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THE PHYSIOLOGICAL EFFECTS PLAYING BEACH HANDBALL HAS ON JUNIOR HANDBALL INDOOR PLAYERS

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ABSTRACT. Beach handball is a branch of sports that was born on the beaches of Italy in the early 1990s and it was designed to help players under go their physical training in a more dynamic training during the summer. Objectives. The main goal of this study is to describe the physiological state of the athletes that underwent a series of beach handball training sessions and to determine the effects of such training sessions on junior level beach handball athletes. Materials and methods. We have suggested that the evaluation of the athletes' condition be determined via invasive methods, such as the analysis of their urinary value. Results. The numerical data obtained from our analysis were computed using Student's t-test for unpaired samples associated with Welch's unequal variance t-test. The statistical significance was determined for an associated $P < 0.05$ (probability > 95%). The comparison was made between the mean of the initial values and the mean of the final value for all the dosed biochemical markers. The data are expressed as mean ± SD (standard deviation). The statistical processing was done using the GraphPad Prism software. Conclusions. Including beach handball practice sessions in the training program of indoor handball players has no significant effect on their physiological state.

Keywords: *beach handball, juniors, physiological status.*

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REZUMAT. ***Efectele practicării jocului de Beach Handball la nivel fiziologic asupra jucătorilor de handbal junior.*** Jocul de Beach Handball este o ramură sportivă nouă care a luat naștere pe plajele din Italia la începutul anilor 1990 cu intenția de a face pregătirea fizică a jucătorilor de handbal mult mai dinamică pe perioada verii. **Obiective.** Obiectivul principal al studiului a fost conturarea statusului fiziologic al sportivilor supuși unor serii de antrenamente organizate de Beach Handball și determinarea efectelor fiziologice în urma aplicării jocului de Beach Handball în pregătirea jucătorilor de handbal la nivel de juniori. **Materiale și metode.** Am propus evaluare stării sportivilor prin metode invazive, cum ar fi determinarea valorii unitare a acestora. **Rezultate.** Datele numerice obținute în urma determinărilor efectuate au fost prelucrate cu testul t Student pentru valori neperechi asociat cu corecția lui Welch. Semnificația statistică a fost stabilită la un *P* asociat < 0.05 (probabilitate > 95%). Comparația s-a efectuat între media valorilor inițiale și media valorilor finale, pentru toți markerii biochimici dozați. Datele sunt exprimate ca medie ± ES (eroarea standard a mediei). Prelucrarea statistică a datelor s-a efectuat folosind softul GraphPad Prism 5. **Concluzii**. Introducerea antrenamentelor de Beach Handball în programul de pregătire al jucătoarelor de handbal (indoor) nu influențează statusul fiziologic a acestora.

Cuvinte cheie: *handbal pe plajă, juniori, stare fiziologică.*

Introduction

Beach handball is a relatively new sport that emerged on the beaches of Italy during the early 1990s. Its aim was to be a more dynamic strategy for physical training during the summer (Morillo-Baro et al. 2015). Ever since its emergence, numerous studies have been conducted regarding the psychological profile (Reigal et al., 2019; Vasquez-Diz et al., 2019), and the anthropometric profile, but also regarding the body composition of athletes that play beach handball. Such studies have seldom focused on the physiological implications of this sport, most notably focusing on the dehydration of the athletes during matches (Puebo et al., 2017; Lemos et al., 2020). Beach handball, just like its classical version, is characterized by mixed effort, with high intensity actions that may quickly cause muscle fatigue during games (Povoas et al., 2012). In contrast to classic handball (indoor handball), beach handball players must cover a smaller running distance (indoor handball (Michalsik & Aagaard,2015): males=3267±568m, females 4002±551m; beach handball: males = 1235±222m, females = 1118±222m) and a lower number of accelerations due to the sand surface that imposes greater physiological effort on the players (Puebo et al., 2017).

Considering the similarities between beach and indoor handball, be they on a technical/tactical level or physical/ anthropometrical level, both being factors that have deep impact on performance (Lemos et al., 2020), we believe that physiological phenomena can be observed/measured for beach handball as well. By looking at all the relevant literature, one may notice that no studies have been done effort endurance markers and their effect in the training of handball players when beach handball is played by junior level players.

Catecholamines are a third indicator of effort endurance and of modulating competitional stress (the first and second being cortisol and testosterone). They have an essential physiological role, encompassing dopamine, noradrenaline and adrenaline, and their release is distributed unevenly throughout the central and peripheral nervous system and through the endocrine system (Pan et al., 2018). The release of catecholamines in the blood flow is a fast, momentary, process that leads to the quick enhancement of motrical performane (especially by increasing oxygen levels in the muscles), of the breathing rate, of the employment of the body's energy resources, and it generates an ample integration of the stress factors within the central nervous system (McMorris et al., 2016). Catecholamines are also present in urine, their presence being an accurate indicator of their blood concentration (Takagi et al., 2020).

Objectives

The main goal of this study has been observing the physiological state of athletes that underwent a series of beach handball training sessions and determining what effect does including beach handball have in the training of junior level handball players.

Materials and methods

Subjects, duration of study

The study group was composed of 26 female athletes, aging from 16-18 years old, with no chronic illnesses and based on their signed consent. The study group has been divided in two, one group being formed of 13 female athletes (control group), and the second group being formed of 13 female athletes that employed the training methods associated with beach handball (experimental group), all part of CSS Viitorul Cluj, both groups from CSS Viitorul Cluj-Napoca.

The duration of the experiment was 6 months, between the 15th of February and the 15th of July 2020. The frequency with the subjects took part in the training sessions was 3 times a week.

Biochemical analysis of urine

The biochemical analysis of the urine was performed using the 2000 Evolution analyzer calibrated by Biomaxima Poland. The reactants used during this process originated from Biomaxima Poland and have been specially selected for determining the relevant markers within our study. The determining of the total urinary catecholamines was done by nitration of the Aromatic Nucleus in an acid environment and the coupling of that reaction with ammonium molybdate (Madrakin et al., 2006). The amount of urinary phosphates was determined using the Tusky method. The urea level in the urine was quantified based on the reaction with picric acid in a high alkaline environment. Urobilinogen was evaluated qualitatively, by looking for its presence/absence. The presence of urobilinogen was established using Erlich's reagent, with p-dimethylaminobenzaldehyde. Urinary pH was established using the colorimetric method with urine test strips.

Data processing and statistical analysis

The numerical data obtained from our analysis were computed using Student's t-test for unpaired samples associated with Welch's unequal variance t-test. The statistical significance was determined for an associated $P < 0.05$ (probability > 95%). The comparison was made between the mean of the initial values and the mean of the final value for all the dosed biochemical markers. The data are expressed as mean ± SD (standard deviation). The statistical processing was done using the GraphPad Prism software.

Results

The quantifying of catecholamines (fig. 1), phosphates (fig. 2), creatinine (fig.3) and urea in urine samples from the two groups in the initial phase and the final phase, after the training sessions of the experimental group. The data are expressed as the mean ±SD. Statistical significance is for $P<0.05$(), $P<0.01$(), $P<0.001$(**).

The results of the biochemical urinary sampling revealed on the one hand the healthy metabolic state of the subjects, and on the other hand their constantly balanced lifestyle. As shown in Fig.1, the level of total urinary catecholamines, including here adrenaline, dopamine and noradrenaline, presented no statistically

significant variations, which implies the lack of activation of the neuroendocrine adrenergic system throughout the intervention period. This same aspect is suggested by the absence of any statistically significant variation of the phosphate concentration (fig.2) urea respectively (fig. 3) which implies the absence of any overloading of the glomerular filtration function associated with urine production.

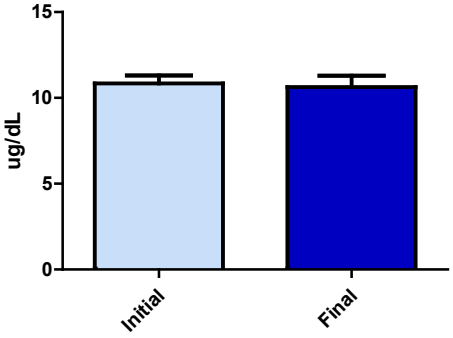

Fig. 1. Urinary cathecolamines concentration

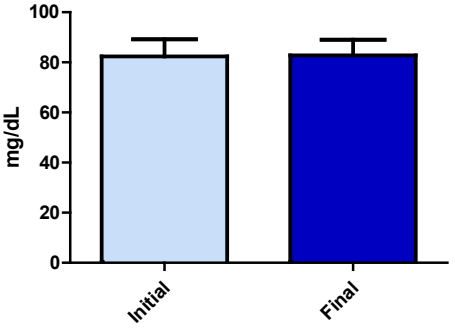

Fig. 2. Urinary phosphates concentration

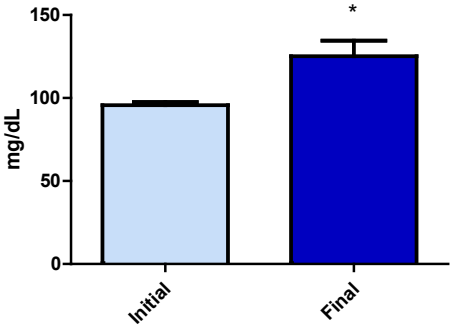

Fig. 3. Urinary creatine concentration

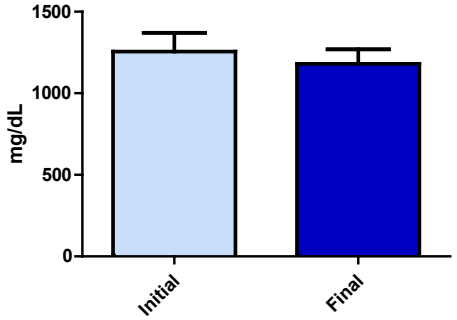

Fig. 4. Urea concentration

The sustained intense physical effort may cause an increase in the renal perfusion rate with an increased level of excretion of urea and phosphates respectively, phenomena absent in both groups. Unlike these parameters, the creatinine urinary level (fig. 4) increased after the intervention period ended, but this increase may be accounted by other environmental factors such as temperature-moisture (outdoor training) that would lead to an increased flow of fluids and an increased excretion of creatinine.

Discussion

The biochemical testing of the subjects in this study had the role of determining whether there are any physiological changes on a handball team (indoor) that also plays beach handball. The urine samples of the athletes (16-18 years old) showed the neuroendocrine reactance and the fact that specific beach handball training sessions have no effect on the physiological measurements of (indoor) handball players.

Within all branches of sports, knowing the blood and urine markers is seen as an important control and planning element for practice and matches (Lopez-Sanchez et al., 2018).

We are unaware of any existing study done to analyze urinary measurements of (indoor) handball that also play beach handball - junior level. The (indoor) handball athletes showed reduced levels of blood and urine pH after practice as a consequence of acid products of the metabolism, such as hydrogen ions, lactate, pyruvate etc. In our study, the end results showed reduced statistical significance. Most papers, in agreement with their own research results, confirm a reduction of urine pH after anaerobic (Hanon et al., 2012), aerobic (Wiacek et al., 2011) or mixed exercise (Wiecek et al., 2015).

The core strengths of this study include the monitoring of the athletes based on the markers identified in the urine. Unfortunately, we have not included the monitoring of ions present in urine and perspiration, nor have we analyzed the athletes' diet. Both could have been valuable resources for coaches who want to study these influences on the electrolytes level and on the acid-base levels during practice. The following studies should also take into account a greater number of athletes, and the experimental period should be longer.

Conclusion

Through our biochemical analysis of athletes' urine we showed that they have a healthy metabolic state, indicating a healthy lifestyle.

Constant beach handball training of (indoor) handball female players, following a certain protocol, with ages ranging from 16 to 18 years old, did not influence their physiological state, the values resulting from urine analysis being statistically insignificant.

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