26 - THE INFLUENCE OF A SWIMMING WORKOUT SESSION ON SKINFOLD MEASURES

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INTRODUCTION

Swimming is a physical activity that exercises contraction of almost all muscles of the human body and therefore, it is considered an excellent workout for physical development (MAGLISCHO, 1999). Comparatively, swimming differs from other kinds of sports in several important aspects. An obvious difference is the body's energy expenditure to maintain flotation while it is generating horizontal movement with the use of arms and legs, both in combination and separately. Other differences include the demands to overcome the forces of resistance (friction) that prevent the anterograde movement of the swimmer. These differences are caused by the dynamic resistance of the water friction on the skin, the dynamic resistance (friction) of the waves and the dynamic resistance of the viscous pressure. (MCARDLE, KATCH AND KATCH, 2003).

The simple immersion of a static body in water causes physiological changes. Most of the effects of immersion are related to the principles of hydrodynamics and thermodynamics (KRUEL et al., 2005). Reily, Dowzer and Cable (2003), Watenpaugh et al. (2000) and Dertkigil, Cecatti and Cavalcante (2005) showed that physical activity in water tends to displace the extracellular fluid to the vascular spaces, thus producing an increase in the blood central volume (central hypervolemia), which is caused by the hydrostatic pressure of water that stimulates the cardiopulmonary baroreceptors to reduce sympathetic nerve activation during exercise.

Anthropometry is the science that studies and evaluates the size, mass, and proportions of the human body. This science presents valuable information regarding the prediction and estimate of several of the body components both of sedentary people and of athletes, whether while growing, developing or aging, and this is the reason why it is fundamental in assessing the physical condition as well as controlling the different variables which are involved when prescribing a training program (FERNANDES FILHO, 1999; PETROSKI, 2003).

This technique can be used in gyms, inside and outside laboratories because it is simple and practical. In the field of physical education it has a special application, once height, length, body mass, circumference, bone diameter and body composition are related both to athletic performance and health, that is, sectors of intense action in this profession (QUEIROGA, 2005).

For the correct use of such information, anthropometric measurements must be made correctly by following a defined methodology, so that the results are clearly understood and can be used (Fernandes Filho, 1999).

The body composition under a skinfold study quantifies the main structural components of the body: muscle, bone and fat. There are some pre-test recommendations to use the skinfold technique, and one of them highlights that no physical activity shall be performed prior to the measurements since it is believed that the results will be influenced by exercise (FERNADES SON, 1999; HEYWARD AND STOLARCZYK, 2000; GUEDES AND GUEDES, 2006).

Yet, lack of publications in this area led to doing this study that aims at verifying whether there are differences between the values of skin folds measured before and after a swimming lesson.

METHODOLOGY

We selected 16 male volunteers at a gym in the city of Belo Horizonte, state of Minas Gerais. As a criterion for inclusion in the study, volunteers should fill out a questionnaire of Readiness for Physical Activity PAR-Q and Coronary Risk, and only the ones considered healthy (ACMS, 2003) were chosen. Every volunteer should be between 20 to 25 years old, nonsmokers, swimmers for at least three months, besides signing a consent agreement delivered as their own act and deed.

All of the tests were performed on a single day. First an evaluation of body composition was done using the skinfold technique, utilizing a (Body Caliter) skinfold caliper and a Filizola ® anthropometric scale to measure the body mass and height. Then water temperature (average of $19 \pm 0.5°$ degrees) and room temperature ($24.7 \pm 0.9°$ degrees) were measured.

After the initial anthropometric measurements there was a swimming workout session which consisted of ten arrivals, starting in front crawl and swimming back in back crawl; afterwards other ten arrivals were performed alternating between legs-only front crawl and back crawl using the kick board.

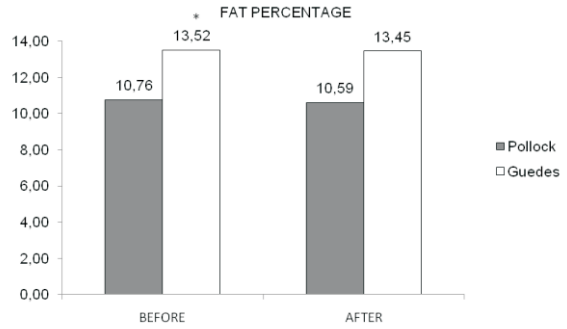
Soon afterwards the swimmers used pullboys to perform other ten arrivals alternating front and back crawl, this time exercising only the arms. At the end of the workout other ten alternating arrivals were performed: two arrivals in front crawl and two in back crawl, with a total length of 1360 meters in 40 to 42 workout minutes (17- meter swimming pool with temperature of 19.5 °C).

At the end of the workout session the volunteer swimmers were given 5 minutes to get themselves dry and go to the toilet to urinate, so that their skin folds and body mass could be assessed again.

To find out the body fat percentage we calculated the body density using Pollock et al. Equation (1976), where DC = 1.09716 – 0.00065 (PT2) – 0.00055 (SB1) – 0.00080 (CX1), and Guedes and Guedes Equation (1993) where DC= 1.1744 – 0.0671 LOG (TR+SI_AB). After calculating the body density, we determined the body fat percentage by using Siri's formula (1961), where G = [(4.95 / DC) – 4.50] x 100. The skinfold measurements were made in nine places (chest, subscapular, midaxillary, suprailiac, abdominal, triceps, biceps, thigh, and calf) in an adaptation of Harrison at al. (1988) quoted by Heyward and Stolarczyk (2000). The recommendations by Heyward and Stolarczyk (2000) were followed to measure the skin folds.A paired student's t-test with a $p \leq 0.05$ significance level was used to analyze the data.

FINDINGS AND DISCUSSION

Graph 1 shows the relation between the fat percentage values found at the two measurements performed (before and after the workout session) according to the two equations used (Pollock and Guedes).



Graph 1: * means the statistical difference of $p \leq 0.05$ between the findings obtained in Pollock's and Guedes's equations.

According to the analysis of the fat percentage obtained by Pollock's and Guedes's formulae, there was no significant difference in the fat percentage when compared before and after the swimming workout session ($p = 0.08$ and $p = 0.67$ respectively).

Several authors (FERNANDES FILHO, 1999; MARINS and GUIANNICHI, 2003, GUEDES and GUEDES, 2006) do not recommend measuring skinfold after physical activity.

According to Keys and Brozeck (1953) (quoted by Duarte and Vieira, 2006) an accumulation of extracellular water (edema) in the subcutaneous tissue caused by factors such as peripheral vasodilation during exercise, or certain diseases, could increase the thickness of skin folds - this suggests that the skin fold should not be measured immediately after workout, especially in hot environments.

According to the results of this study one might think that probable changes in the values of skinfold measures following a workout session could be related to different kinds of workout, intensity and duration, which increases the importance of clarifying what type of workout could influence the results of this specific technique.

It was found that Guedes's Equation showed fat percentage values higher than the values obtained through Pollock's Equation at the two times of measurement (before swimming 10.76 and 13.52, and after swimming 13.45 ± 4.30% and 10.59 ± 3.43% respectively).

When comparing the values of the two equations (Pollock's x Guedes's) before the swimming workout session, differences were statistically significant ($p = 0.00$).

This finding was consistent when we compared two equations after the swimming workout session ($p = 0.00$).

This difference in results is directly related to the skin folds used and to the factors that could interfere with them, such as the same characteristics of the sample used. (HAYWARD, 2000; GUEDES AND GUEDES, 2006).

In Graph 2 we can observe a significant difference in the sum of skin folds: before the swimming workout session we obtained an average of 92.49 (± 30.55) mm, and after the workout a decrease in the sum of skin folds of mean 91.49 (± 29.98) mm ($p \leq 0.05$).

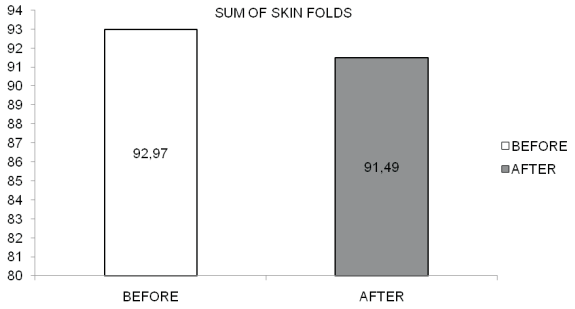


CHART 2: * denotes a statistical difference of p= 0.05 between measurements performed before and after the workout session.

According to Duarte and Vieira (2007), which aimed at analyzing the acute interference of an aerobic exercise at 60% of VO2max in the measurement of skin folds, it was observed that, when comparing the pre-exercise measures with the measures obtained immediately after physical activity, some folds, but not all, showed a reduction in relation to the pre-exercise measure , which is in agreement with this study that also observed a reduction in the sum of the folds after a swimming workout session (p = 0, 05).

As the average sum of skin folds was lower after physical exercise, it could be inferred that there was no hyperemia or if it occurred, it did not influence the result. According to Guyton and Hall (2000) hyperemia would be the increase of blood flow, which could reach four to seven times the normal rate, due to the restriction of blood flow during exercise caused by muscle contractions, especially in high-intensity exercise.

Because it was a swimming workout session conducted at a water temperature of 19.5 ± 0.57 ° C, we could expect that a peripheral vasoconstriction would occur to reduce heat loss (MCARDLE, KATCH AND KATCH, 2003). In tests developed in our laboratory, a cooling was observed in the skin temperature (ZORZI and CORREA, 2007) after swimming in a water temperature of 28 ° C. As in this study the water temperature was approximately 7.5 ° C, one would expect a cooling of the skin that could have contributed to the reduction in the findings of skin folds; however, a new study using a specific methodology to verify the cooling effect on the skin in the measurement of body composition should be developed.

With these results we observe that the use of equations to calculate the fat percentage can often present limitations in interpreting their results (difference between equations) and in relation to the effects of exercise involving large muscle groups in the skinfold techniques , once we observed a difference in the sum of skin folds, and the same result was not observed with the

equations.

CONCLUSION

The results of this study show a reduction in the general sum of the skinfold values. Even showing a reduction in the sum of the values, when we applied the equations by Pollock and Guedes no difference was observed in the percentage of fat before or after a swimming workout session.

However, more studies should be developed given the limitations of this research and the scarcity of information in the literature regarding assessment of fat percentage before or after a swimming lesson.

REFERENCES

AMERICAN COLLEGE OF SPORTS MEDICINE. **ACSM's Manual: Diretrizes para os testes de Esforço e Prescrição de Exercício**, 6º. ED. Rio de Janeiro, Guanabara Koogan, 2003.

FERNANDES FILHO, J.**A prática da avaliação física: testes, medidas e avaliação física em escolares, atletas e academias de ginástica.** Rio de Janeiro: Shape, 1999.

GUEDES, D.P.; GUEDES, J.E. **Manual Prático para avaliação em educação física.** Barueri, SP: Manole. 2006.

HEYWARD, V. H,; STOLARCZYK, L. M. **Avaliação da composição corporal aplicada.** São Paulo: Manole, 2000.

JACKSON, A.S.; POLLOCK, M.L. **Factor analysis and multivariate scaling of antrophometric variables for the assessment of body composition. Medicine and science in Sports and Exercise,** chapter 8, pages 196-203. 1976.

MARINS, J.C.B.; GUIANNICHI, R.S. **Avaliação e prescrição de atividade física: guia prático.** Rio de Janeiro, RJ: Editora Shape, 3º edition, chapter 2, pages 33-88. 2003.

McARDLE, W.D., KATCH, F.I.: KATCH, V.L. **Fisiologia do Exercício: Energia, Nutrição e Desempenho Humano.** 5º edition. Rio de Janeiro, RJ. ED. Guanabara. Chapter 28, pages 773 – 787; chapter 32, page 940. 2003.

MAGLISCHO, **E. W. Nadando ainda mais rápido.** 1. Ed. São Paulo: Manole, 1999.691p.

PETROSKI, E. L.; **Antropometria – técnicas e padronizações**. 2º ed. Porto Alegre: Pallotti, 2003.

ZORZE, P.C.; CORRÊA, R. E.; **Efeitos do Aquecimento e Resfriamento Corporal Prévio Sobre a Performance na Prova de 800 metros na Natação.** Pages 27,28,42, 2007.

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THE INFLUENCE OF A SWIMMING WORKOUT SESSION ON SKINFOLD MEASURES

ABSTRACT

The body composition quantifies the structural components of the body, muscle, bone and fat. The skinfold technique requires some pre-test measures, and it is strongly recommended to avoid any physical activity prior to the test. Objectives: To investigate the influence of a swimming workout session on skinfold measures. Methods: The sample consisted of 16 male volunteers, aged 20-25 years, nonsmokers, swimmers for at least three months. Initially, the subjects underwent an assessment using the skinfold technique, and the measurement of body mass and height. Then we started a workout session that consisted of ten arrivals: a length swimming front crawl and a length back swimming back crawl; ten arrivals alternating between front crawl and back crawl legs-only with a kick board, and ten arrivals were performed using a pullboy, swimming arms - only front crawl and back crawl. At the end of the workout other ten alternating arrivals were performed: two arrivals in front crawl and two in back crawl, with a total length of 1360 meters in 40 to 42 lesson minutes (17- meter swimming pool with temperature of 19.5 º C). The skin folds and body mass were assessed again five minutes after workout session after the skin dried. A paired student´s t-test was used as statistical analysis with a significance level of $P \leq 0.05$. Results: We observed a reduction in the general sum of the skin fold values ($p = 0.05$). Conclusion: Even showing a reduction in the sum of the values, when we applied the equations by Pollock and Guedes, there was no difference in the percentage of fat before or after a swimming lesson.

KEYWORDS: Fat percentage, exercise, skin folds.

L'INFLUENCE D'UN COURS DE NATATION SUR LA MESURE DES PLIS CUTANÉS

RÉSUMÉ

La composition corporelle quantifie les composants structurels du corps, muscle, os et graisse. La technique des plis cutanés exige quelques recommandations avant test, entre lesquelles on peut souligner la non-réalisation d'activité physique préalable. Objectifs : Vérifier l'influence d'un cours de natation sur la mesure des plis cutanés. Méthodes : L'échantillon a été composé de 16 volontaires, de sexe masculin, entre 20 et 25 ans, non fumeurs, pratiquant la natation depuis au moins trois mois. Tout d'abord, les sujets ont été soumis à une évaluation par la technique des plis cutanés, et la mesure de la masse corporelle et de la stature. Ensuite le cours a commencé, il a consisté en dix allers retours, l'aller étant fait en crawl et le retour en dos crawlé, dix allers retours alternés en crawl et dos avec une planche en battements de jambes et en utilisant le pull buoy ont été effectués dix allers retours en crawl et dos en n'utilisant que les bras. À la fin de l'entraînement, ont été effectués dix allers retours alternés soit deux en crawl et deux en dos, totalisant une distance de 1360 mètres en 40 à 42 minutes de cours (piscine de 17 mètres avec une température de 19,5°C). Cinq minutes après le cours, avec la peau sèche, les plis cutanés et la masse corporelle ont été mesurés de nouveau. En tant qu'analyse statistique on a utilisé le test T de Student apparié avec un résultat statistiquement significatif de $P \leq 0,05$. Résultats : On a observé une réduction dans la somme générale des valeurs des plis cutanés ($p = 0,05$). Conclusion : Même avec cette diminution dans la somme des valeurs, lorsqu'on utilise les équations de Pollock et de Guedes, on n'a pas observé de différence dans le pourcentage de graisse avant et après un cours de natation.

MOTS CLÉS : Pourcentage de graisse, exercice, plis cutanés.

LA INFLUENCIA DE UNA CLASE DE NATACIÓN EN LAS MEDIDAS DE LOS PLIEGUES CUTÁNEOS

RESUMEN

La composición corporal cuantifica los componentes estructurales del cuerpo, músculos, huesos y grasa. La técnica de pliegues cutáneos exige algunas recomendaciones anteriores a la prueba, entre las cuales se distingue la no realización de actividad física previa. Objetivos: Verificar la influencia de una clase de natación en las mediciones de los pliegues cutáneos. Métodos: La muestra se compuso con 16 voluntarios del sexo masculino, con edades entre 20 y 25 años, no fumadores, practicantes de natación desde hace por lo menos tres meses. Inicialmente, los individuos fueron sometidos a una evaluación por medio de la técnica de pliegues cutáneos, y la medida de la masa corporal y estatura. Enseguida se empezó una clase que consistía de diez rondas con la ida en estilo crol y la vuelta en espalda, diez rondas alternadas de crol y espalda con tabla en

batido de piernas y diez rondas más se ejecutaron usando el pullboy en crawl y espalda con solamente la brazada. Al fin del entrenamiento se ejecutaron diez rondas alternadas más, siendo dos en crol y dos espaldas, totalizando un monto de 1360 metros en 40 a 42 minutos de clase (piscina de 17 metros con temperatura de 19,5ºC). Cinco minutos después de la clase, con la piel seca, se midieron nuevamente los pliegues cutáneos y la masa corporal. Como análisis estadístico se utilizó la prueba T de student pareada con nivel de significancia de $P \leq 0,05$. Resultados: Se observó una reducción en la suma general de los valores de los pliegues cutáneos (p = 0,05). Conclusión: Aún con esa disminución en la suma de valores, al utilizarse las ecuaciones de Pollock y de Guedes, no se observó diferencia en el porcentaje de grasa antes o después de una clase de natación.

PALABRAS CLAVE: Porcentaje de grasa, ejercicio, pliegues cutáneos.

A INFLUÊNCIA DE UMA AULA DE NATAÇÃO NAS MEDIDAS DAS DOBRAS CUTÂNEAS

RESUMO

A composição corporal quantifica os componentes estruturais do corpo, músculo, osso e gordura. A técnica de dobras cutâneas exige algumas recomendações pré-teste, na qual se destaca a não realização de atividade física prévia. Objetivos: Verificar a influência de uma aula de natação nas medidas das dobras cutâneas. Métodos: A amostra foi composta por 16 voluntários do sexo masculino, com idade entre 20 a 25 anos, não fumantes, praticantes de natação há pelo menos três meses. Inicialmente, os sujeitos foram submetidos a uma avaliação através da técnica de dobras cutâneas, e a medição da massa corporal e estatura. Em seguida foi iniciada uma aula que consistia em dez chegadas, sendo a ida de crawl e volta de costas, dez chegadas alternadas de crawl e costas com prancha em pernada e utilizando pulboia foram executadas mais dez chegadas de crawl e costas utilizando apenas a braçada. Ao fim do treino foram executadas mais dez chegadas alternadas sendo duas crawl e duas de costas, totalizando um volume de 1360 metros em 40 a 42 minutos de aula (piscina de 17 metros com temperatura de 19,5ºC). Cinco minutos após a aula, com a pele seca, foram aferidas novamente as dobras cutâneas e massa corporal. Como analise estatística foi utilizado o test-t de student pareado com nível de significância de $P \leq 0,05$. Resultados: Foi observada uma redução na soma geral dos valores das dobras cutâneas (p = 0,05). Conclusão: Mesmo com essa diminuição no somatório dos valores, quando utilizada às equações de Pollock e de Guedes, não foi observada diferença no percentual de gordura antes ou depois de uma aula de natação.

PALAVRAS CHAVES: Percentual de gordura, exercício, dobras cutâneas.