27 - COMPARASION OF BASAL METABOLIC RATE MEASURED AND PREDICTED FROM WHELLCHAIR BASKETBALL PLAYERS

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INTRODUCTION

Meet the energy demands - the first nutrition's priority for athletes - is essential on maintaining lean body mass, immune system and physical performance. The dietary recommendation is based on normal daily needs, considering, in athletes, the specificities of the sport (ADA, 2000). But for disabled athlete, the energy requirement can be altered by changes in body composition caused by chronic use of a wheelchair and by the characteristics of disability.

The basal metabolic rate (BMR) is the amount of energy required for maintenance of vital bodily functions, as measured under standard conditions of fasting, physical and mental rest in a quiet environment with controlled temperature, lighting and noise (CRUZ et al , 1999; WAHRLICH & ANJOS, 2001a; WAHRLICH & ANJOS, 2001b; SCHNEIDER & MEYER, 2005). For being the most important quantitative component of energy expenditure (EE) (BUCHHOLZ et al, 2003; DONAHOO et al, 2004; SCHNEIDER & MEYER, 2005), and as the World Health Organization (WHO) suggests that the components are the same expressed as multiples of BMR, it is necessary that it be estimated as close to the reality of each population for appropriate prescription of its energy needs and levels of physical activity (CRUZ et al, 1999). Thus the measure of oxygen consumed, ie, indirect calorimetry, has meant a significant improvement in the measurement of heat production for estimation of resting energy expenditure, and is currently the gold standard for this purpose (WAHRLICH & ANJOS, 2001b).

The wheelchair basketball is a sport for individuals with permanent physical disability in the lower body that prevents them from running and jumping. Generally, spinal cord injured, amputees, polio Seguela and myelomeningocele are those that make up this group. It is therefore essential to consider the physiological changes imposed by the disability for the determination of BMR, energy expenditure, dietary assessment and prescription and sports training.

Due to the high cost and lack of availability to use indirect calorimetry in clinical practice, the BMR predictive equations are used to the general population. However, these seem to overestimate the BMR of individuals living in the tropics, as in Brazil (CRUZ et al, 1999; WAHRLICH & ANJOS, 2001a; WAHRLICH & ANJOS 2001b, SCHNEIDER & MEYER, 2005) and disabled (MONROE et al. 1998, BUCHHOLZ et al, 2003, JEON et al, 2003) ones.

Considering the greater risk that this population presents to the early development of obesity by increasing body fat and decreased lean body mass (SPUNGEN et al, 2003; BUCHHOLZ & PENCHARZ, 2004, BERTOLI et al, 2006) and influence of improvement in body composition sports performance, the objective of this study was to determine the BMR of adapted basketball players by indirect calorimetry and compare your result with the prediction equation recommended by WHO (FAO / WHO / UNU, 1985) and Harris and Benedict (1919).

METHODS

The sample of 15 wheelchair basketball players, practitioners of the sport to at least six consecutive months, two teams from Rio de Janeiro. The age ranged from 25 to 57 years. All signed a consent form agreeing to participate in the survey, which was approved by the Ethics in Research of the University Hospital Clementino Fraga Filho (HUCFF), Federal University of Rio de Janeiro (UFRJ), Brazil under the number of 165/07.

The BMR was measured by indirect calorimetry using the gas analyzer MEDGRAF brand, model VO2000 as described by Wahrlich et al (2006). This device collects samples of gases with the aid of a nozzle and nasal occlude. This analysis was done between seven and nine o'clock in the morning, quiet room, with appropriate conditions of temperature, light and noise. The volunteers were transported to the Laboratory for Exercise Physiology (LABOFISE) School of Physical Education and Sport (EEFD) UFRJ, by motor vehicle to ensure minimal activity before data collection. It was verified adherence to protocol for measurement of BMR, which included fasting for at least 12 hours, eight hours of sleep the night before the test and maintenance of daily activities, avoiding intense physical activity the day before.

Initially, the test was explained to the volunteer who stayed 10 minutes lying supine at rest. After this period, the nasal tip and the occlude were fixed on his face and the first connected to the calorimeter. Oxygen consumption (VO2) and carbon dioxide production (VCO2) were measured for 25 minutes with the same lying still. The measurement of BMR (kcal.min-1) was obtained by equation [3.9 x (VO2) + 1.1 x (VCO2)] described by Weir (1949), which corrects the non-use of protein metabolism, with data from the last 20 minutes, whose average was multiplied by 1440 to get the BMR of 24 hours.

The BMR measured by colorimetry (BMRm) was compared with values generated by the prediction equations of FAO/WHO/UNU: BMRf (18-30 years old) = (15.3 x 679 + MC) or to 30-60 years BMRf=[(11.6 x 879 + MC)]; and to equation of Harris & Benedict: BMRb= 66.47 + (13.75 x MC) + (5.00 x E) - (6.76 x ID); where MC= body mass (kg), E= height (m) and ID= age (years).

The relative difference between the BMRm and predicted by equations (MBRp) were calculated as follows: [(BMRp - BMRm) / BMRm] x 100.

Body mass was determined on an electronic scale Star - Mark FILIZOLA with a capacity of 300 kg and 100 g precision. The athletes were weighed themselves sitting in chairs. Soon after the chair was heavy discounting, their own and the total obtained to calculate body mass. The athletes were barefoot and with as little clothing as possible.

The height was estimated from the half-arm span (MEB). For the determination of the appraised MEB was kept in the supine position with arms abducted and palms facing up. The measure corresponding to the extension point at the level of the central segment of the jugular sternal notch to the end of the third right finger, without considering the nail. Measurements were made using a flexible metal tape CARDIOMED ®, with precision of 1 mm. The height is double this value (LOHMAN et al, 1988; MANADHAR & ISMAIL, 1999).

The relative body fat (%BF) and lean body mass (kg) were estimated by the method of dual-energy X-ray absorptiometry (DXA) with the densitometer Lunar Prodigy Advanced Plus (GE Lunar, Milwaukee, WI, USA) with the the software 9.0.

To check the normality test was used Kolmogorov-Smirnov. The data exhibited a normal distribution for the descriptive analysis of the physical characteristics, body composition and metabolic disorders, were obtained mean and standard deviation.

The paired Student t test was used to verify differences between BMRm and TMBp (BMRf and BMRb). To describe the correlation between BMR, age, body mass and body composition, we used the linear correlation coefficient of Pearson. The significance level was 5%. All tests were performed in the statistical package Statistical Package for Social Sciences (SPSS) version 17.0 for Windows.

RESULTS

Between the 15 athletes, two had unilateral amputation, three were disabled because of congenital sequelae of poliomyelitis were four and six were paraplegics. The mean and standard deviation of age (years), height (m), body mass (kg), body mass index (BMI, kg/m2), lean body mass (kg) and body fat (%BF), are described in Table 1, as well as values and m TMBP (TMBf and TMBhb). The equation of the FAO / WHO / UNU was the most overestimated BMR (1741.36 ± 189.58, 26.6%, $p \leq 0,05$). The equation of Harris & Benedict overestimated BMR by 24.5% ($p < 0.05$). The BMRm showed a weak negative correlation between BMRp and other variables. However, there was strong correlation enters the BMRf and BMRb ($r^2 = 0.752$) and those with body mass ($r^2 = 0.975$ and $r^2 = 0.745$, respectively) and lean mass ($r2 = 0.872$ and $r^2 = 0.802$, respectively).

Table 1: RESULTS

Variables	Mean ± Sd
Age (years)	34.37 ± 8.10
Height (m)	1.85 ± .10
Body Mass (kg)	74.15 ± 15.06
Body Mass Index (kg/m²)	21.55 ± 3.49
Lean Body Mass (kg)	50.72 ± 9.84
Fat percentage (%)	26.39 ± 9.07
TMBm (kcal/ dia)	1375.19 ± 376.48*
TMBf (kcal/ dia)	1741.36 ± 189.58*
TMBhb (kcal/dia)	1712.16 ± 356.55*

* Significant difference for $p < 0.05$

DISCUSSION:

The BMRm was statistically minor of the BMRp. This difference may be related to the use of body weight in prediction equations. Since adipose tissue is metabolically less active, an increase in body fat contributes to less kcal / kg / day when compared to individuals with less body fat. Although the BMI of the athletes to be classified as normal weight, fat percentage was considered high (26.39%) for men and especially athletes (ACSM, 1986). Both body crumples as the amount of muscle mass were strongly correlated with the BMRp.

BMR predictive equations used for the general population seem to overestimate the BMR of disabled confined to wheelchairs (MONROE et al, 1998, BUCHHOLZ et al, 2003, JEON et al, 2003). Molling et al (1985) evaluated the BMR of 48 men with spinal cord injury by calorimetry. The results also showed lower measured BMR when compared with the predicted equations. Most of these equations have been validated with European and North American non-disabled. When used for the disabled, such equations overestimate the energy needs of 5 to 32% (BUCHHOLZ et al, 2003). In the present work BMRf and BMRm overestimated in 26.6% and 24.5% respectively.

Other studies have compared the BMRm of disabled individuals with non-disabled controls and the overestimate were confirmed. Monroe et al (1998) evaluated the BMR of ten American men with disabilities (nine paraplegic and a quadriplegic with complete injuries) and compared with 59 control men without disabilities. The authors found a BMR 26% lower in disabled. Buchholz et al (2003) investigated the influence of body composition on basal metabolism in paraplegic Canadians, compared with individuals without disabilities. The BMR was 14% higher in controls. Jeon et al (2003) determined the BMR of 14 Canadians with spinal cord injury and this was significantly lower when compared with control (1451 ± 241 and 1848 ± 258 kcal / day, respectively, $p = 0.01$), 27% .

The BMR is influenced by different factors (ANTUNES et al, 2005), as lean mass and fat mass (SPUNGEN et al, 2003), body surface area and degree of physical activity (BUCHHOLZ et al, 2003, JONES et al , 2003; BERTOLI et al, 2006), which are commonly altered in disabled people confined to wheelchairs.

The continued practice of physical activity changes body composition of these individuals so that preclude the extrapolation of TMB disabled physically active to sedentary. This confirms the need to use more accurate methods for determination of and enable the formulation of specific equations for this population. With that avoid overestimation, when evaluated as non-disabled, and perhaps an underestimation when compared with sedentary individuals with disabilities, which would undermine the nutritional status, exercise performance and quality of life of these athletes.

CONCLUSION

The equations to predict BMR by FAO/WHO/UNU and Harris & Benedict were not appropriate to estimate BMR of wheelchair basketball players, when compared with BMR determined by indirect calorimetry. Whereas the early development of obesity in disabled, and the influence of body composition in improving sports performance, meet the BMR will guide the actual energy requirements for maintenance of health, dietary interventions and of specific sports training.

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COMPARASION OF BASAL METABOLIC RATE MEASURED AND PREDICTED FROM WHEELCHAIR BASKETBALL PLAYERS

BACKGROUND: To meet the energy demands is essential in maintaining lean body mass, immune system and physical performance and dietary recommendations for athletes is based on daily needs and the specificities of the sport. In disabled athlete, the energy requirement can be altered by changes in body composition caused by chronic use of a wheelchair and by the characteristics of disability. The basal metabolic rate (BMR) is the most important quantitative component of energy expenditure and how the World Health Organization (WHO) suggests that the same components are expressed as multiples of BMR, it must be estimated as close to reality as possible to appropriate prescription of physical activity and energy. OBJECTIVE: To determine the BMR of adapted basketball players by indirect calorimetry and compare your result with the prediction equation recommended by WHO (FAO/WHO/UNU, 1985) and Harris and Benedict (1919). METHODS: There was evaluated15 adapted basketball players, male, initially it was measured the body mass (kg) and height (m). Body mass composition was performed by the method “Dual-energy X-ray absorptiometry” (DXA). The BMR was measured by indirect calorimetry (BMRm) with a protocol validated by Wahrlich et al (2006) and compared with values generated by the prediction equations (BMRp). The paired t-Student test was used to determine the difference between BMRm and BMRp. To describe the correlation between TMB, age, body mass and body composition, it was used the linear correlation coefficient of Pearson. RESULTS: The average was BMRm 1375.19 kcal (±376.48 kcal), significantly lower than the BMRp, and the equation of the FAO / WHO / UNU was the most overestimated BMR (26.6%). There was a strong correlation between BMRp and those with body mass and lean body mass. CONCLUSÃO: The BMRp not reliably predicts the BMR of basketball players adapted, when compared with BMRm.

KEY WORDS: Basal metabolic rate, Basketball adapted, Physically handicapped

COMPARAISON DES TAUX DE MÉTABOLISME DE BASE MESURÉES ET PRÉDITES DE JOUEURS DE BASKET-BALL ADAPTÉ

INTRODUCCIÓN: Pour répondre à la demande d'énergie humane est essentielle dans le maintien de la masse maigre, le système immunitaire et la performance physique. En athlète handicapé, le besoin en énergie peut être modifié par des changements dans la composition corporelle causée par l'utilisation chronique d'un silla de ruedas et par les caractéristiques du handicap. Le taux métabolique basal (TMB) est l'élément le plus important quantitatif de la dépense énergétique. Considérant que l'Organisation mondiale de la Santé (OMS) suggère que les composantes de la dépense énergétique sont exprimées en multiples de TMR, elle doit être estimée le plus proche de la réalité que possible pour aider la prescription de l'énergie et individualisée de l'activité physique. OBJECTIF: Déterminer la TMR de joueurs de basket-ball adapté par calorimétrie indirecte et comparer les résultats avec celle de l'équation de prédiction recommandées par l'OMS (FAO / OMS / UNU, 1985) Harris et Benedict (1919). MÉTHODES: Un total de 15 joueurs de basket-ball adapté, de sexe masculin, a eau évaluée. La masse corporelle (kg) et la hauteur (m) sont évaluées pour la méthode anthropométrique. La composition corporelle a été réalisée par le method “Dual-Energy X-ray Absorptiometry” (DXA). Le TMB a été mesurée par calorimétrie indirecte (TMBm) validé par le deuxième protocole Wahrlich et al. (2006) et comparées avec les valeurs générées par les équations de prédiction (TMBp). Le test de t-Student apparié a été utilisé pour déterminer la différence entre TMBm et TMBp. Pour décrire la corrélation entre TMR, à l'âge, la masse

corporelle et la composition corporelle, il y a été utilisé le coefficient de corrélation linéaire de Pearson. RÉSULTATS: La moyenne était de 1375,19 TMBm kcal (± 376,48 kcal), nettement inférieure à la TMBp, et l'équation de la FAO / OMS / UNU a été la plus surestimée TMR (26,6%). Il y avait une forte corrélation entre TMBp et masse corporelle et masse maigre. CONCLUSÃO: Le TMBp pas prévoir de manière fiable la TMB de joueurs de basket-ball adapté, par rapport à TMBm.

MOTS CLÉS: Taux métabolique basal, Basket-ball adapté, Handicapés physiques.

COMPARACIÓN DE LA TASA METABÓLICA BASAL MEDIDO Y PREDIJO DE JUGADORES DE BASKET-BALL ADAPTÉ

INTRODUCCIÓN: Satisfacer las demandas de energía es esencial para mantener la masa corporal magra, el sistema inmune y del rendimiento físico. En los atletas con discapacidad, las necesidades energéticas pueden ser alterados por los cambios en la composición corporal causado por el uso crónico de una silla de ruedas y por las características de la discapacidad. La tasa metabólica basal (TMB) es el componente cuantitativo más importante de los gastos de energía. Considerando que la Organización Mundial de la Salud (OMS) sugiere que los componentes del gasto de energía se expresan como múltiplos de la TMB, se debe estimarse la TMB o más a cerca posible a la realidad para el prescripción de la energía y de la actividad física. OBJETIVO: Determinar el TMB de los jugadores de basquetbol adaptado por calorimetría indirecta y comparar su resultado con la ecuación de predicción que recomienda la OMS (FAO / OMS / UNU, 1985) - Harris y Benedict (1919). MÉTODOS: Se evaluó 15 jugadores de baloncesto adaptado, hombres. Se medirán la masa corporal (kg) y la altura (m). La composición corporal se realizó mediante el método “Dual-Energy X-ray Absorptiometry” (DXA). El TMB fue medido por calorimetría indirecta (TMBm) segundo protocolo Wahrlich et al (2006) y se compararon los valores encontrados con los valores generados por las ecuaciones de predicción (TMBp). Se utiliza La prueba de t-Student pareado para determinar la diferencia entre TMBm y TMBp. Para describir la correlación entre el TMB con la edad y con la masa corporal y la composición corporal, se utilizó el coeficiente de correlación lineal de Pearson. RESULTADOS: El promedio fue de 1.375,19 TMBm kcal (± 376,48 kcal) fue significativamente más bajo que el TMBp, y la ecuación de la FAO / OMS / UNU fue el TMB más sobreestimado (26,6%). Hubo una fuerte correlación con TMBp con masa corporal y con masa magra. CONCLUSÃO: El TMBp fue menos fiable para estimación de la TMB de los jugadores de basquetbol adaptado, en comparación con TMBm.

PALABRAS CLAVE: Tasa metabólica basal, Baloncesto adaptado, Discapacitados físicos.

COMPARAÇÃO DA TAXA METABÓLICA BASAL MEDIDA E PREDITA DE JOGADORES DE BASQUETE ADAPTADO

INTRODUÇÃO: Atender as demandas energéticas é essencial para a manutenção da massa magra, sistema imune e desempenho físico. Em atleta deficiente físico, a necessidade energética pode estar alterada pelas mudanças na composição corporal causadas pelo uso crônico da cadeira de rodas e pelas características da deficiência. A taxa metabólica basal (TMB) é o mais importante componente quantitativo do gasto energético. Tendo em vista que a Organização Mundial de Saúde (OMS) sugere que os componentes do gasto energético sejam expressos como múltiplos da TMB, esta deve ser estimada o mais próximo possível da realidade para que se proceda adequada prescrição energética e de atividade física. OBJETIVO: Determinar a TMB de jogadores de basquete adaptado pela calorimetria indireta e comparar seu resultado com os da equação de predição recomendada pela OMS (FAO/WHO/UNU, 1985), e a de Harris e Benedict (1919). MÉTODOS: 15 jogadores de basquete adaptado, do sexo masculino, foram avaliados. Determinou-se a massa corporal (kg) e estatura (m). A composição corporal foi medida pelo método de absorciometria radiológica de dupla energia (DXA). A TMB foi medida pela calorimetria indireta (TMBm) segundo protocolo validado por Wahrlich et al. (2006) e comparada com valores gerados pelas equações de predição (TMBp). O teste t-Student pareado foi utilizado para verificar diferença entre a TMBm e as TMBp. Para descrever a correlação entre a TMB, idade, massa corporal e composição corporal, foi utilizado o coeficiente de correlação linear de Pearson. RESULTADOS: A TMBm média foi 1375,19 kcal (± 376,48 kcal), significativamente menor do que as TMBp, sendo que a equação da FAO/WHO/UNU foi a que mais superestimou a TMB (26,6%). Houve forte correlação entre as TMBp e, destas com a massa corporal e a massa magra.CONCLUSÃO: A TMBp foi menos eficaz para estimar a TMB de jogadores de basquete adaptado, quando comparadas com a TMBm.

PALAVRAS-CHAVE: Taxa metabólica basal, Basquete adaptado, Deficiente físico.