105 - THE INFLUENCE OF STRENGTH TRAINING IN ACQUIRED IMMUNODEFICIENCY SYNDROME (HIV) INDIVIDUALS

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INTRODUCTION

Since its discovery, in the final years of the 1970's, the Acquired Immunodeficiency Syndrome (AIDS) has proliferated rapidly, causing the advancement and widely spreading the epidemic (BRITO et al., 2005).

The introduction of the Highly Active Antiretroviral Therapy (HAART) has had positive effects in the treatment of individuals with the Human Immunodeficiency Virus (HIV), for it has reduced the viral load (amount of viral RNA replicas per ml of blood), and protect the immune system of these individuals. Despite of some of the adverse effects, it has been proved that the HIV causes conditions, including lypodistrophy, characterized by the abnormal distribution of body fat, in which lipo-hypertrophy is the accumulation of fat in the upper or central part of the body and lypo-atrophy, the loss of fat in the peripheral areas (BOPP et al., 2003; TERRY et al., 2006; DRISCOLL et al., 2007). The use of HAART may also lead to metabolic alterations such as the increase of plasmatic levels of total cholesterol, LDL cholesterol, triglycerides and glucose; increase of the arterial pressure and the decrease of HDL cholesterol serum concentrations. These alterations cause these individuals to have a predisposition to cardiovascular diseases (GRINSPPON, 2005). Moreover, HAART may cause the increase of mitochondrial toxicity, which may interrupt the cycle of energy production into the mitochondria and the increase of lactate production. This increase leads to the elevation of acidosis along with fat metabolism interruption, which causes the excessive amount of energy loss at resting point, and contributes to the loss of muscle mass (MARLINK, 2001; GRINSPOON, 2003).

The anabolic effect of exercise is known to medical science as prevention and treatment for the loss of muscle mass (AREY & BEAL, 2002). Strength training promotes adaptations relating to the increase of strength, muscle hypertrophy, the growth of fat free mass and the decrease of body fat (FLECK, 1999; DIAS et al, 2005).

In face of these facts, this study proposed to examine the influence of strength training and muscle mass, fat mass, fat percentage, total body mass, and strength in HIV individuals.

MATERIAL AND METHODS

The 8 HIV positive men that participated in this protocol came from a program history of strength training, using weightlifting machines during 7 months, between the ages of 28 and 55 years. All individuals were under the antiretroviral treatment and presented laboratory blood exams, stating undetectable viral loads and CD4 cell counts above 200 cells/mm³. This was the criteria used to be accepted for this research.

Before the beginning of the strength training, the individuals presented written medical approval confirming aptitude for physical activities, and underwent a selection based on the results of the PAR-Q and Coronary Risk factors Questionnaires.

The research was approved by the Ethics Committee of the Itaúna University (protocol 009/2006). All subjects signed a written free and clarified consent and where informed about the procedures of the study, respecting all the terms of the 196 Resolution of the National Court of Health, dating 10th of October of 1996.

Three anthropometric evaluations (pre, intermediate and post) were performed in a period of approximately two months. The individuals were evaluated according to the Jackson and Pollock (1985) protocol: total body mass, body muscle mass, fat mass, fat percentage using 7 Skinfolds (chest, middle armpit, triceps, sub-escapulae, abdominal, supra iliac, and thigh) measured by a CESCORT Body Fat Caliper (MARINS, 2003).

The Bittencourt (1986) 12 repetition weight test was used based on a choice of number of repetitions according to the desired physical capacity (dynamic strength), along with weight load considered to be acceptable to perform the established movement (MARINS, 2003).

According to the protocol, the subject being evaluated would perform the movement with a certain degree of mechanical difficulty in the final repetitions, however, maintaining a constant rhythm of motion during the whole cycle of movement. Observations of amount of weight and the ease and/or difficulty in performing the exercise would be made in the first attempt of the test. In case of excessive amount of weight load at the moment when movement was being performed with great difficulty, or amount of weight below the capacity where the movement was performed with great ease, the test would be performed in other muscle groups, and then returning to the first group after a resting period of 5 minutes.

The test was applied before (Pre-test) and after (Post-test) the periodization of lower member strength training which used following exercises, knee flexions (uniarticular), extension of the hips and knees (multi-articular), following the Bittencourt protocol (1986).

Strength training included exercises using resistive weight lifting machines and included all the main muscle groups of upper and lower body segments. The variables of training were programmed for muscular hypertrophy. The frequency of training sessions used were of 3 times/week and lasting approximately 1 hour and 30 min, resting periods of approximately 1 to 2 minutes in between sets and interval of 48 hours in between training sessions. General stretching and aerobic exercises where used for warm-ups. For the aerobic exercise a static ergometric bicycle and a treadmill were used according to the characteristics and needs of each individual (the specificity and individuality principal) (ACSM, 2003).

The training program was set for three months (April, May and June) and is presented in Table 1.

TABLE 1. Exercise Program

	MESOCYCLE 1					MESOCYCLE 2				MESOCYCLE 3				
WEEKS	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**
WEIGHT (%)	70	75	80	85	80	80	85	85	90		90	95	90	85
SETS	3	3	3	3	3	3	3	3	3		4	4	3	3
REPETITIONS	12	12	10	10	10	10	10	10	8		6	6	12	10
REST INTERVAL	1'	1'	1'	1'	1'	1'	1'	1'	1'		2'	2'	1'	1'

Mesocycle 1 included five weeks, where in the first weeks 3x12, 70% with a 1 minute resting interval was used for the beginning of the training program. In the second, third and forth week, respectively, the intensity was gradually increased, varying between 3x2, 75% with 1 minute of resting period 3x10, 80 with 1 minute of resting period, and 3x10 85% with a rest interval of 1 minute. In the fifth week a recuperation protocol was used maintaining moderate intensity (3x10 and resting interval of 1 minute).

The duration of Mesocycle 2 was of four weeks, and included an intensity that continued through the first three weeks (3x10, 85% with 1 min resting interval), and in the last week, the training program was modified to 3x8, 90% and 1 minute of resting period.

In the second, third and forth weeks of Mesocycle 3, the workload varied in 4x6, 90% with a 2 minute rest interval. 4x6, 95% with 2 minute rest interval, and 3x12, 90% with an interval of 1 minute, respectively. In the fifth week, the work load was of 3x10. 85% with a 1 minute rest interval. The last week of the program the Strength Test (Post-test) was applied. One subject did not participate in the last strength test due to medical restrictions (because of the diagnosis of varicose veins in lower members). This individual was excluded from the testing.

Relating to the statistical procedures, the error significance was calculated for all dependant variables. For the analysis of muscle mass, fat mass, fat percentage and total body mass, the ANOVA statistic test one-way post hock Tuckey was used. For the evaluation of the level of strength the Student *t*-test was used. For both tests, the significance considered was of p=0.05.

RESULTS AND DISCUSSION

There were no significant differences for the muscle mass (Fig.1), fat mass (Fig 2), fat percentage (Fig.3) and total muscle mass (Fig.4).

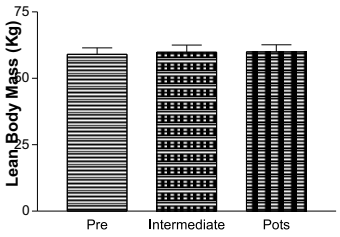


Figure 1- Lean Body Mass

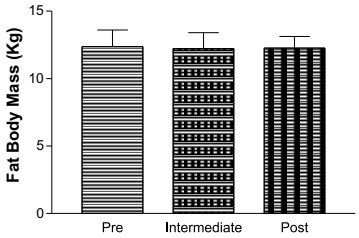


Figure 2- Fat mass

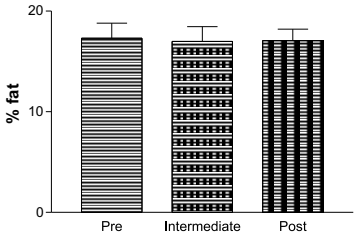


Figure 3- % of fat

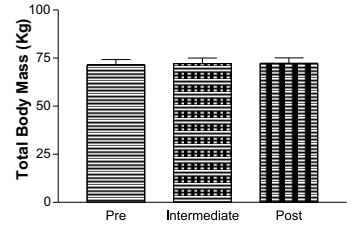


Figure 4- Total body mass

Significant increases were found for the strength variable in the leg flexion (Fig.5) (p=0.0008) and for the hip and leg extensions (Fig.6) (p<0.0001) which is demonstrated in Table 2. For all of the remaining exercises there was an increase was observed in absolute strength due to the increase of weight load during the duration of training.

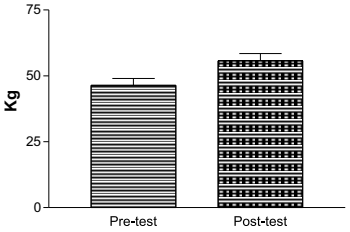


Figure 5 - Leg Curls

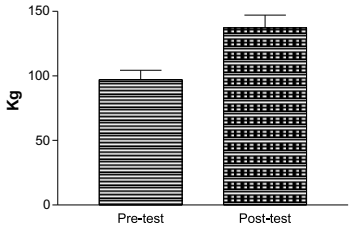


Figure 6- Legpress 45

Table 2. Mean values and standard deviation of the strength test.

	Pre-test (Mean ± S.D.)	Post test (Mean ± S.D.)	*p*
LEG CURLS	**46,42 ± 6,90**	**55,71 ± 7,31**	**=0.0008**
LEG PRESS 45º	**97,14 ± 18,89**	**137,14 ± 26,27**	**<0.0001**

The loss of weight and muscle mass are characteristics of the HIV infection associated with HAART. There was no significant difference in the results found for the variables of muscle mass, fat mass, fat percentage and total body mass, that agrees with the study performed by Driscoll et al. (2004), who also did not find significant differences for variables of total body mass, upper body fat, and visceral abdominal fat. Yarasheski et al (2001) confirms these respective results, affirming that there was no significant increase in the total body mass and muscle mass. Both studies used men under HAART. However, Roubenoff (2002) reached the results in a case study of a 44 year old HIV male individual, of total body mass and fat mass reductions, and increase in muscle mass after a period of four months. Malita et al (2005) stated that strength training offers the possibility of increase in free fat mass and the decrease of fat mass, but these results are controversial.

Results from the strength training protocol, in this study are confirmed by what was found in the study performed by Driscoll, et al. (2004), who examined the increase of strength in individuals under HAART treatment during a training period of three months. The protocol studied by Rigsby et al. (1992), only examined HIV positive men that underwent a program of strength

exercises performed with isokinetic machines during a period of 12 weeks. This study verified a significant amount of strength in the hip and knee extension exercises and horizontal adduction of the shoulders. Yarasheski et al (2001) also observed significant increases in strength in HIV positive men under the HAART treatment during a training program of 16 weeks.

CONCLUSION

This study came to the conclusion that a strength exercise program is capable of leading to significant adaptations related to the increase of strength level in individuals with HIV, which influence the increase of their functional capacity. However, no significant changes in the values of the variables related to body composition were observed. This suggests that other studies about physical activity are needed, along with nutritional orientation for the possibly greater control of calorie ingestion, considered an important variable related to body composition.

REFERENCES

AMERICAN COLLEGE OF SPORTS MEDICINE. *Diretrizes do ACSM para os testes de esforço e sua prescrição*. 6º ed. Rio de Janeiro: Editora Guanabara Koogan S.A. 2003. p. 92-105.

AREY, B. D.; BEAL, M. W. The Role of Exercise in the Prevention and Treatment of Wasting in Acquired Immune Deficiency Syndrome. *Journal of the Association of Nurses in AIDS Care*, v. 13, n. 1, p.29-49, 2002.

BOPP, C. M.; PHILLIPS, K. D.; FULK. L. J.; HAND, G. A. Clinical Implications of Therapeutic Exercise in HIV/AIDS. *Journal of the Association of Nurses in Aids Care*. v. 14, n.1. January/February 2003, p.73-78.

BRITO, I.; CHINAGLIA, M.; DIAZ, J.; GALVÃO, L.; LIPPMAN, S.; LOPES, V. *A aids nas fronteiras do Brasil: diagnóstico estratégico da situação da epidemia de aids e doenças sexualmente transmissíveis nas fronteiras do Brasil*. Coleção DST/AIDS_Séries Estudos, Pesquisas e Avaliação n.6, Brasília, 2005. p. 13.

DRISCOLL, S. D.; MEININGER, G. E.; LJUNGQUIST, K.; HADIGAN, C.; TORRIANI, M.; KLIBANSKI, A.; FRONTERA, W. R.; GRINSPOON,S. Differential Effects of Metformin and Exercise on Muscle Adiposity and Metabolic Indices in Human Immunodeficiency Virus - Infected Patients. *The Journal of Clinical Endocrinology and Metabolism*. v.89, n.5, p.2171-2178. 2004.

DIAS, R. M. R.; CYRINO, E. S.; SALVADOR, E. P.; NAKAMURA, F. Y.; PINA, F. L. C.; OLIVEIRA, A. R. Impacto de oito semanas de treinamento com pesos sobre a força muscular de homens e mulheres. *Revista Brasileira de Medicina do Esporte*. v. 11,n. 4, p.224-228, 2005.

FLECK, S.J.; KRAEMER.W.J. *Fundamentos do treinamento de força muscular*. 2º ed. Porto Alegre: Editora Artmed, 1999. p.19-29.

GRINSPOON, S.; MULLIGAN, K. Weight Loss and Wasting in Patients Infected with Human Immunodeficiency Virus. *Clinical Infectious Diseases*. v. 36, Suppl 2, p.S69-S78, 2003.

GRINSPOON, S. Metabolic syndrome and cardiovascular disease in patients with human immunodeficiency virus. *The American Journal of Medicine*. v.118, Suppl 2, p.2-3, 2005.

MALITA, F. M.; KARELIS, A. D.; TOMAS, E.; RABASA, L. R. Effects of different types of exercise on body composition and fat distribution in HIV - infected patients: a brief review. *Canadian Journal of Applied Physiology*. v.30, n.2, p. 233-245, 2005.

MARINS, J. C. B.; GIANNICHI, R. S. *Avaliação e prescrição de atividade física: guia prático*. 3 ed Editora Shape: Rio de Janeiro. 2003. p. 50-51; 117-118.

MARLINK, R.G. Lipodystrophy from A to Z. An overview of lipodystrophy syndrome in patients with HIV infection. *Journal of the International Association of Physicians in AIDS Care*. Chicago, IL, USA.. p.S1-S24, 2001.

RIGSBY, L. W.; DISHMAN, R. K.; JACKSON, A. W.; MACLEAN, G. S.; RAVEN, P. B. Effects of exercise training on men seropositive for the human immunodeficiency virus - 1. *Medicine and Science in Sports and Exercise*. v.24, n.1. p. 6-12, 1992.

ROUBENOFF, R.; SCHIMITZ, H.; BAIROS, L.; LAYNE, J.; PETTS, E.; COUTIER, G. J.; DENRY, F. Reduction of Abdominal Obesity in Lipodystrophy Associated with Human Immunodeficiency Virus Infection by Means of Diet and Exercise: Case Report and Proof of Principle. *Clinical Infectious Diseases*. v.34, p.390 - 393, 2002.

TERRY, L.; SPRINZ, E.; STEIN, R.; MEDEIROS, N. B.; OLIVEIRA, J.; RIBEIRO, J. P. Exercise Training in HIV - 1 - Infected Individuals with Dyslipidemia and lipodystrophy. *Medicine and Science in Sports and Exercise*. v.38, n.3, p.411-417, 2006.

YARASHESKI, K. E.; TEBAS, P.; STARNESON, B.; CLAXTON, S.; MARIN, D.; BAE, K.; KENNEDY, M.; TANTISIRIWAT, W.; POWDERLY, W. G. Resistance exercise training reduces hypertriglyceridemia in HIV - infected men treated with antiviral therapy. *Journal of Applied Physiology*. v.90, n.1, p.133-138, 2001.

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THE INFLUENCE OF STRENGTH TRAINING IN ACQUIRED IMMUNODEFICIENCY SYNDROME (HIV) INDIVIDUALS

ABSTRACT

Individuals with the Human Immunodeficiency Virus that undergo the Highly Active Antiretroviral Therapy (HAART) commonly present many adverse effects. These side effects reduce their functional capacity due to the loss of muscle mass, metabolic alterations and abnormal body fat distribution. This study examined the question that strength training should be sufficient for the increase in strength, muscle mass and the decrease of body fat in individuals with HIV. Eight physically active men, with HIV and under HAART participated in this study. They underwent a selection based on the Par-Q and Coronary Risk Factor Questionnaires and presented written medical approval prior to the study confirming aptitude for physical activity. All individuals signed a free and clarified written consent. A strength training program with weightlifting machines were studied during a period of 14 weeks. Significant differences were found in levels in standard Leg Press 45 exercises ($p<0.0001$) and Leg Curls ($p=0.0008$). No significant differences were found for anthropometric variables. The conclusion achieved was that strength exercises lead to the increase of muscle strength and there were no significant modifications in body composition in these individuals in the duration of study.

KEYWORDS: HIV, Strength Training

L'INFLUENCE DE LA FORMATION DE FORCE DANS INDIVIDUS PORTEURS D'IMUNODEFICIÊNCIA HUMAINE (HIV)

RESUMÉ

Les porteurs du virus de l'imunodeficiência humain (HIV) cela utilise de l'antiretroviral de la thérapie présentez des plusieurs effets secondaires qui réduisent la capacité utilitaire dû à la perte de modifications de masse, métaboliques musclées et caractères anormaux dans la distribution de graisse du caporal. L'hypothèse testée est que la formation de force est efficace dans l'augmentation de la force, masse mince et baisse de la graisse corporelle dans soropositivos des individus. Ils ont participé physiquement à l'étude 8 hommes atouts sous antiretroviral du traitement, a soumis à une sélection à travers le questionnaire que le Q Égal et moi Grattons dehors Coronariano et la présentation de certificat médical antérieur qui affirme ce you/they était capable pour l'entraînement d'activité physique. Tous les individus ont signé un terme de consentement libre et illustre. Une formation de force a été accomplie dans les vêtements de l'activité musclés pendant une période de 14 semaines. Ils ont été trouvés des différences considérables dans les niveaux de force dans la Jambe de l'exercice-modèle Presse 45e (P <0.0001) et je Supporte le Fléchisseur (P=0.0008). ils n'ont pas été trouvés de différences considérables pour l'antropométricas des variables. Nous avons terminé dans cette étude que les exercices de force induisent à l'augmentation de force musclée, cependant, la composition corporelle ne souffre pas de modifications considérables.

MOTS CLEFS: HIV, Formation de Force.

LA INFLUÊNCIA DEL ENTRENAMIENTO DE FUERZA EN SUJETOS PORTADORES DE LA IMMUNODEFICIÊNCIA HUMANA (HIV)

RESUMEN

Los portadores del virus de la inmunodeficiencia humana (HIV) que hacen uso de la terapia antirretroviral presentan muchos efectos colaterales que disminuyen la capacidad funcional debido a la perdida de masa muscular, alteraciones metabólicas y anormalidades en la distribución de grasa corporal. La hipótesis testada es que el entrenamiento de fuerza sea eficaz en el aumento de la fuerza, masa magra y disminución de la grasa corporal en individuos seropositivos. Participaron del estudio 8 hombres físicamente activos sob tratamiento antirretroviral, sometidos a una triagem a través del cuestionario Par-q y Riesgo Coronariano y la presentación del atestado médico previo firmando que estaban aptos para la practica de actividad física. Todos los individuos firmaron un término de consentimiento libre y aclarado. Fue realizado un entrenamiento de fuerza en aparatos de musculación durante un período de 14 semanas. Fueron encontradas diferencias significativas em los niveles de fuerza en los ejercicios-padrón Leg Press 45º (p<0.0001) y Banco Flexor (p=0.0008). No fueron encontradas diferencias significativas para las variables antropométricas. Se concluye en el estudio que los ejercicios de fuerza inducen al aumento de fuerza muscular, sin embargo, la composición corporal no sufre alteraciones significativas.

PALABRAS-CLAVE: HIV, Entrenamiento de Fuerza

A INFLUÊNCIA DO TREINAMENTO DE FORÇA EM INDIVÍDUOS PORTADORES DA IMUNODEFICIÊNCIA HUMANA (HIV)

RESUMO

Os portadores do vírus da imunodeficiência humana (HIV) que fazem uso da terapia antiretroviral apresentam diversos efeitos colaterais que diminuem a capacidade funcional devido à perda de massa muscular, alterações metabólicas e anormalidades na distribuição de gordura corporal. A hipótese testada é que o treinamento de força seja eficaz no aumento da força, massa magra e diminuição da gordura corporal em indivíduos soropositivos. Participaram do estudo 8 homens fisicamente ativos sob tratamento antiretroviral, submetidos à uma triagem através do questionário Par-q e Risco Coronariano e a apresentação de atestado médico prévio afirmando que estavam aptos para a prática de atividade física. Todos os indivíduos assinaram um termo de consentimento livre e esclarecido. Foi realizado um treinamento de força em aparelhos de musculação durante um período de 14 semanas. Foram encontradas diferenças significativas nos níveis de força nos exercícios-padrão Leg Press 45º (p<0.0001) e Banco Flexor (p=0.0008). Não foram encontradas diferenças significativas para as variáveis antropométricas. Concluímos nesse estudo que os exercícios de força induzem ao aumento de força muscular, entretanto, a composição corporal não sofre alterações significativas.

PALAVRAS-CHAVE: HIV, Treinamento de Força