27 - IDENTIFICATION OF THE MAXIMAL AEROBIC CAPACITY, SPEED AND THE VERTICAL JUMPS HEIGHTS OF ADULT FEMALE HANDBALL PLAYERS FROM THE CITY OF BETIM, MINAS GERAIS, BRAZIL.

MARCOS DANIEL MOTTA DRUMMOND
GIANNA EMANUELLA BATISTA
ÍCARO RICHELLI DIAS
VINÍCIUS LOPES DE FARIA
FACULDADE PITÁGORAS, BETIM, MINAS GERAIS, BRASIL.
marcos.drummond@pitagoras.com.br

INTRODUCTION

Handball is a sport modality that involves a large amount and variety of movements, associated with the handling of the ball and interaction with other players. The morphological characteristics of athletes, physical qualities resulting from regular training and innate abilities are of great importance for a good performance. These factors enable the development and global harmony of physical inherent performance of this modality (ELENO et al., 2002).

In handball, as in many events and sports games, the conquer of good results depends directly of the ability to jump (ALVES et al., 2008; CHELLY et al., 2011; ELENO et al., 2002), which makes fundamental the evaluation of the impulse produced by the athlete and his ability to transfer it to sports situations (FERREIRA et al., 2008). The squat jump test allows the analysis of concentric force production of lower limbs. In countermovement jump (CVJ) is present the stretch-shortening cycle (SSC) in the lower limbs (Brazz et al., 2010), which is also present in various situations in the handball game.

The aerobic and anaerobic pathways are utilized in the practice of handball, in different physical capabilities. Chelly et al. (2011) analyzed images of six handball games, to describe the average effort of the players in the adult category. The results showed that athletes run approximately three and a half miles per game, but the actions of throws, jumps and high speed displacement are predominant in the match. These results are corroborated by the findings of Alves et al. (2008), which emphasize that anaerobic events such as running at high speed, change of direction, jumps and throws, are more present in a handball match, being essential to the performance. However, according to these authors, athletes of this sport, in several studies, showed values of VO2 max relative high compared to individuals of the same gender and age were not engaged in sports activities. These findings suggest the development of aerobic capacity through training and regular practice of handball.

Eleno et al. (2002), have similar considerations. According to these authors the maximum speed in shifts, high reaction speed and agility are important physical capabilities for the handball performance, as well as the maximum muscle strength and power in the jumps, throws and explosive movements. The endurance is also important because it is responsible for maintaining the performance in the match and the proper recovery after and during the handball game. Other physical capabilities are also important, such as flexibility and strength endurance, together with the ability to coordinate movements of precision specific modality.

The analysis about the energetic pathways and physical abilities required in the exercise is essential to plan and execute training (ALVES et al., 2008; ROSENGUINI et al., 2008). In Brazil it is common that the choice of handball players is made considering physical and technical condition, which should not be neglected (NOGUEIRA et al., 2005). However, there are few data about important parameters for good performance in handball for women's adult category, as reference values for aerobic capacity, speed and height of vertical jumps. Obtaining such data certainly contributes to the identification of athletes and prescription of the handball training.

The purpose of this study was to measure and identify the values of aerobic capacity, speed and height of vertical jumps, of the female handball players from the city of Betim, Minas Gerais, Brazil, adult category. Thus, make available an additional source of references for consultation by researchers and trainers who work or will work with this modality.

MATERIALS AND METHODS

SUBJECTS

The sample consisted of 16 female handball athletes, adult category, from the city of Betim, Minas Gerais, Brazil. The mean age was 18.3±2.4 years. The mean total body mass was 56.86 ± 11.23 kg, while the average height was 1.64±0.07 m and body mass index (BMI) was 21.20±3.01 kg/m2.

PROCEDURES

The tests were applied at intervals of approximately 72 hours, in the year 2011, on the court with the dimensions of 40x20 meters in the gymnasium Divine Braga in Betim, Minas Gerais, Brazil.

The measure of the total body mass was obtained on a digital scale of the brand Plenae®, where the mass was distributed on both feet. Height was measured in portable stadiometer, brand Sanny®. The athletes were wearing light shorts, light shirts, barefoot or with socks. All were instructed to form a right angle with the vertical edge of the device.

To evaluate the aerobic capacity was applied the 1600m running test which estimates the maximum oxygen consumption. The volunteers were instructed to run at a constant speed, close to the maximum, where adjustments should be made so as subjective and individualized. The goal was to go through 1600 meters in the shortest time possible. The route was marked by cones placed around the court. The test was selected to be practical and specific, since it was applied in the handball court officer. Also, the absolute speed control was performed individually as well as in the handball games. For the calculation of the aerobic capacity, in relative VO2 max (ml/kg.min-1), was used the following equation proposed by Almeida et al. (2010) (equation 1):

$$VO2\ max\ (mL.kg{-}1.min{-}1) = [0{,}177 \times 1600\ average\ speed] + 8{,}101 \quad (1)$$

The speed test distance was 30 meters. The distance was determined according to the average distance covered in a handball match, second Chelly et al. (2011) and for be used in other studies such as the Dechechi et al. (2010). To measure the average speed were used photocells positioned at the starting line, after 10 meters from the start line and in the end of the course of 30 meters. To avoid deceleration before 30 meters, the final of the run was marked three meters ahead of the last photocell. An

area of deceleration with five feet long was enclosed at the end of route. The data acquisition, calculation and determination of the results were performed using the program Multisprint Full ®. Addition to the analysis of the final result of 30 meters, the 10 meters initial determine the average acceleration, while analysis section between 10 and 30 meters can determine the maximum speed of the player, as long as the total duration of the test does not exceed six seconds (FERNANDES, 2003).

The estimates of heights of the vertical jumps were made measuring the flight time of each player, recorded by a contact plate Jumptest ® which proved reliable and valid before a force platform (PLA3-1D-7KN/JBA Zb, Staniak ®, Poland) with a coefficient of variation of 3.03% (Ferreira, et al. 2008). The interface with the contact plate was performed using the software Multisprint ®.

In squat jump the player started from a static position with the knees flexed at an angle of approximately 90 degrees, hands still on her hips, feet parallel with spacing corresponding to the width of the shoulders. Starting from this initial position was allowed only upward movement. The movement was executed and the player tried to reach the greatest height possible. Three jumps were performed and recorded.

In countermovement jump (CMJ) the player came from a standing position with his hands still on her hips, feet parallel with spacing corresponding to the width of the shoulders. Thereafter moved down, "flexing" the hip joints, knees and ankles. The transition from the first phase (descending) to the next phase (ascending) happened in a continuous movement in which the joints were extended as soon as possible. Thus, the mechanism associated with muscular stretch-shortening cycle (SSC) possibly been used. Three jumps were performed and recorded.

RESULTS

In the test of the aerobic capacity (1600m running), the average VO2 max relative was 32.04 ± 3.46 ml/kg.min-1. The VO2 max absolute was 1.89 ± 0.36 L / min. The results are shown in Table 1.

Table 1 - Mean and standard deviation (SD) of aerobic capacity (1600m running), of the 16 female players of the Handball team from Betim, Minas Gerais, Brazil.

	VO_2 max relative ($ml/kg.min^{-1}$)	VO_2 max absolute (L/min)
Mean	32,04	1,89
SD	3,46	0,36

In the analysis of the best speed test results, the mean and standard deviation of 30 meters was 5.91±0.31 m/s. In the section 0-10 meters the mean values were 4.86±0.20 m/s, while in the section 10-30 meters the mean values were 6.77±0.44 m/s. The best results of CMJ showed mean values of 27.94±4.77 cm. In the squat jump the mean of the best results was 26.19±4.10 cm (Table 2).

Table 2 - Mean and standard deviation (SD) of the best results of the speed test and vertical jumps.

Teste	Mean	SD
30 meters (m/s)	5,91	0,31
0-10 meters (m/s)	4,86	0,20
10-30 meters (m/s)	6,77	0,44
CMJ (cm)	27,94	4,77
Squat jump (cm)	26,19	4,10

DISCUSSION

This study measured e identified values of aerobic capacity, speed and vertical jumps heights of the female players of the handball team from the city of Betim, Minas Gerais, Brasil. Thus, provided a further source of references for consultation by researchers and trainers who work or will work with this modality.

Regarding to the aerobic capacity, Nogueira et al. (2005) evaluated the aerobic capacity of adult female handball players of the Brazil women's national handball team. The mean of VO2 max relative was 45.3±5,4 ml.kg.min-¹. Vargas et al. (2008) evaluated the maximal aerobic capacity of female handball players from Associação Atlética Universitária de Concórdia (Concordia University Athletic Association), which have a mean value of 45.03±3.0 ml.kg.min-¹. The values found in these studies were similar, but showed great difference with the values of the players of the present study. A possible lower training load and number of games of this study sample is the possible explanation for this difference. Alves et al. (2008) corroborate this idea when discussing that in several studies, handball practitioners showed higher values of VO2 max relative when compared to individuals of the same gender and age were not engaged in sports activities. Thus, these findings suggest the development of aerobic capacity through regular practice of handball. Thus, these findings suggest that the development of aerobic capacity is proportional to the regular practice of handball. However, it is necessary to analyze the load of physical training in relation to aerobic conditioning, which can raise the values of that physical ability, but perhaps they are not used effectively during matches. Further studies about this topic are needed.

Regarding the values of speed tests, Dechechi et al. (2010) evaluated during six months the players of the Brazil women's national handball team, category sub 21, and finding average values of 5.83 m/s in the test of 30 meters after the training season. There were no other studies assessing this parameter in female adult handball players.

The result of the speed test dependent of the initial and maximum acceleration, in this situation the contact time with the ground is short, which leads to a reduction of the time available for power generation. Thus, the SSC and a higher

development of the rate of force become determinants of individual performance (CHELY et al., 2011). The results of this study in 30m speed test, which registered a mean of 5.91±0.31 m/ s, showed superior results to those found by Dechechi et al. (2010) where the best mean for the speed test of 30 meters was 5.83 m/s. This difference may be related to the age or category. According Dechechi et al. (2010), the findings of their study emphasizes that the individuality in response to the effects of training should be considered. These authors also suggest that other assessment methods and speed training should be developed.

In this study, the speed test was also assessed fractionated for the distances between 0 to 10m and 10 to 30m. In the passage between 0 to 10m the performance is dependent of the player's acceleration ability, while between 10 and 30m the maximum speed is possibly crucial for good performance. No studies were found that made this fractioned analysis to a similar sample, which does not allow the classification and comparison, making explicit the need for further studies.

Regarding to vertical jumps, Raso et al. (2000) tested young handball players, females, in the CMJ without the aid of the upper limbs. The mean value was 35.4±2.9 cm. These values were compared to adult women's handball team of the state of São Paulo, Brazil, which showed mean values of 31.4±4.0 cm. Environmental factors, together with heredity and genetic variation may determine the response patterns of an individual training (RASO et al., 2000). When applying the vertical jump tests in the present study sample, was found that the best results of the CMJ are inferior in relation to the values of Raso et al. (2000), which evaluated the Brazil women's national handball team. This difference may be explained by differences in sample characteristics. Thus, the sample of this study may not have been able to use optimally the SSC.

In the squat jump the individual is stabilized in the squatting position, not using SSC, being dependent of the concentric muscle strength (Ferreira et al., 2008). Thus, the jump squat becomes an excellent way to evaluate the concentric force. However, were no found studies that evaluated the squat jump in a similar sample, making it impossible the discussion of the results about their parameters.

CONCLUSION

This study achieved its purpose, to test and identify the aerobic capacity, speed and height of vertical jumps heights of the female handball players from the city of Betim, adult category. The values found for the CMJ are lower than those reported in the literature, as well as the values of aerobic capacity. However, the average speed was higher than values reported in the literature, for a similar sample.

Thus, new data were made available for classification and comparison of female handball players, which directs the evaluation and training prescription for this modality. Further studies with other women handball teams, are needed to enrich the data available for evaluation and training prescription.

REFERENCES

ALVES, T.C.; BARBOSA, L.F. e PELLEGRINOTTI, I.L. Características Fisiológicas do Handebol. CONEXÕES, revista da Faculdade de Educação Física da UNICAMP. Vol. 6, Ed. Especial, p. 59-71, 2008.

BRAZ, T.V. et al. Comparação entre diferentes métodos de medida do salto vertical com contramovimento. R. bras. Ci. e Mov V. 18, n. 2, p. 43-49. 2010.

CHELLY, M.S. et al. Match Analysis of Elite Adolescent Team Handball Players. Journal of Strength Conditioning Research. V. 25, n. 9, p. 2410-2417, 2011.

DECHECHI, C.J. et al. Estudo dos efeitos de temporada de treinamento física sobre a performance de uma equipe de handebol feminino sub-21. Rev. Bras. Med. Esporte. V. 16, n.4, p. 293-300, 2010.

ELENO, T.G.; BARELA, J.A. e KOKUBUN, E. Tipos de Esforço e Qualidades Físicas do Handebol. Rev. Bras. Cienc. Esporte. V. 24, n.1, p.83-98, 2002.

FERNANDES FILHO, J. A Prática da Avaliação Física. 2. ed. Rio de Janeiro: Shape, 2003.

FERREIRA J.C., CARVALHO R.G.S., SZMUCHROWSKI L.A. Validade e confiabilidade de um tapete de contato para mensuração da altura do salto vertical. Rev. Bras. Biomecânica. V. 9, n.17, p.39-45, 2008.

NOGUEIRA, T.N. et al. Perfil Somatotipo, Dermatoglifico e das Qualidades Físicas da Seleção brasileira de Handebol feminino adulto por posição de jogo. Fit. Perf. J. V. 4, n.4, p. 237-244, 2005.

RASO, V. et al. Estabilidade no prognóstico do perfil de aptidão física de jovens atletas de handebol. Rev. Bras. Med. Esporte. Vol. 6, n. 3, p. 85-92, 2000.

ROSEGUINI, A.Z. et al. Determinações e Relações dos Parâmetros Anaeróbios do RAST, do Limiar Anaerobio e da Resposta Lactacidemica Obtida no Inicio, no Intervalo e ao Final de uma Partida Oficial de Handebol. Rev. Bras. Med. Esporte. V. 14, n. 1, p. 46-50, 2008.

VARGAS, R.P. et al. Avaliação de características fisiológicas de atletas de handebol feminino. Fit. Perf. J. V. 7, n. 4, p. 93-98, 2008.

MARCOS MOTTA DANIEL DRUMMOND.
R. Des. Penna, 95, Belvedere.
Belo Horizonte, Minas Gerais, Brazil.
marcos.drummond@pitágoras.com.br

IDENTIFICATION OF THE MAXIMAL AEROBIC CAPACITY, SPEED AND THE VERTICAL JUMPS HEIGHTS OF ADULT FEMALE HANDBALL PLAYERS FROM THE CITY OF BETIM, MINAS GERAIS, BRAZIL.

ABSTRACT

The aim of this present study was to measure and to identify the values of the aerobic capacity, speed and the vertical jumps heights of the female handball players from the city of Betim, Minas Gerais, Brazil. The sample was constituted by 16 players of the adult category (18,3±2,4 years, 56,86±11,23kg, 1,64±0,07m). For measuring the VO2 max relative was applied the 1600 m running test, while for determining the height of vertical jumps, countermovement jump and squat jump, contact plates were used. In 30 meters speed test, data were obtained using photocells. The best results obtained showed an mean of 25,26±9,04cm in the countermovement jumps and 25,82±4,36cm in the squat jumps. The mean speed was 6,77±0,44 (30m) and the VO2 max relative was 32,04±3,46 ml/Kg.min-1. Thus, data were obtained and made available for comparison, evaluation and training prescription for this modality.

KEYWORDS: Handball, aerobic capacity, vertical jumps.

L'IDENTIFICATION DE LA CAPACITE AÉROBIE, LA VITESSE ET LA HAUTEUR DES SAUTS VERTICAUX D'ATHLÈTES DE L'ÉQUIPE FÉMININE DE HANDBALL LA CITÉ DE BETIM, MINAS GERAIS, AU BRÉSIL, CATÉGORIE ADULTE.

RÉSUMÉ

L'objectif de cette étude était de mesurer et identifier les valeurs de la capacite aérobie, vitesse et la hauteur des sauts verticaux, de la athlète féminine de handball de la cité de Betim, Minas Gerais, au Brésil. L'échantillon était composé de 16 athlètes de la catégorie des adultes (18,3 ± 2,4 ans, 56,86 ± 11,23 kg, 1,64 ± 0,07 m). Pour la mesure de la VO2 max. relatif a utilisé le test de course 1600m, alors que pour la détermination de la hauteur des sauts verticaux, contre-mouvement et squat sauté, contactez plaques ont été utilisées. Sur test de vitesse de 30 mètres, les résultats ont été obtenus avec l'utilisation de cellules photoélectriques. Les meilleurs résultats ont montré une moyenne de 25,26 ± 9,04 cm pour la hauteur des sauts contre-mouvement et 25,82 ± 4,36 cm de squat sauté. La vitesse moyenne était de 6,77 ± 0,44 (30 mètres) et le VO2 max. relatif était 32,04 ± 3,46 ml/kg.min-1. Ainsi, les valeurs ont été recueillies et mises à disposition pour la comparaison, évaluation et prescription de entraînement pour le handball.

MOTS-CLÉS: Handball, capacité aérobie, sauts verticaux.

IDENTIFICACIÓN DE LA CAPACIDAD AERÓBICA, VELOCIDAD Y ALTURA DE LOS SALTOS VERTICALES DEL EQUIPO FEMININA DE BALONMANO DE LA CIUDAD DE BETIM, MINAS GERAIS, BRASIL.

RESUMEN

El objetivo del presente estudio fue medir e identificar los valores de la capacidad aeróbica, velocidad y altura de los saltos verticales, de las atletas de balonmano feminino de la ciudad de Betim, Minas Gerais, Brasil. La muestra constaba de 16 atletas la categoría de adultos (18,3 ± 2,4 años, 56,86 ± 11,23 kg, 1,64 ± 0,07 m). Para la medición de VO2 max fue utilizado la puebra de la carrera 1600m, mientras que para la determinación de la altura de los saltos verticales, con contramovimiento y a partir de una posición en cuclillas (sin contramovimento), placas de contacto fueron utilizados. En puebra de velocidad de 30 metros, los datos se obtuvieron con el uso de fotocélulas. Los mejores resultados mostraron una media de 25,26 ± 9,04 cm para la altura de los saltos con contramovimiento y 25,82 ± 4,36 cm en los saltos sin contramovimento. La velocidad fue de 6,77 ± 0,44 (30 metros) y VO2 max fue 32,04 ± 3,46 ml/kg.min-1. Así, los datos fueron obtenidos y puestos a disposición para la comparasion, , evaluación y prescripción de lo entrenamiento para el balonmano .

PALABRAS CLAVE: Balonmano, capacidad aeróbica, saltos verticales.

IDENTIFICAÇÃO DA CAPACIDADE AEROBIA, VELOCIDADE E ALTURA DOS SALTOS VERTICAIS DAS ATLETAS DA EQUIPE FEMININA DE HANDEBOL DA CIDADE DE BETIM, MINAS GERAIS, BRASIL, CATEGORIA ADULTO.

RESUMO

O objetivo do presente estudo foi medir e identificar os valores da capacidade aeróbica, velocidade e altura dos saltos verticais, das atletas da equipe de handebol feminino da cidade de Betim, Minas Gerais, Brasil. A amostra foi constituída por 16 atletas da categoria adulta (18,3±2,4 anos, 56,86±11,23kg, 1,64±0,07m). Para a mensuração do VO2 máximo relativo foi utilizado o teste de corrida de 1600m, enquanto que para determinação da altura dos saltos verticais, Contramovimento e partindo da posição agachada, foram utilizadas placas de contato. No teste de velocidade de 30 metros, os dados foram obtidos com a utilização de fotocélulas. Os melhores resultados obtidos apresentaram média de 25,26±9,04cm para a altura dos Saltos Contramovimento e 25,82±4,36cm nos Saltos Agachados. A média de velocidade foi de 6,77±0,44 (30 metros) e o VO2 máximo relativo foi 32,04±3,46 ml/kg.min-1. Assim, foram obtidos e disponibilizados dados para comparação, avaliação e prescrição do treinamento para a modalidade.

PALAVRAS CHAVES: Handebol; Capacidade aeróbica; Saltos verticais.