EFFECTS OF 12 PHYSICAL TRAINING SESSIONS ON A FEMALE BEACH HANDBALL TEAM PERFORMANCE

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ABSTRACT
The beach handball is a new team sport. The aim of this study is to evaluate a 12 specific fitness training sessions on the physical capacities of under e upper body power, and 15-meter sprint speed and endurance. The training was successful to make positive adaptations on the physical capacities developed, and had significative differences (p < 0,05) on the capacities of upper body strength and power and 15-meter speed and endurance. KEY WORDS: beach handball – performance – physical capacities

INTRODUCTION
Beach handball is a new sport in the worldwide level and is in frank ascension of popularity, particularly with the support of International Handball Federation (1), as much the European and National Federations. The game is played in a rectangular field that measures 27-meter length for 12-meter width, whereas the goalkeeper area measures six meters length for 12 meters width. Thus, it remains for the line players a play area measuring 15-meter length for 12-meter width. Four players in each team are necessary to start the game, and one of these players must be the goalkeeper (2, 3). The game is consisted by two sets of ten minutes each one. If each team won a set, there is a shoot out to get a winner team. In case of a set end tied, there is a golden score, where the team that scores a goal wins the set (2,3).

The beach handball was created with the intention of been more spectacular than de indoor handball. For this, specific rules were developed, as penalization for a vigorous contact, reduction of the number of penalization for each player, compared to indoor handball. It also had created some kind of scores that confer two points (2,3). As the goal scored in flight, where the athlete receives the ball in suspension and throws it before touch any kind of the body on the sand. There are also the 360° throwing, where the athlete receives the ball and jump making a complete turn in his sagital plane, throwing the ball before touch the sand. Beyond these possibilities the team who owner the ball may use the goalkeeper for attack. Or even substitute the goalkeeper by a line player. This player is named specialist, and each goal of this player scores two points.

There are no studies that determine the physiological profile of the beach handball. In spite of this, where considered for this study physiological profile of the indoor handball, who consider essential the physical capacities of upper and lower limb power (4, 5, 6, 7, 8, 13, 26), and the endurance of these capacities (9).

The aim of this study was to analyze the effects of 13 days physical training on the capacities of upper limb strength and power, lower limb power, sprint speed and endurance in 15-meter consecutives displacements.
METHODS SUBJECTS

12 female beach handball players took part of this study (age 26.5 ± 6.0 years old; 171.9 ± 0.5 m height; 17, 6 ± 3.0% fatty mass percentage). All the athletes were regularly training and competing, and have expressive results in national and international competitions.

TRAINING SCHEDULE

The periodization was planned in 12 training sessions. The peak of performance was planned for the end of this period, near the beginning of the II Beach Handball World Championship. The figure 1 shows the physical training planning, even the physical tests and friendly games done during this period.

![Figure 1: physical training schedule, friendly games and physical tests done by the team.](image)

The physical training sessions always occurred on the mourning training session with 90 to 120 minutes duration, the exercises was planned based on being the most specific for the sport, and applied through the following sequence:

- Endurance training: developed through five training sessions. Were applied of general characteristics (not based on specifics movements of the players during the game) (G) as six meter traction sprints (R1), 12 and 15 meter single hand one kg medicine ball pass (R2), and six and eight meter double hands three kg medicine ball pass (R3), and by specific (based on specifics movements of the players during the game) characteristics activities (E), as traction specific defensive moving (R4), 15 meter go-and-back sprints followed by throwing to goal (R5), defensive side and ahead moving (R6), and defensive side and ahead moving followed by 15 meter sprints and throwing to goal (R7). The Table I shows the activities developed by the athletes during the endurance training.

Table 1: description of the activities developed during the endurance training sessions, with the general (G) and specific (E) characteristics activities, for the activities R1 -six meter traction sprints; R2 -12 and 15 meter one kg medicine ball pass; R3 -six and eight meter three kg medicine ball pass; R4 -traction specific defensive moving; R5 -15 meter go-and-back sprints followed by throwing on the goal; R6 -defensive side and ahead moving; R7 -defensive side and ahead moving followed by 15 meter sprints and throwing on the goal.

<table>
<thead>
<tr>
<th>Activity</th>
<th>Mean number of series</th>
<th>Mean stimuli on the series</th>
<th>Mean duration of each stimulus</th>
<th>Mean time of pause between stimuli</th>
<th>Mean time of pause between series</th>
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<tr>
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<td>180</td>
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</table>

Figure 1: physical training schedule, friendly games and physical tests done by the team.
-Strength Training: developed through two training sessions, also applied in G and E activities. The G activities were consisted by one jump through two overlapping cones (F1), two consecutive jumps through two pairs of obstacles (F2), one jump through two obstacles, with five kg overload (F3), two consecutive jumps through two pairs of obstacles, with a five kg overload (F4), six meter single hand one kg medicine ball throwing (F5), six meter single hand three kg medicine ball throwing (F6), six meter single hand one kg medicine ball throwing, with a four kg overload on the fist (F7), six meter single hand one kg medicine ball throwing, with a four kg overload on the fist and leg (F8), six meter single hand three kg medicine ball throwing, with a four kg overload on the fist (F9), six meter single hand three kg medicine ball throwing, with a four kg overload on the fist and leg (F10), series of five consecutive jumps through obstacles (F11), one jump through two obstacles followed by three steps jump (F12), one jump through two obstacles followed by three steps jump with a 5 kg overload (F13). The E activities was consisted by one jump through a laying chair with a five kg overload, followed by the overload leaving, receiving the ball and throwing to the goal, differentiating in simple throwing (F14), 360 jump and throwing (F15), and flight throwing (F16). The Table II shows the activities done during the strength training sessions.

Table II: description of the activities developed during the strength training sessions, with the general (G) and specific (E) characteristics activities, for the activities F1 – one obstacle jump; F2 – two consecutive jumps on two obstacles; F3 – one obstacle jump with five kg overload; F4 – two consecutive jumps on two obstacles of with five kg overload; F5 – one kg medicine ball throwing; F6 – three kg medicine ball throwing; F7 - one kg medicine ball throwing with four kg overload on fist; F8 - one kg medicine ball throwing with four kg overload on fist and leg; F9 - three kg medicine ball throwing with four kg overload on fist; F10 - three kg medicine ball throwing with four kg overload on fist and leg; F11 – five consecutive jumps on obstacles; F12 – one jump through obstacles followed by three steps jump; F13 - one jump through obstacles followed by three steps jump with a five kg overload; F14 - one jump with five kg overload followed by simple throwing; F15 - one jump with five kg overload followed by 360° jump and throwing; F16 - one jump with five kg overload followed by flight throwing.

<table>
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<tr>
<th>Activity</th>
<th>Mean number of series</th>
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</table>
-Plyometric Training: developed through two training sessions, applied with G and E activities. The G activities were constituted by one fall from two 20 cm boxes in the sand, following by one jump on a pair of obstacles (P1), one fall from two 20 cm boxes in the sand, following by two jumps jump on a pair of obstacles (P2), one fall from two 20 cm boxes on the sand followed by one jump through two obstacles and a three pass running (P3), a four meter distance 3 kg medicine ball reception and pass (P4), a six meter distance 1 kg medicine ball reception and pass (P5). The E activities were consisted by one fall from two steps on the sand followed by one jump from two 20 cm boxes receiving the ball, fainting a defense and jumping and throwing the ball differentiating by simple throwing (P6), and 360° jump and throwing (P7). The Table III shows the activities done during the plyometric training sessions.

Table III: description of the activities developed during the plyometric training sessions, with the general (G) and specific (E) characteristics activities, for the activities P1 – one fall followed by one jump; P2 – one fall followed by two jumps; P3 – one fall followed by one jump and a three pass running; P4 – 3 kg medicine ball reception and pass; P5 – 1 kg medicine ball reception and pass; P6 – one fall followed by one jump, ball reception, faint and simple throwing; P7 -one fall followed by one jump, ball reception, faint and 360° throwing.

<table>
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<th>Activity</th>
<th>Mean number of series</th>
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-Displacement speed training: developed through two training sessions, consisted by only E activities, which consisted in one defensive movement in the defense line followed by counter attack in pairs and simple throwing (V1), flight throwing (V2), 180 degrees jump followed by flight throwing pass (V3), two attackers against one defender (V4), three attackers against one defender with simple, 360° or flight throwing (V5), three attackers against two defenders (V6), three attackers and the specialist against three defenders (V7). The Table IV shows the activities developed during the displacement speed training.

Table IV: description of the activities developed during the displacement speed training. The activities V1 – defensive movement in the defense line followed by counter attack in pairs and simple throwing; V2 – defensive movement in the defense line followed by counter attack in pairs and flight throwing; V3 – defensive movement in the defense line followed by counter attack in pairs and 180 degrees jump and flight throwing pass; V4 – two attackers against one defender; V5 – three attackers against one defender; V6 – three attackers against two defenders; V7 – three attackers and the specialist against three defenders.
<table>
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<th>Activity</th>
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<td>36</td>
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**Physical Tests**

Two physical tests were applied, the first on the day 1, before beginning the trainings, and the second on the day 13, 48 hours after the 12 training session. The methodology of the physical tests comes to proceed. It is important to notify that the athletes accomplished the physical tests in the sand, in the place where the trainings were accomplished. All the athletes knew the tests applications because of previous training phases.

**3 kg medicine ball throwing. Objective:** to evaluate the upper limb power (10, 11).

**Methodology:** the test is applied with the athlete seated on the ground, and the back positioned on the screen that involved the field. With the medicine ball positioned in the chest the athlete must throw the ball as far as possible without removing the back off the screen. It is measured the distance between the point zero until the initial point the medicine ball touch the ground. Each athlete performed three attempts, with 30 seconds interval between throws, the best result was considered.

**Three Pass Running Objective:** to evaluate the lower limb power (12)

**Methodology:** Consisted in a maximum extension three pass jump measures from the zero point for the point marked on the sand for the last pass. There are done three attempts for each athlete, with three minutes interval between throws, and the best result is considered.

**15-meter consecutive sprints with 10” interval between sprints Objective:** a) to evaluate endurance for 15-meter sprints; b) to evaluate the maximum mean displacement speed in 15-meter sprint.

**Methodology:** in this test each athlete travel a 15-meter distance in maximal speed. 10second active pause was used after each sprint. After the third sprint was made an average of time in that sprint, and added 10% in this value. That final value is named cut value. If the athlete crosses the distance with a time upper than the cut value, the test is stopped. The number of sprints done by the athlete is counted also the best displacement speed.

**STATISTICAL PROCEDURES**

The results of the performance tests used will be presented in the table form with medium and
range for each variable. Test was used to evaluate the statistical differences, for pair and parametric data. The value of significant reference will be \( p < 0.05 \). The correlation test used was the Pearson’s test, being the value of significant reference considered \( p < 0.05 \).

**RESULTS**

It was found significant differences for upper body strength and power and sprint speed and speed endurance in 30 m consecutive sprints \( (p < 0.05) \). And it was also found correlations between the 1 and 3 kg medicine ball throwing tests \( (r = 0.953, p < 0.0001) \), and between 30 m sprint speed and horizontal triple jump alternate \( (r = 0.66, r = 0.002) \). The Table V shows the results of the performance tests accomplished during the season.

<table>
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<th>RESULT Test 1</th>
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<td>3.69</td>
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<tr>
<td>Three Pass Running (m)</td>
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<td>30 m sprint speed (m/s)</td>
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<tr>
<td>Number of sprints (n)</td>
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<td>7 - 20</td>
<td>0.0436</td>
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‡ \( p < 0.05 \) test 2 from test 1.

**DISCUSSION**

This is the first study that evaluates the effects of a periodized training on a beach handball team, mainly in one of the best female beach handball teams. We verified statistically significant improvement in the variables of upper body power, speed and sprint endurance. Just the upper body power did not presented significant improve. However there was showed an increase tendency for that test.

The team had better results in comparison to other studies involving collective sports \((13, 14, 15, 16, 17)\), which found positive results, however without significant differences in the physical capacities. Considering that the exercises were applied directly at the training court (sand), and that there was no weight training during this stage, as well as in previous stages, we noticed that the exercises with overload accomplished through the specific sport motor gestures were efficient for the development of the athletes' physical capacities, mainly the muscle strength and power.

Some studies indicate that the genetic limitation due to athletes’ conditioning \((15)\), or appropriated training stimulus \((15, 23)\) does not allow a significant increase in the physical capacities. The present study, however, despite of other studies \((25, 26, 27, 28)\) shows that even taking into account the athlete’s level of athletes' performance, if is applied specific and appropriated training stimulus, it is possible to find significant increases in performance, even without using weight lifting.

The sprint endurance and jumps are very important for sports played on the sand, once that surface, compared to solid surfaces of the indoor handball, when the beach handball athletes
are running or walking in the sand results in a larger degradation in the elastic energy potential and it reduces the efficiency of the compound muscle tendon (18). There is reported a reduction in the reverse-use of elastic energy as well as loss of energy (19). Those biomechanics and physiologic conditions are pointed as the causes of the largest energy expenditure, comparing with solid surfaces (16). Some studies reported that walking on sand presents an energetic cost from 1.8 to 2.7 times larger than solid surfaces (19, 20), while running on sand present an energetic cost from 1.2 to 1.6 times larger than solid surfaces (20, 21, 22).

The fact that the lower body power showed an lower improvement than the upper body power is also found in other studies with team sports, because of the possibility of a difference of initial conditioning of upper and lower bodies (23), and in the daily intensity effort pattern used by the legs and arms (14, 24, 25). That performance differences among upper and lower body was found in studies with adolescent (25) and elite handball players (17). There is also the possibility of a excess in lower body training, if we consider just effort spent in physical trainings, without consider that even in tactical trainings we can note a large demand in lower body in the displacements.

The high correlation found between the three pass running tests and 15 m sprints shows a positive effect of specific stimulus of Motor Unities potential and activation, considering that both have neuromuscular characteristic, important for the elite indoor handball success (13), mainly in the beach handball, where will help in the execution of spectacular goals, accomplished through 360° jumps and flight throwing.

PRACTICAL APPLICATION

The beach handball is a new sport. The interest of this study is it to show parameters for the physical capacities that are important to the modality in order to present results for comparison in subsequent studies. The training applied got to present positive adaptations whole physical capacities, being significant for strength and power upper body, 15 m speed sprints endurance. This study can serve as parameter for future training applications in beach handball teams, seeking official competitions.

REFERENCES

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