83 - RENAL FUNCTION DURING MAXIMAL PHYSICAL EXERCISE IN APPARENTLY HEALTHY ELDERLY PEOPLE

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Abstract

Actually, physical education must include human beings of different ages, especially the elderly. Adequate guidance in the practice of physical activity will improve your quality of life. However, there are conditions such as exercise-induced proteinuria, which in the long term can lead to kidney disease if the duration and intensity of exercise are not properly considered. Therefore, the purpose of the study was to determine the effect of different intensities of physical exercise on proterinuria (albuminuria) in adults apparently healthy older adult. The present study is of an experimental, prospective, longitudinal and comparative nature in men over 65 years of age without manifestations of disease and participated in recreational activities. Participated 25 older people with mean age of 72 ± 9.3, and without pathology. They They performed 3 treadmill exercise tests: maximal and submaximal physical exercise for 30 minutes at 60 and 80% of the observed heart rate. The order of tests was randomized. The participants presented a slight presence of microalbuminuria, which reverted 24 hours after their exercise. Guiding the practitioner of physical activity will allow a better state of health and avoid kidney damage.

Keywords: Physical activity, aging, microalbuminuria, exercise intensity

Resumen

En la actualidad, la educación física debe incluir a seres humanos de diferentes edades, especialmente a los ancianos. Una adecuada orientación en la práctica de actividad física mejorará su calidad de vida. Sin embargo, existen condiciones como la proteinuria inducida por el ejercicio, que a largo plazo pueden conducir a la enfermedad renal si no se considera adecuadamente la duración y la intensidad del ejercicio. Por lo tanto, el propósito del estudio fue determinar el efecto de diferentes intensidades de ejercicio físico sobre la proteinuria (albuminuria) en adultos mayores aparentemente sanos. El presente estudio es de carácter experimental, prospectivo, longitudinal y comparativo en hombres mayores de 65 años sin manifestaciones de enfermedad y que participaban en actividades recreativas. Participaron 25 personas mayores con edad media de 72 ± 9.3 y sin patología. Realizaron 3 pruebas de ejercicio en banda sin fin: ejercicio físico máximo y sub máximo durante 30 minutos al 60 y 80% de la frecuencia cardíaca observada. El orden de las pruebas fue aleatorio. Los participantes presentaron una ligera presencia de microalbuminuria, que revirtió 24 horas después de su ejercicio. Orientar al practicante de actividad física permitirá un mejor estado de salud y evitará daños renales.

Palabras clave: actividad física, envejecimiento, microalbuminuria, intensidad del ejercicio

Résumé

En fait, l'éducation physique doit inclure des êtres humains d'âges différents, en particulier les personnes âgées. Un encadrement adéquat dans la pratique de l'activité physique améliorera votre qualité de vie. Cependant, il existe des conditions telles que la protéinurie induite par l'exercice, qui à long terme peut entraîner une maladie rénale si la durée et l'intensité de l'exercice ne sont pas correctement prises en compte. Par conséquent, le but de l'étude était de déterminer l'effet de différentes intensités d'exercice physique sur la protéinurie (albuminurie) chez des adultes apparemment en bonne santé. La présente étude est de nature expérimentale, prospective, longitudinale et comparative chez des hommes de plus de 65 ans sans manifestation de maladie et ayant participé à des activités récréatives. Y ont participé 25 personnes âgées d'âge moyen de 72 ± 9,3 ans et sans pathologie. Ils ont effectué 3 tests d'effort sur tapis roulant : exercice physique maximal et sous-maximal pendant 30 minutes à 60 et 80 % de la fréquence cardiaque observée. L'ordre des tests a été randomisé. Les participants ont présenté une légère présence de microalbuminurie, qui est revenue 24 heures après leur exercice. Guider le pratiquant d'activité physique permettra un meilleur état de santé et évitera les lésions rénales.

Mots-clés: Activité physique, vieillissement, microalbuminurie, intensité de l'exercice

Resumo

Na verdade, a educação física deve incluir seres humanos de diferentes idades, principalmente os idosos. A orientação adequada na prática de atividade física melhorará sua qualidade de vida. No entanto, existem condições como a proteinúria induzida pelo exercício, que a longo prazo pode levar à doença renal se a duração e a intensidade do exercício não forem devidamente consideradas. Portanto, o objetivo do estudo foi determinar o efeito de diferentes intensidades de exercício físico sobre a proteinúria (albuminúria) em adultos idosos aparentemente saudáveis. O presente estudo é de natureza experimental, prospectiva, longitudinal e comparativa em homens acima de 65 anos, sem manifestações da doença e participando de atividades recreativas. Participaram 25 idosos com média de idade de 72 + 9,3 anos, e sem patologia. Eles realizaram 3 testes de exercício em esteira: exercício físico máximo e submáximo por 30 minutos a 60 e 80% da frequência cardíaca observada. A ordem dos testes foi randomizada. Os participantes apresentaram discreta presença de microalbuminúria, que reverteu 24 horas após o exercício. Orientar o praticante de atividade física permitirá um melhor estado de saúde e evitará danos nos rins.

Palavras-chave: Atividade física, envelhecimento, microalbuminúria, intensidade de exercício

Introduction.

New approaches in physical education include attention throughout the human life cycle. Physical exercise is one of the most important elements to maintain a better quality of life in older people. Different authors recommend their practice as an essential element in healthy lifestyles to get a better life quality. (Oliveira, Santa-Marihna, Leao, Monteiro, Bento, Santos & Rito, 2017; González, Froment, 2018; Pereira, Fernandez, Cruz, Santiesteban, 2018). Despite its importance, there is scanty information about the responses to physical exercise, especially at high intensities.

If the intensity of the exercise is not properly prescribed, proteinuria could be present as the effect produced by the increase in the hydrostatic pressure of blood pressure and the loss of vascular function in the kidney in older people. Long-term proteinuria can produce kidney

damage, as has been demonstrated for our group, in other pathologies such as type-1 diabetes mellitus (Kornhauser, Malacara, Macías-Cervantes, Rivera Cisneros, 2012)

In aging, Poortmans et al. (2006) suggest that the repetitive biological stress produced by the exercise, can result in cumulative damage in the older adult if this is not properly regulated. Although exercise helps preserve and improve kidney health, it is necessary to specify the intensity and duration of exercise in which there is little or no possible kidney damage. Few studies have been conducted to determine the effect of exercise acute maximal and submaximal in older adults. Even though the positive effects of practice of physical exercise on human health and the delay in aging are evident, the practice of exercise can cause changes in kidney function, such as reduced circulation kidney and glomerular filtration under normal conditions (Farquhar, Kennedy, 1999; Heathcote, Wilson, Quest, Wilson, 2009; Poortmans, Ouchinsky, 2006; Shavandi, Samiei, Afshar, Saremi, & Sheikhhoseini, 2012).

Therefore, the purpose of the study was to determine the effect of different intensities of physical exercise on proterinuria (albuminuria) in adults apparently healthy older adult, using a protocol similar to another study performed by this author.

Material and methods

The present study is of an experimental, prospective, longitudinal and comparative nature in men over 65 years of age without manifestations of disease and participated in recreational activities.

The clinical characteristics are showed in table 1.

Table 1.
Clinical characteristics of the participants (n=25 male). Values are ± sd

Clinical characteristics of the participants (n=25 male). Values are ± sd	
Age (years old)	72 ± 9.3
Weight (Kg)	70 ± 5.4
Height (m)	167.0 ± 8.0
Body Mass Index (Kg/m^2)	27.3 ± 4.1
Body Fat (%)	25.6 ± 4.2
Glucose (mg/dL)	103.2 ± 8.3
Cholesterol (mg/dL)	181.4 ± 28.0
Triglycerides (mg/dL)	137.2 ± 44.2
Creatinine (mg/dL)	0.94 ± 0.30

VO_2max was of 29.9 ± 8.3 ml/Kg/min y and his maximal (HR max) de 149 ± 9.0 latidos por minuto

The participants were scheduled for 3 sessions in a physiology laboratory in University of Guanajuato campi, San Carlos. In the first meeting, clinical history, physical examination, determination of vital signs, anthropometry and laboratory tests by venipuncture of the cephalic or basilic veins were performed. The variables described in Table 1 were evaluated. Anthropometry and body composition were performed by determining 7 skinfolds on the dominant side. The tests were carried out on an treadmill with an adapted Balke´s protocol,

with ACSM criteria, and monitoring by 12 electrocardiographic leads Maximum effort criteria were: reaching at least 90% of maximum HR for age; no increases in HR despite increasing workloads; respiratory quotient (VCO2/VO2) of 1; Borg's perceived exertion rate.

After performing the maximal test, and with a difference of ten days, between them, 2 exercise tests were carried out at sub maximum effort for thirty minutes (at 80% and 60%), based on peak heart rate, resting heart rate. The tests were randomly assigned. Thirty minutes before, and for ten minutes after the completion of the 3 exercise tests, the participants ingested 250 ml of water. A urine sample was collected before starting each test exercise, at the end, 60 minutes and 24 hours post-exercise to determine the presence of microalbuminuria (mg/l) by immunoturbidometric technique.
The results are presented as mean and standard deviation (+ sd). Two way analysis of variance was made to compare the response of the study variables in two groups at the different intensities. Statistical significance was set at an alpha of 95 %.

Results

As was showed in table 1 the BMI and the levels of serum glucose were slightly above recommended limits. The serum concentration of total cholesterol, triglycerides, uric acid, creatinine (0.96 ± 0.27 mg/dl), and Hemoglobin (15.51 ± 0.98 g/dl), hematocrit (45.20 ± 4.32%) are within the normal values.

The participants had a good functional capacity according to the VO_2max obtained and the maximum heart rate was in the expected value for their age.

Figure 1

Shows the responses in maximal capacity of VO_2max in the different experimental conditions.

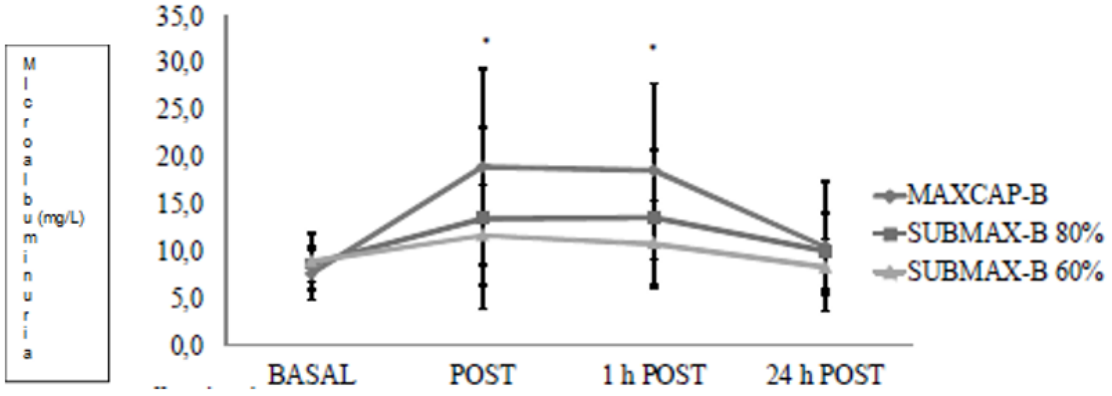

Fig. 1 Microalbuminuria responses a maximal (MAXCAP-B), submaximal 80% of maximal heart rate (SUBMAX-B 80%) and submaximal 60% of maximal heart rate (SUBMAX-B 60%)

Before the physical exercise tests, the urinary excretion of albumin was for MAXCAP-B of 7.6±2.7 mg/l; for SUBMAX-B 80% was 8.7±2.01 mg/l; and in the physical exercise test SUBMAXB 60% of 8.9±3.0 mg/l. The 2-way ANOVA showed changes statistically significant ($p < 0.05$) in microalbuminuria only in MAXCAP-B post-exercise (19.0±10.7 mg/l) and 1 hour post-exercise (18.6±9.4 mg/l) ($p < 0.05$). After carrying out the test of physical exercise SUBMAX-B 60% and 80% no changes were presented statistically significant in the presence of microalbuminuria. Albumin excretion concentrations returned to values baseline

at 24 hours after performing all the tests of physical exercise.

Discussion

The results of this study show that there is no microalbuminuria in subjects under baseline conditions and is according with the other studies (Poortmans et al (2006), who also in older adults, founded an significant elevation in albumin excretion after 30 minutes of high intensity in physical exercise with respect to baseline, even when they do not describe the effect immediately after exercise.

In another hand Heathcote et al (2009), also showed elevation in the excretion of albumin in young adults in urine collected 15 minutes post-exercise, which decreased to normal values in the following 24 hours. The results of both studies were similar, even though this study is thought to show more completes the effect of exercise on albumin excretion, since it is determined the urinary conditions obtained immediately after the exercise.

The absence of microalbuminuria 24 hours after performing the MAXCAP-B physical exercise tests and SUBMAX-B 80% and 60% indicates that the microalbuminuria was not persistent.

The studies by Kramer et al (1988), Poortmans, Labilloy, (1988) Bellinghieri, Savica, Santoro (2008) and Kornhauser et al 2012), showed that the effect of exercise on the excretion of albumin is more related to the intensity of the exercise than to the its duration, which is consistent with the results of this study showing the effect of a maximal aerobic capacity exercise on albumin excretion. In this regard, Allen (2005) indicated that training of high intensity and short duration can increase albumin excretion by mechanisms of glomerular alteration and tubular.

In the patients of the present study, the exercise test physical SUBMAX-B 60% and 80%, with a duration of 20 minutes, no had a greater effect on albumin excretion, which suggests that in these subjects at these intensities and duration of exercise does not had an important effect on albumin excretion.

Even though Clerico et al. (1990) found microalbuminuria in athletes trained at intensities between 60-90%, this study shows discordant results since there was no microalbuminuria after performing acute physical exercise at intensities submaximal of 80% and 60%.
Under normal conditions, albumin is filtered by the glomeruli and the proximal tubules which actively reabsorb this protein (Tojo, Kinugasa, 2012), these physiological conditions could be altered in older adults. However, the normalization of albumin excretion 24 hours after exercise similarly to what was found in young adults would support the idea that although In older adults apparently healthy, the intensity of physical exercise can be an important factor in determining albumin excretion, has no persistent physiological impact.

Conclusion

The maximum intensity of exercise produce microalbuminuria in apparently healthy older adults and this response is moderate and transient, and should be considered in programs of exercise. There was no persistent microalbuminuria at 24 hours after the practice of maximum and submaximal physical exercise, which indicates that in apparently healthy older adults the effect is slight and transitory. More studies should be conducted to measure responses effects to acute exercise in patients with chronic diseases to characterize the risk of renal damage and for an adequate prescription and indications for the physical activity in older people.

REFERENCES

Abdelhafiz, A. H., Ahmed, S., & El Nahas, M. (2011). Microalbuminuria: marker or maker of cardiovascular disease. *Nephron Experimental Nephrology, 119*(Suppl. 1), e6-e10.

Allen, T. (2005). Exercise physiology: people and ideas. *British Journal of Sports Medicine, 39*(3), 182.

Bellinghieri, G., Savica, V., & Santoro, D. (2008). Renal alterations during exercise. *Journal of Renal Nutrition, 18*(1), 158-164.

Buckalew, V. M., & Freedman, B. I. (2011). Effects of race on albuminuria and risk of cardiovascular and kidney disease. *Expert review of cardiovascular therapy, 9*(2), 245-249.

Clerico, A., Giammattei, C., Cecchini, L., Lucchetti, A., Cruschelli, L., Penno, G., et al. (1990). Exercise-induced proteinuria in well-trained athletes. *Clinical chemistry, 36*(3), 562-564.

Farquhar, W., & Kenney, W. (1999). Age and renal prostaglandin inhibition during exercise and heat stress. *Journal of Applied Physiology, 86*(6), 1936-1943.

González, A. J. G., Froment, F. (2018). *Beneficios de la actividad física sobre la autoestima y la calidad de vida de personas mayores*. *Retos*, *33*(33), 3-9.

Hawkins, M. S., Sevick, M. A., Richardson, C. R., Fried, L. F., Arena, V. C., Kriska, A. M. (2011). Association between physical activity and kidney function: National Health and Nutrition Examination Survey. *Medicine and science in sports and exercise, 43*(8), 1457-1464.

Heathcote, K. L., Wilson, M. P., Quest, D. W., & Wilson, T. W. (2009). Prevalence and duration of exercise induced albuminuria in healthy people. *Clinical & Investigative Medicine, 32*(4), 261-265.

Jackson, A. S., & Pollock, M. L. (1985). Practical assessment of body composition. *The Physician and Sportsmedicine, 13*(5), 76-90.

Karvonen, M. J., Kentala, E., Mustala, O. (1957). The effects of training on heart rate; a longitudinal study. In *Annales medicinae experimentalis et biologiae Fenniae* (Vol. 35, No. 3, p. 307).

Kornhauser, C., Malacara, J.-M., Macías-Cervantes, M.-H., & Rivera Cisneros, A.-E. (2012). Effect of exercise intensity on albuminuria in adolescents with Type 1 diabetes mellitus. *Diabetic Medicine, 29*(1), 70-73.

Kramer, B. K., Kernz, M., Ress, K., Pfohl, M., Müller, G., Schmülling, R., et al. (1988). Influence of strenuous exercise on albumin excretion. *Clinical chemistry, 34*(12), 2516-2518.

Oliveira, R., Santa-Marinha, C., Leão, R., Monteiro, D., Bento, T., Santos Rocha, R., & Brito, J. P. (2017). Exercise training programs and detraining in older women. *Journal of Human Sport and Exercise*, *12*(1).

Pereira, L. G., Fernandez, E. B., Cruz, M. G., & Santiesteban, J. R. G. (2018). *Programa de actividad física y su incidencia en la depresión y bienestar subjetivo de adultos mayores. Retos*, *33*(33), 14-19.

Poortmans, J., & Labilloy, D. (1988). The influence of work intensity on postexercise proteinuria. *European journal of applied physiology and occupational physiology, 57*(2), 260-263.

Poortmans, J. R., & Ouchinsky, M. (2006). Glomerular filtration rate and albumin excretion after maximal exercise in aging sedentary and active men. *The Journals of Gerontology Series A: Biological Sciences and Medical Sciences, 61*(11), 1181-1185.

Robert shaw, M., Cheung, C., Fairly, I., & Swaminathan, R. (1993). Protein excretion after prolonged exercise. *Annals of Clinical Biochemistry: An international journal of biochemistry in medicine, 30*(1), 34-37.

Robinson, E. S., Fisher, N. D., Forman, J. P., & Curhan, G. C. (2010). Physical activity and albuminuria. *American journal of epidemiology, 171*(5), 515-521.

Saeed, F., Pavan Kumar Devaki, P. N., Mahendrakar, L., & Holley, J. L. (2012). Exercise-induced proteinuria? *Journal of Family Practice, 61*(1), 23.

Shavandi, N., Samiei, A., Afshar, R., Saremi, A., & Sheikhhoseini, R. (2012). The effect of exercise on urinary gamma-glutamyltransferase and protein levels in elite female karate athletes. *Asian journal of sports medicine, 3*(1), 41.

Storer, T. W., Davis, J. A., & Caiozzo, V. J. (1990). Accurate prediction of VO2max in cycle ergometry. *Medicine and Science in Sports and Exercise*, *22*(5), 704-712.

Tojo, A., & Kinugasa, S. (2012). Mechanisms of glomerular albumin filtration and tubular reabsorption. *International journal of nephrology, 2012*.

Touchberry, C. D., Ernsting, M., Haff, G., & Kilgore, J. L. (2004). Training alterations in elite cyclists may cause transient changes in glomerular filtration rate. *Journal of sports science & medicine, 3*(YISI 1), 28.

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