44 - CAN A 3-MONTH HANDBALL TRAINING CHANGE ANTHROPOMETRIC PARAMETERS AND CARDIOVASCULAR RESPONSES IN ADOLESCENTS AGED 14 TO 18 YEARS?

FABIANA NEVES LIMA BATISTA[1]
MARCOS ANTÔNIO PEREIRA DOS SANTOS[1]
MARIA DO CARMO DE CARVALHO E MARTINS[1]
MOISÉS TOLENTINO BENTO DA SILVA[2]
[1]UNIVERSIDADE FEDERAL DO PIAUÍ –. TERESINA-PI, BRASIL.
[2]UNIVERSIDADE FEDERAL DO CEARÁ - FORTALEZA – CE, BRASIL.

INTRODUCTION

Well oriented and regular physical training can result in significant changes in cardiovascular performance, as well as produce changes in anthropometric parameters and corporal composition1, 2. Several studies have evaluated different types of physical exercise with varied intensities, in sedentary besides physically active subjects with the intent of evaluating anthropometric and cardiovascular parameters 3, 4, 5.

Among popular sports practiced in school setting, handball is worth mentioning since it is a cyclical sport which alternates between periods of energy input and rest. Bompa6 states that as a sport, it has as a predominant way of energy utility via the alactic anaerobism, resulting from varied speed levels and intensity employed during the game.

Although several studies relating to various sports and their correlation with the corporal composition 3,4, besides cardiovascular adjustments in response to aerobic exercise and resistance exist, few studies have attempted to investigate the influence of practicing handball on body composition as well as the possible consequent hemodynamic effects in children and adolescents.

Therefore, this study aimed to evaluate the influence of practicing handball on anthropometric parameters and body composition, as well as cardiovascular parameters in adolescents aged 14 to 18 years old, incorporating both sexes.

MATERIAL AND METHODS

The descriptive study consisted of 24 handball practicing youth consisting of both sex, being 13 females and 11 males and aging between 14 and 18. The study was conducted from May to August 2007. Parents or guardians of participating adolescents confirmed their participation in the study by signing the Declaration of Consent according to the CNS resolution 1996/96. The study was approved by the Ethics Committee of the Federal University of Piauí (Protocol No. 192/07).

The participating subjects were at least handball athletes who had practiced the sport for a minimum three months and were affiliated to the Handball Federation of the state of Piauí. The exclusion criteria ranged from the use of any substance that could affect the cardiovascular responses at rest to motor impairments of any known nature that could preclude the practice of handball training during the period of observation and data collection. With the aid of a detailed and well structured questionnaire, were obtained before the start of the study, information on the level of individual physical activity, family history of heart disease and drug use.

A 100g precision stadiometer was used to evaluate body weight and height using the mark digital scale (Techline) as recommended by Fernandes Filho7. The assessment of body composition was performed by the method of skin folds using the skinfold brand CESCORF®, adhering to recommendations byHeyward & Stolarczyk8 Petroski9 for boys and girls.

Cardiovascular parameters which were evaluated included systolic (SBP), diastolic blood pressure (DBP), mean arterial pressure (MAP), heart rate (HR) and double product (DP) at the pre and post 12 weeks of training with the aid of a handball digital pressure monitor (Mark of Fitness). Two measurements were performed (5 and 10 min.) before and after all training sessions during both periods.

The training was performed 3 times per week (60-min.) for 12 weeks. Training activities consisted of warming-up (approx. 10min), the main part of the handball game with focus on specific techniques such as passing, shooting and tactical movement (approx. 40min) and a warming-down session consisting of stretching exercises.

The data were processed by GraphPad Prism 5.0 and expressed as mean ± SEM. To assess the effects of training on anthropometric parameters and cardiovascular events in each group, we used paired t-test. The significance level was set at $p < 0.05$.

RESULTS

Table 1 shows demographic data of the study sample before and after 3 months of training. A significant increase ($p < 0.05$) in height was noted in male adolescents at the end of the 3-month physical training period. The BMI of the boys was significantly lower ($p < 0.05$) at the end of the training period, while it increased in studied girls ($p < 0.05$). However, with regard to BMI, both boys and girls present themselves within required normal parameters, with accordance to age. In relation to body mass, fat percentage and lean mass, no significant changes were observed in any group.

Table 1 - Anthropometric characteristics of the studied adolescents before and after 3 months of physical handball training, by sex.

	Pre -Training		Pos - Training	
	Boys	Girls	Boys	Girls
Age (years)	15.9 ± 0.2	15.9 ± 0.3	–	–
Height (cm)	173.4 ± 6.9	166.1 ± 6.2	178.0 ± 7,1 †	166.3 ± 6.3
Body weight (kg)	67.0 ± 15.0	55.0 ± 9.3	69.0 ± 15.0	56.9 ± 9.8
BMI (kg.cm ^{2})	22.2 ± 1.2	19.8 ± 0.8	21.6 ± 1.1 *	20.5 ± 0.7 *
Fat (%)	11.3 ± 10.7	19.6 ± 8.2	10.6 ± 10.1	20.9 ± 6.2
Total fat (kg)	8.9 ± 11.4	11.3 ± 6.7	8.5 ± 11.0	12.4 ± 6.0
Lean body mass (%)	88.6 ± 10.7	80.3 ± 8.2	89.3 ± 10.1	79.0 ± 6.2
Lean body mass (kg)	57.9 ± 4.9	43.6 ± 4.8	59.9 ± 5.2	44.5 ± 6.2

* $p < 0.05$, Post-Training (boys and girls) vs. Pre-Training;
$p < 0,05$, Post-Workout vs. Pre-Workout;

Table 2 (A and B) represented the data on the average values of HR, SBP and DBP at the fifth and tenth minute before and after the exercise performed, before and after the 3-month-handball training of training for girls. During the pre-training period, there was a significant ($p < 0.05$) increase in values of DBP at the 5th minute after exercise, when compared to the resting value at the 5th minute before exercise. After 3 months of training, significant ($p < 0.05$) increases were observed in HR, SBP and DBP at the 5th minute after exercise in relation to the rest period prior to exercise.

Table 2 - Values comparing data during the pre-training period (A) and post-training period (B) of handball practice over a 3-month interval of 3 in girls (n = 13).

	Pre-Training			
A	**Pre-Exercise**		**Pos-Exercise**	
	5min.	**10min.**	**5min.**	**10min.**
HR (beats.min)	67.8 ± 3.8	68.3 ± 4.6	78.8 ± 6.5	69.7 ± 5.7
SBP (mmHg)	103.2 ± 3.7	103.2 ± 2.7	107.5 ± 2.3	103.7 ± 2.4
DBP (mmHg)	62.8 ± 2.5	66.6 ± 3.7	69.2 ± 2.0 †	69.9 ± 1.5
MAP (mmHg)	76.3 ± 2.3	78.9 ± 3.2	82.0 ± 1.5 †	81.1 ± 1.4
DP (mmHg.bpm)	6913 ± 344.8	6940 ± 376.5	8427 ± 670.0	7194 ± 541.9
	Pos-Training (12 months)			
B	**Pre-Exercise**		**Pos-Exercise**	
	5min.	**10min.**	**5min.**	**10min.**
HR (beats.min)	68.9 ± 4.4	69.0 ± 5.4	87.1 ± 6.9 *	85.6 ± 7.2
SBP (mmHg)	104.7 ± 2.5	103.1 ± 1.8	114.5 ± 1.8 *	104.3 ± 4.0
DBP (mmHg)	64.6 ± 1.1	63.6 ± 2.2	73.5 ± 3.0 *	70.5 ± 2.9
MAP (mmHg)	77.9 ± 1.0	76.8 ± 1.7	87.1 ± 2.3 †	81.7 ± 2.9
DP (mmHg.bpm)	7123 ± 393.8	7125 ± 589.1	10017 ± 865.8 *	8835 ± 786.2

Data are expressed as mean ± SEM. HR = heart rate, SBP = Systolic blood pressure, DBP = Diastolic blood pressure, MAP - Mean arterial pressure, DP = double product;

* $p < 0.05$, 5min.Pre-exercise/Post-training vs 5min. Pre-exercise/Post-training;

□ $p < 0.05$, 5min.Pre-exercise/Post-training vs 5min. Pre-exercise/Post-training;

.The data for HR, SBP and DBP obtained for the group of male adolescents are shown in Table 3 (A and B). Note that the DBP was significantly lower ($p < 0.05$)

Table 3 - Values comparing parameters during pre-training (A) to post-training (B) of handball over a-12 week period in boys (n = 11).

	Pre-Training			
A	**Pre-Exercise**		**Pos-Exercise**	
	5min.	**10min.**	**5min.**	**10min.**
HR (beats.min)	62,0 ± 5,0	54,0 ± 3,6	70,2 ± 5,7	56,9 ± 4,0
SBP (mmHg)	122,2 ± 7,1	118,5 ± 6,2	118,5 ± 4,0	115,4 ± 4,2
DBP (mmHg)	79,3 ±9,7	74,9 ± 8,7	83,4 ± 6,9	76,5 ± 5,4
MAP (mmHg)	93,6 ± 8,8	89,4 ± 7,7	95,1 ± 5,8	89,4 ± 4,8
DP (mmHg.bpm)	7693 ± 899,4	6439 ± 574,9	8202 ± 582,1	6541 ± 495,2
	Pos-Training (12 semanas)			
B	**Pre-Exercise**		**Pos-Exercise**	
	5min.	**10min.**	**5min.**	**10min.**
HR (beats.min)	62,7 ± 4,4	61,8 ± 5,0	73,7 ± 4,8 $	65,0 ± 4,3 +
SBP (mmHg)	112,6 ± 3,4	111,4 ± 3,5	121,7 ± 4,5	120,4 ± 3,6
DBP (mmHg)	65,3 ± 2,2 *	65,2 ± 2,5 *	80,4 ± 6,0 $	74,6 ± 6,3
MAP (mmHg)	81,1 ± 2,5	80,6 ± 2,6	94,2 ± 5,1	89,8 ± 5,3
DP (mmHg.bpm)	7062 ± 551,3	6877 ± 600,8	8980 ± 676,9 $	7841 ± 577,9 +

Data are expressed as mean ± SEM. HR = heart rate, SBP = Systolic blood pressure, DBP = Diastolic blood pressure, MAP - Mean arterial pressure, DP = double product;

* $p < 0.05$, 5min. And 10min. Pre-exercise/Post-training vs 5min. and 10min. Pre-exercise/Post-training;

+ $p < 0.05$, 10min. Post-exercise/Post-training vs 10min. Post-exercise/Post-training;

$ $p < 0.05$, 5min. Post-exercise/Post-training vs 5min. Pre-exercise/Post-training;

The 5th and 10th minute-interval values before exercise and the 5th minute post-training were compared to pre-training period. Moreover, the HR and RPP values at the 5th and at the 10th minute after exercise were significantly higher ($p < 0.05$) after 12 weeks of exercise, when compared to the pre-training period.

DISCUSSION

In this study, we found that training handball over a 12-week period resulted in differential changes in BMI of adolescents, which was contrastingly increased in girls but decreased in boys. However, no significant changes related to body composition were observed. The BMI besides not being the best indicator in identifying body anthropometric composition, it is easy to apply and is widely used worldwide to study the overall nutritional status of individuals from varied age-sets10. However, it can be misinterpreted due to some physiological changes such as the menstrual cycle in female subjects, due to higher water retention, hence higher values of body mass which could mask the results.

In this study, we observed significant changes in height values in male athletes, who manifested increase in stature after undergoing 12 weeks of handball training. However, such changes in female athletes were absent, where the height remained unchanged. This can be explained by the fact that there exists a growth spurt, common in this age group both in boys and girls, which is usually more evident in boys due to the fact that with the average age being 16 years, it coincides with the second spurt in boys at this time, contrarily to girls who have already undergone such a process.

The modernization and industrialization process, besides bringing benefits to the modern society has as well resulted to misgivings which include inadequate lifestyle which encompasses lax living and improper nutrition resulting to diseases linked to body composition such as obesity, which each day affects increasing population of children and adolescents 11, 12. In this in mind, regular practice of physical activity, associated with appropriate diet in obese children has been found effective in losing weight healthily, a fact enforced with improved inflammatory markers and levels of Insulin-like Growth Factor - 1 (IGF-1) and Insulin- like growth factor binding protein-3 (IGFBP-3) 13.

Current study did not show any significant changes in body composition components in relation to the percentage of fat and lean mass, although tendency to higher lean mass values was observed in both groups of students after the training period. Similar data were observed by Cyrino et al 4 in young male soccer players who trained over a 24-week period, with a tendency to a decreased body fat but an increase lean body mass, without statistical significance. Thus, we could speculate that a longer training period may be necessary to obtain even more expressive results. Another fact that may explain the absence of changes in body composition would be the type of energy substrate used, considering the predominant route in handball is the anaerobic and not the aeróbic14.

In relation to cardiovascular adjustments, prior studies show that chronic cardiovascular system adaptation to exercise of various intensities is characterized with decreased resting heart rate due to several factors, which including a decrease in sympathetic activity and an exacerbated vagal activity at rest15. On the other hand, it is worth noting that immediately after an extenuating physical exercise the heart rate remains at levels higher than the rest values over a period; a rate which is directly proportional to the intensity and duration of the performed activity, possibly as an attempt by the heart to compensate for the reduced stroke volume so as to maintain cardiac output 16. In our study samples, higher HR values during the 3-month training period and after the exercise were observed in both sexes, although the persistence of such (HR) values were higher than those determined during the pre-exercise period among the male adolescents. These data probably reflect the influence of higher intensity training applied to adolescent males as compared to females.

Blood pressure values are good indicators as well in determining cardiovascular system function during a physical activity. Published studies have shown that physical activity when associated with pharmacological treatment is capable of normalizing blood pressure more effectively in hypertensive athletes17. Monitoring of blood pressure values during sport activity is as important during sports, with some studies undertaking such a process for example during an American football match18, 19. With regard to strength training, exercise performed with a longer intervals between the series seems to be permissive to a new stimulus develop without altering significantly blood pressure responses, probably due to minimal stimulation to chemoreceptors and mechanoreceptors besides less activation due to the Valsalva maneuver20.

In the present study, we did not observe the post-exercise hypotension phenomenon widely described in literature. This fact can be explained by the short observation time of 10minutes after exercise, which may have been a limiting factor for this observation during our study. Another limiting factor in interpreting the results obtained here is related to the intensity and duration of exercise, which are directly associated with hypotension after an exercising activity21. In studies which evaluated different intervals between sets of resistance exercise utilizing different muscle groups, changes in SBP were not observed, however values of DBP decreased just after exercise22, 23. Moreover, our findings are concordant to those described earlier, in that increased values of SAP, MAP and RPP in both adolescent males and females was noted at the end of the 3-month physical training period. It is worth mentioning that the type of adopted activity may have caused differences in blood pressure responses.

Therefore, training handball with 12-week duration in adolescent males and females with ages ranging between 14 to 18 years promoted anthropometric changes without significant changes in body composition. We observed too, significant changes in cardiovascular parameters such as SBP, DBP, MAP, HR and DP. However, further studies ought to be undertaken, which includes ergospirometric tests so as to identify changes in lung volumes and capacities, which was not investigated in this study.

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Autor para Correspondência:
Moisés Tolentino Bento da Silva
Universidade Federal do Ceará – Depto. de Fisiologia e Farmacologia
Rua Cel. Nunes de Melo 1315 – Rodolfo Teófilo, CEP: 60430-270 – Fortaleza/CE-Brasil
Fone: (85) 3366-8345/96031350
e-mail: moisesfisio@yahoo.com.br

CAN A 3-MONTH HANDBALL TRAINING CHANGE ANTHROPOMETRIC PARAMETERS AND CARDIOVASCULAR RESPONSES IN ADOLESCENTS AGED 14 TO 18 YEARS?

ABSTRACT

Introduction: The practice of regular physical activity promotes important changes in cardiovascular performance, and produce changes in anthropometric parameters and body composition. Objective: To evaluate changes in anthropometric and cardiovascular adjustments adolescents aged 14 to 18 years, of both sexes, submitted to the handball training of 12 weeks. Methods: The study included 24 adolescents, 11 boys and 13 girls. We evaluated height, weight, body mass index (BMI), body composition and cardiovascular parameters (HR), systolic blood pressure (SBP), diastolic blood pressure (DBP), mean arterial pressure (MAP) and double product (DP) before and after the period of 12 weeks of training handball. Results: There was a significant increase ($p < 0.05$) in boys' height with no change in girls. There was a significant decrease ($p < 0.05$) for BMI of boys, while girls increase was observed ($p < 0.05$). There was no change in body composition in terms of percentage of fat and lean mass. In the pre-training period, we observed a significant increase ($p < 0.05$) in the 5th minute after exercise in DBP and MAP in females. In the post-training increased values were observed ($p < 0.05$) in the 5th minute post-exercise HR, SBP, DBP, MBP and DP in girls. After 12 weeks, increased ($p < 0.05$) in the 5th minute post-exercise HR and DBP and HR and DP in the 10th minute after exercise in boys. Conclusion: The training for handball 12 weeks promoted anthropometric changes, and generate cardiovascular adaptations in the adolescents studied

KEYWORDS: anthropometry, cardiovascular parameters, handball, physical training.

RESUMÉ:

introduction: La pratique d'une activité physique régulière favorise des changements importants sur la performance cardiovasculaire, les paramètres anthropométriques et la composition corporelle. Objectif: évaluer les ajustements anthropométriques et cardio-vasculaires chez les adolescents agés de 14 à 18 ans, des deux sexes, soumis à des activités de handball durant 12 semaines. Méthodes: L'étude a inclus 24 adolescents, 11 garçons et 13 filles. Nous avons évalué la taille, poids, indice de masse corporelle (IMC), la composition corporelle et les paramètres cardiovasculaires (HR), la pression artérielle systolique (PAS), la pression artérielle diastolique (PAD), la pression artérielle moyenne (PAM) et double produit (DP) avant et après la période de 12 semaines d' execercices de handball. Résultats: Il y a eu une augmentation significative (p <0,05) sur la taille des garçons sans aucun changement chez les filles. Il y a eu une diminution significative (p <0,05) pour l'IMC des garçons, tandis qu' un accroissement a été observée chez chez les filles(p <0,05). Il n'y a eu aucun changement sur la composition du corporelle en termes de pourcentage de masse grasse et maigre. Durant la période de pré formation en handball, nous avons observé une augmentation significative (p <0,05) à la 5eme minute après exercice de la PAD et du PAM chez les fille. En ce qui concerne les valeurs post-formation, des accriossements ont été observées (p <0,05) à la 5e minute après exercice en HR, PAS, PAD, PBM et DP chez les filles. Après 12 semaines, il y a eu augmentation de (p <0,05) à la 5e minuteaprès exercice RH et le DBP et le RH et DP à la 10e minute après exercice chez les garçons. Conclusion: La formation en handball durant 12 semaines a promu des changements anthropométriques et générer des adaptations cardiovasculaires chez les adolescents étudiés.

MOTS-CLÉS: anthropométrie, paramètres cardiovasculaires, handball, entraînement physique.

RESUMEN:

Objetivo: Evaluar los cambios en los adolescentes ajustesantropométricos y cardiovasculares entre 14 y 18 años, en ambos los sexos, sometidos al entrenamiento de balonmano de 12 semanas. Métodos: El estudio incluyó a 24 adolescentes, 11 varones y 13 niñas. Se evaluó la estatura, el peso, el índice de la masa corporal (IMC), la composición corporal y los parámetros cardiovasculares (FC), presión arterial sistólica (PAS), presión arterial diastólica (PAD), presión arterial media (PAM) y el doble producto (DP) antes y después del período de 12 semanas de entrenamiento de balonmano. Resultados: Hubo un aumento significativo (p <0,05) en la altura de los chicos sin ningún cambio en las niñas. Hubo una disminución significativa (p <0,05) para el IMCde los niños, mientras que aumentan las niñas se observó (p <0,05). No hubo cambios en la composición corporal en términos de porcentaje de la masa grasa y magra. En el periodo de formación previa, se observó un aumento significativo (p <0,05) en el minuto 5después del ejercicio de la PAD y el PAM en las hembras. En los valores de la formaciónpost-incremento se observó (p <0,05) en el minuto 5 después del ejercicio FC, PAS,PAD, PAM y la DP en las niñas. Después de 12 semanas, el aumento (p <0,05) en el minuto 5 tras el ejercicio de recursos humanos y de la PAD y FC y DP en el minuto 10después de hacer ejercicio en los niños. Conclusión: La formación para el balonmano 12 semanas promovido los cambios antropométricos, y generar las adaptaciones cardiovasculares en los adolescentes estudiados

PALABRAS CLAVE: handebol, Antropometría, Parámetros Cardiovasculares, treinamento Físico.

TREINAMENTO DE HANDEBOL DE 3 MESES PODE ALTERAR PARÂMETROS ANTROPOMÉTRICOS E RESPOSTAS CARDIOVASCULARES EM ADOLESCENTES DE 14 A 18 ANOS?

RESUMO

Introdução: A prática regular de atividade física promove modificações importantes no desempenho cardiovascular, além de produzir alteração em parâmetros antropométricos e de composição corporal. Objetivo: Avaliar alterações antropométricas e ajustes cardiovasculares em adolescentes de 14 a 18 anos, de ambos os sexos, submetidos a treinamento de handebol de 12 semanas. Métodos: Participaram do estudo 24 adolescentes, sendo 11 meninos e 13 meninas. Foi avaliada a estatura, peso, índice de massa corpórea (IMC), composição corporal e os parâmetros cardiovasculares freqüência cardíaca (FC), pressão arterial sistólica (PAS), pressão arterial diastólica (PAD), pressão arterial média (PAM) e duplo produto (DP), antes e após o período de 12 semanas de treinamento de handebol. Resultados: Observou-se aumento significativo (p<0,05) na estatura dos meninos sem alteração nas meninas. Houve uma diminuição significativa (p<0,05) do IMC dos meninos, enquanto que nas meninas foi observado aumento (p<0,05). Não houve alteração na composição corporal quanto ao percentual de gordura e massa magra. No período pré-treinamento, foi observado um aumento significativo (p<0,05) no 5° minuto pós-exercício na PAD e PAM nas meninas. No pós-treinamento foram observados valores aumentados (p<0,05) no 5° minuto pós-exercício na FC, PAS, PAD, PAM e DP nas meninas. Após 12 semanas, houve aumento (p<0,05) no 5° minuto pós-exercício na FC, PAD e DP, bem como na FC e DP no 10° minuto pós-exercício nos meninos. Conclusão: O treinamento de handebol de 12 semanas promoveu alterações antropométricas, além de gerar adaptações cardiovasculares nos adolescentes estudados.

PALAVRAS-CHAVE: handebol, antropometria, parâmetros cardiovasculares, treinamento físico.