# HEART RATE MODIFICATIONS OF JUNIOR HANDBALL PLAYERS ON SPECIFIC FIELD TESTING

# МОДИФІКАЦІЯ ЧАСТОТИ СЕРЦЕВИХ СКОРОЧЕНЬ МОЛОДШИХ ГАНДБОЛІСТІВ В УМОВАХ СПЕЦІАЛІЗОВАНОГО ТЕСТУВАННЯ

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*From a general point of view, it is noticeable that there is not numerous information about the implications and modifications of the cardiac system during specific efforts, especially if we are to refer to junior handball players. In any elite sport the athlete must have a series of skills connected to the psycho-social, technical, tactical, physiological aspects of the discipline, these having an important saying when talking to match performance. Even the psychology characteristics that the game itself requires from a player, can be connected to the physical performance of a handball players. As we all know, it is imperative for a better chance of success that the players even from a young age to be continuously observed and measured in order to have a better perspective of their level of performance. The main objective of this study is to have a proper image of the evolution of the heart rate of junior handball players when performing different types of efforts, and also their recovery after completing it.*

*Methods of research used where represented in an incipient phase to consult the specific literature for a better understanding of the specialists interests, then it was mainly represented by applying the specific tests in order to be measured during the efforts. In what concerns the results of the study, they will be presented in the research article. The handball game is a very demanding one, this meaning that the training process in a very complex one. From the point of view of effort type, this team sport is a mixt one (aerobic and anaerobic) depending on the moments of the game and the requirements that the phases have for the players. Also, the handball game is a dependent one on the actions of the opponents, but in the modern days its dynamism grows more and more this meaning the increase of the physical demands. Therefore, we see the necessity of analyzing the modifications of the heart rate of the handball players even from the junior level in order to be able to have a pertinent and general point of view of the implications of the cardio vascular system and the evolution of its parameters when performing specific efforts.*

**Key words:** *handball, junior players, heart rate, field testing*

*Загалом, помітно, що інформації про наслідки та модифікації серцевої системи під час конкретних зусиль, особливо якщо говорити про юніорських гандболістів, немає. У будь-якому елітному виді спорту спортсмен повинен володіти рядом навичок, пов'язаних з психосоціальними, технічними, тактичними, фізіологічними аспектами дисципліни, які мають важливе значення, коли йдеться про результати матчу. Навіть психологічні характеристики, які сама гра вимагає від гравця, можуть бути пов'язані з фізичною працездатністю гандболістів. Як ми всі знаємо, для кращих шансів на успіх дуже важливо, щоб гравці навіть з юного віку постійно спостерігалися та вимірювалися, щоб мати кращу перспективу їхнього рівня продуктивності. Основна мета цього дослідження – скласти правильне уявлення про еволюцію серцевого ритму юніорських гандболістів при виконанні різних видів зусиль, а також їх відновлення після його виконання.*

*Методи дослідження, які використовувалися на початковому етапі для звернення до спеціальної літератури для кращого розуміння інтересів спеціалістів, в основному були представлені шляхом застосування конкретних тестів для вимірювання під час роботи. Що стосується результатів дослідження, то вони будуть викладені в дослідницькій статті. Гра в гандбол дуже вимоглива, а це означає, що тренувальний процес дуже складний. З точки зору виду зусиль, цей командний вид спорту є змішаним (аеробним та анаеробним) залежно від моментів гри та вимог, які фази висувають до гравців. Також гандбольна гра залежить від дій суперників, але в наш час її динамізм дедалі більше зростає, що означає збільшення фізичних вимог. Тому ми бачимо необхідність аналізу змін частоти серцевих скорочень у гандболістів навіть з юнацького рівня, щоб мати можливість мати доречну та загальну точку зору на наслідки серцево-судинної системи та еволюцію її. параметри при виконанні конкретних зусиль.*

**Ключові слова:** *гандбол, юніори, ЧСС, польове тестування*

**Target setting in general and its connection with important scientific or practical tasks.** From a general point of view, it is noticeable that there is not numerous information about the implications and modifications of the cardiac system during specific efforts, especially if we are to refer to junior handball players. In any elite sport the athlete must have a series of skills connected to the psycho-social, technical, tactical, physiological aspects of the discipline, these having an important saying when talking to match performance. Even the psychology characteristics that the game itself requires from a player, can be connected to the physical performance of a handball players.

**Analysis of recent research and publications.** As we all know, there is a variety of team sports, or sports in generally, that have different needs and present efforts from the body of the athletes (aerobic/anaerobic). In some team sports (e.g., Football, handball, basketball), the sportsman performs a series of varied types of physical gestures that can range from the simple position of standing still to the running phase at different intensities [1].

Other authors state that training is an important component in this complex area of elite team sports, it's necessity being the one of influencing the match performance. Therefore, the actual quantification of this training process becomes the main objective

and also the responsibility of the coaches, on every performance level, to be able to make the difference between a well-prepared team and one that needs other aspects of the game to be improved [2].

**Highlighting previously unresolved parts of the overall problem.** In this modern stage of the game, due to its growth and development from a dynamic point of view, some of the most important trends in any sport, especially in team sports, are the continuous process of replicating match conditions in a noncompetitive context. This meaning that coaches must research and a valid set of information about the characteristics of an official competition in order to create an efficient plan or a training program [4; 7; 9].

Some of the most important aspects when talking about sports performance, is the one connected to the physiological implication of the effort and the modifications that the cardio-vascular suffers throughout the phase. We think that the first conclusion that ought to be taken into consideration is the one that more and more data gathered about this subject can improve the training process.

This type of reasoning is not sound because win-loss records alone do not scientifically validate the conditioning programs used by the successful teams. In fact, the successful team might be victorious by virtue of its superior athletes and not its outstanding conditioning program. Without question, the planning of an effective athletic conditioning program can best be achieved by the application of proven physiological training principles. Optimizing training programs for athletes is important because failure to properly condition an athletic team results in a poor performance and often defeat. The coaches presently use various conditioning skills among, skill-based conditioning is prescribed to all level players, because this type offers many benefits. One of the benefits of implying this type of training is the combination of sports specific skills and fitness.

As a long-term tradition, coaches must plan their conditioning programs for the teams that they have in their suborder, using examples of teams that followed them and had a continuous streak.

Many authors state that some movement patterns of the athletes are connected to the heart rates and sources of muscular energy and are generally used to gain some information about the physiological demands of team sports [3; 8; 12]. Data about the metabolic implications experienced on the duration of a competition is necessary in order to create specific training programs to aid the athletes reach their optimal fitness levels by reducing the heart rate and the stress of the musculoskeletal system [10]. We noticed a series of research works in football and rugby [8; 9], thus in other team sports such as basketball the researches are far few in comparison. It is well known that physical exercises are a major mean in the prevention and treatment of cardiac and metabolic diseases [9] and by being physical active can prologue life and set back some chronical conditions [8]. Many studies concerning the effects of physical training on health have the tendency to focus on the implications of the aerobic efforts on the cardiovascular and metabolic state.

Team handball is being seen as a high intensity exercise that primarily uses the aerobic system of the athletes, with moments of high intensity moments that are connected to the anaerobic path due to the phases of the game, some of them having the tendency to grow from a intensity point of view [6; 10]. The activity in this team sport is to be compared to some other team sports played in a small-sided version [3; 4; 10].

**Material and method.** The study was conducted on 9 junior handball players with different training levels. For gathering the data, we have used Polar H7 which is a performant sensor that indicates in real time and with high accuracy the heart rate and transmits is directly to the monitoring devices. By using these sensors we've had the chance to observe the modifications and the recovery of the cardiac rate of the players when performing an anaerobic type of effort.

As a main field test, we have used VAMEVAL in order to assess their maximal aerobic speed.

Procedure: the subjects run around a track with markers placed every 20 meters. The test begins at 8km/hr and the pace increases by 0.5km/hr every minute. Each player must maintain the correct speed as indicated by the audio recording, so that they are in line with a marker cone when each pacing signal sounds. If a player is one meter or more behind the required pace, they receive a warning. If they are more than two meters behind, they have reached the end of the test and their result is recorded.

In the sixth figure it is presented an example of the final statistics of a players after finalizing the evaluation process. In what concerns the heart rate, the average one during the test, was around 146 BPM, reaching the maximal one at 191 BPM in the final stage, due to the effort's intensity that increases towards the end. These can be seen as important information for the coaches, in order to gradually evolve the training process for the players to gain the physical condition that can help them obtaining performance on official competitions.

Figure 7, presents another example of a player's statistics on the duration of the test. In his case, the average heart rate was 159 BPM, reaching 215 at his maximal point. We have to state that this maximal value could have appeared because of a short burst and a minor misreading of the Polar sensors.

Other information about the players about their heart rate evolution both seen from an average point of view and also the maximal values that they had.

To see if there is any correlation between the average, maximal times zones of the effort, we have used the program SPSS 20, in order to see if there are any

significant values. The Pearson test and the results have been highlighted in the table above. A first correlation is to be noticed between the maximal HR and the first time zone (,854), as follows we can see another correlation that is significant statistically in what concerns the final time zone and the 10-15 one (-,673) this leading to the conclusion that the maximal values of the HR influences in a certain way the actions of the players when performing specific efforts.

It is noticeable that the heart rate of the players, modifies from a moderate sill in the beginning of the field test due to the low intensity of the effort and the requirements of the cardiovascular system. With every stage that continues to demand more and more implication of the musculoskeletal and also the respiratory and cardiac systems, the heart rate of the players raises to a maximal sill, for athletes to be able to sustain the effort.


**Figure 1. The status of the heart rate of the players at the beginning of the trial**


**Figure 2. The status of the heart rate of the players in the first minute of the effort**


**Figure 3. The status of the players in the 5th minute of the effort**


**Figure 4. Heart rate on the highest intensity moment of the trial**


**Figure 5. Example of chart regarding the overall stats of a player**


**Figure 6. Example of chart regarding the overall stats of a player**

Table 1

**Pearson correlations of the heart rates and time zones**

| | | Average HR | Time zone 0-5_% | Time zone 10-15_% | Time zone 15-20_% |
|---|---|---|---|---|---|
| Maximal HR | Pearson Correlation | ,587 | ,**854**** | -,003 | -,110 |
| | Sig. (2-tailed) | ,096 | ,003 | ,994 | ,777 |
| | N | 9 | 9 | 9 | 9 |
| Time zone 0-5_% | Pearson Correlation | ,463 | 1 | -,245 | -,008 |
| | Sig. (2-tailed) | ,854 | ,317 | ,068 | ,302 |
| | N | 9 | 9 | 9 | 9 |
| Time zone 10-15_% | Pearson Correlation | ,246 | -,245 | 1 | -,**673*** |
| | Sig. (2-tailed) | ,524 | ,525 | | ,047 |
| | N | 9 | 9 | 9 | 9 |
| Time zone 15-20_% | Pearson Correlation | ,030 | -,008 | -,**673*** | 1 |
| | Sig. (2-tailed) | ,939 | ,983 | ,047 | |
| | N | 9 | 9 | 9 | 9 |

The most important information that can be withdrawn from this sets of figures is that the level of training of the players is equally distributed due to the similar values that can be observed above, this meaning constant and gradually calculated training programs for the athletes. The heart rate values tend to be distributed in a normal mean across the duration of the evaluation.

It is important to have a general opinion of the evolution of the heart rate and also the modifications of the cardio vascular system when performing specific efforts in order to understand the complete process that the players must go through when preparing for official competitions.

**Conclusions and research perspectives.** The handball game is a very demanding one, this meaning that the training process in a very complex one. From the point of view of effort type, this team sport is a mixt one (aerobic and anaerobic) depending on the moments of the game and the requirements that the phases have for the players. Also, the handball game is a dependent one on the actions of the opponents, but in the modern days its dynamism grows more and more this meaning the increase of the physical demands. Therefore, we see the necessity of analyzing the modifications of the heart rate of the handball players even from the junior level in order to be able to have a pertinent and general point of view of the implications of the cardio vascular system and the evolution of its parameters when performing specific efforts.

This study, can also represent the starting base for further researches that could treat this area of the athletes with more and more interest.

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