of the physical condition, it is characterized by amplitude – stretch – shortening, it is present in most specific movement gestures in handball, it is defined as the size of the movement amplitude of a joint and it helps in the correct performance of the technical procedures (8, 10, 15).



**Table 2. Mental and movement requirements (control tests) in male handball**

Ability	Test	Place in the team					
		X	Goal keeper	Wings right/left	Pivot	Back right/left	Center forward
Movement speed	50 m (s)	6,02	6,03	6,01	6,02	6,02	6,02
Endurance	Cooper test 12' (m)	3440	3300	3500	3400	3600	3400
Force (speed-force)	Length from a stationary position (m)	275	275	275	275	275	275
Speed endurance	Running 5x30 m	4,01	4,01	4,00	4,01	4,01	4,01
Throwing force	Throwing the ball (m)	54	48	52	52	60	58
Coordination and speed	Dribbling in zigzag 30 m	6,05	-	6,05	6,05	6,06	6,05

**Table 3. Requirements for the joint and muscle amplitude (Chevyl, L., Hubley- Kozeg)**

Joint	Action	Movement angle	Variability
Hip (coxal -femoral)	Flexion	80,8	7,1
	Flexion-extension	107,1	18,9
Shoulder	Flexion-extension	198,3	16,3
	Abduction-adduction	160,5	18,8
	Rotation	187,0	21,5
Elbow	Flexion-extension	150,9	8,9
Knee	Flexion-extension	138,5	8,9
Wrist (radio-carpal)	Flexion-extension	127,2	18,2

### Concerning the characteristics of the effort during the handball game

The works of the researchers (3, 4, 12, 16, 17) have the following characteristics:

- During the handball game, the effort has an alternation of the aerobic and anaerobic processes. The ergo-genesis: lactic acid 20%, lactic acid 30% and aerobic 50%.
- Effort in handball has a high intensity. It is a fast, explosive game, with deployment of great energies, repeated 20-40 times during a match. The recovery periods are of 3-7 seconds.
- Effort with a larger volume, duration 2 halves of 30 minutes, using over 2/3 of the muscular mass, global effort which requires endurance in a force situation.
- The effort during the handball game is especially complex: intense efforts, great volume and it includes multi-structural (complex) movements.
- Handball is a situational game.
- The perception factors and the technical and tactical abilities have a decisive role.
- In the analysis of the game the following must be measured: movement speed, the endurance to this movement and the duration or time, as well as the answer of the blood lactate to the effort.
- The limit of the lactate in handball is for the aerobic-anaerobic effort of 4 mmol/l which can increase during the competition game up to 12 mmol/l (2, 13, 14, 32). The individual values are variable and they depend on the structure of the game phase.



- The energy consumption in the case handball players is between 78 and 271 KJ/Kg per day, according to the place they have in the team, to the somatic type, to age and the degree of adaptation to effort (22, 23, 24, 25).

### **Technical and tactical movement ability as another component of the physical condition**

The Technical and tactical movement ability, considered as a component of the physical condition shows us that the specific abilities can be seen in:

- movement skills (the background of movement elements);
- movement abilities (movement intelligence, mobilization ability, recovery ability, operational structures);
- abilities (easiness in the field movement, handling the ball, promptitude in the performance of the automatic movements, instantaneous choice of the technical procedures).

In order to make up the profile of the handball player from this point of view, proposes a record where the assessment must have a mark from 7 to 10. The prospective model of the national handball team is presented at the same time, as a reference.

We must also emphasize the fact that the technical procedures subordinated to thought become operational schemes which, based on the intelligence of the player, represent abilities able to change the movement skill structure (18, 19, 20).

#### **Mental ability**

The mental ability is a necessity in the achievement of the physical condition and it includes: mental-behavior manifestations during the game and the training, the structure of the personality, motivation, needs, aspirations (18, 21, 26, 27). Among the mental-behavior manifestations we must also mention the movement intelligence which leads to some extra performance during the handball game and which guides us concerning the dynamic of the growth in the effort adaptation. „Any movement act performed consciously by a sportsman has a certain degree of mental effort” (19, 30).

The level of knowledge helps during the game as well as during the training.

#### **Recovery ability**

The recovery of the body after effort is a component and, at the same time, a necessity for obtaining the best physical condition.

Since energy systems are present during the handball game, higher requirements concerning the recovery after effort are necessary (4, 5, 29).



**Table 4. Requirements for the recovery**

Recovery processes	Time	
	Minimum	Maximum
Muscular phosphocreatine (ATP) C.P.	2 minutes	3-5 minutes
Compensation of the alactacid oxygen debt	3 minutes	5 minutes
Compensation of the lactacid oxygen debt	30 minutes	1 hour
<b>Recovery of the muscular glycogen</b>		
After intermittent activity	40 % in 2 hours	
After long-term nonstop activity	55% in 5 hours	
<b>Removing the lactic acid from muscles and blood</b>		
	25% - 10 minutes	
	50% - 25 minutes	
	95% - 1-1,15 hours	
Recovery of the vitamins and enzymes	24 hours	

### **Energy balance**

An important factor of the physical condition is the energy supply, especially the one which comes from the consumption of carbon hydrates from natural sources; fat with a well-balanced consumption is also important. Vitamins have a very important role in the chemical processes of the body. We must also pay attention to the consumption of water (about 2 l/2 l per day). It is also necessary to eat animal as well as vegetal proteins, since this is the substance the body is made up of. The food consumption standards are the ones prescribed by the tam physician.

### **Global analysis of the physical condition**

The graphic of the data base for the global analysis of a sportsman presented (11, 17, 31, ) includes: data about the subject, anthropometric data, performance criteria data, physiological data, biochemical data, muscular biopsy data, nutrition data, maximal performance data, data on traumatism, analysis tables, mental strategies, force and flexibility. After collecting the data comes the updating, the interpretation of the updating, the analysis program, reports, diagrams, online display, online updating. All the interpretations have a unique key for the file; all the data can help to increase the level of the physical condition during the training process, but this problem will be the subject for another work.

### **Conclusions**

1. The physical condition is the whole potential of a particular sportsman for a certain sports field, on which depends the adaptation to a certain effort in order to achieve high performance. This refers only to performance and high performance sportsmen.

2. The elements of the physical condition are: the state of health, the somatic features, the mental and motion skills, the functional capacity, the energy resources, the movement ability, the mental capacity, the recovery ability, abilities, the movement agility, knowledge.

3. The particularization of the physical condition elements in handball and the determination of the requirements for each component part are in fact the model of physical condition:



- a. the state of health must be inexorable;
  - b. the somatic features, especially height and the proportionality of the body are the main indicators for the handball game, which choose the place of the players in the field and influence the physical condition development process. The most important somatic features are the mesomorph and the endomorph ones;
  - c. the mental and motion skills have a special manifestation during the handball game and are always present together. A great attention is given to the coordination and to the movement amplitude;
  - d. the effort during the handball game is complex and it defines the characteristics of this game;
  - e. the involvement of the movement ability as an element of the physical condition requires the knowledge, the analysis and the characterization of the movements from the kinesthetic, kinetic, dynamic point of view by means of electromagnetic studies, using modern technologies. We will be able to extract from this data concerning the sports craftsmanship;
  - f. the mental capacity and the recovery ability are important elements of the physical condition for which proper requirements have been established;
  - g. the energy resources represent the contribution of the nutrition to the efficient achievement of the physical condition.
4. The completion of the requirements included in the present paper with others will be able to make up a proper model for the performance sport concerning the physical condition in handball.



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