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THE EFFECT OF STRENGTH TRAINING IN SUBJECTS DIAGNOSED WITH HIV/AIDS

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ABSTRACT

The present study presents the effect of strength training in subjects diagnosed with HIV/AIDS. The first chapter addressed the action and forms of HIV transmission. The second, the definition and action of strength training in the body. In the third chapter, a broad discussion was held between the practices of strength training in individuals with HIV/AIDS. The objective of the present study was to examine the effect of strength training on individuals with HIV/AIDS, taking into account evidence found in the scientific literature.

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INTRODUCTION

Several diseases and infections affect a large part of the world population nowadays, and the one that has stood out is the human immunodeficiency syndrome (AIDS) (GUIMARÃES *et al.,* 1993). This silent disease is transmitted by the human immunodeficiency virus (HIV) and is spread through sexual intercourse, semen and blood transfusion, as well as the shared use of surgical materials among infected persons (GUIMARÃES *et al.,* 1993). It acts directly on the immune system, leaving the infected individual at the mercy of other infections (KUMAR *et al.,* 2005). In addition, the treatment with Combined Antiretroviral Therapy (cART) is associated with other conditions, such as hyperglycemia, hyperinsulinemia, insulin resistance, loss of lean mass, and weight loss, which are part of the effects caused by the association between HIV and cART (MILEI *et al.,* 1998, CARR *et al.,* 2000, RERKPATTANAPIPAT *et al.,* 2000, BARBAR, 2006, MASIÁ-CANUTO *et al.,* 2006). As an alternative treatment to the effects caused by the disease, the practice of physical exercises presents a good non-drug intervention because of its beneficial effects on the immune system, glycemic metabolism, besides increasing the lean mass and reducing fat percentage and many other effects on the body (ACSM, 2016). The indication of the American College of Sports Medicine (2014) for this population is the prevalence of aerobic exercise (three to five days per week, 40-60% VO2R) associated with the practice of resistance training (two to three days per week, 60%1RM). Although the association of aerobic training with strength training is indicated and promotes several beneficial adaptations in the body, the practice of isolated strength training has been considered a

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modality capable of promoting various metabolic and tissue changes in the body (BOSSI, 2014).Thus, this work was developed with the objective of examining the effect of the strength training on subjects diagnosed with HIV/AIDS.

HIV / AIDS

The Human Immunodeficiency Syndrome (AIDS) is a disease transmitted by the Human Immunodeficiency Virus (HIV) and was firstly reported in the late 1970s and early 1980s in Zaire, Haiti and the United States. In Brazil, the first recorded case was in 1980 (GUIMARÃES *et al.,* 1993). Despite a short time elapsed since the first case was recorded, according to the World Health Organization, more than one million people had been infected with the virus until 1991. In Brazil, according to the Ministry of Health, until 1992 more than 25 thousand people had caught the virus (GUIMARÃES *et al.,* 1993). The most common characteristic of this disease is its direct effect on the immune system of the infected individual, since the virus interferes negatively in this system, leaving it vulnerable to other diseases (kumar *et al.,* 2005). The virus is transmitted through blood or semen, and contamination occurs with unprotected sex, blood transfusion, use of shared surgical and/or hospital supplies such as syringes and needles contaminated with infected people's blood. Another method of transmission is by the perinatal route, when the infected mother transmits the virus to the baby at the time of delivery or in the membrane rupture (Guimarães *et al.,* 1993). The treatment of infected people is carried out by means of combined antiretroviral (cART) and antiretroviral therapy offered by the Unified Health System (SUS) on a free-of-charge basis. Although the aim of this drug was to improve the quality of life and to increase life expectancy, it also presented some side effects such as metabolic alterations, dyslipidemias, insulin resistance and cardiovascular diseases (Kramer *et al.,* 2009).

The changes introduced in lipid metabolism caused by the ART treatment in individuals with HIV are characterized by an increase in the levels of VLDL (Very Low Density Lipoprotein), LDL (Low Density Lipoprotein) and a reduction of HDL (High Density Lipoproteins) (MASIÁ- Canuto *et al.,* 2006). The glycemic changes showed a significant increase in the occurrence of hyperglycemia, insulin resistance and type 2 diabetes mellitus (Carr *et al.,* 2000; BARBAR, 2006), whereas the occurrence of cardiovascular events is due to insulin resistance and diabetes mellitus (Milei *et al.,* 1998; Rerkpattanapipat *et al.,* 2000). Although the individuals present these conditions during treatment, it is not yet thoroughly recognized whether these effects occur as a direct consequence of ART or as the result of the interaction of several isolated or associated factors, such as genetic predisposition, antiretroviral treatment, environmental factors or other issues like the host's response to HIV infection (MASIÁ-CANUTO *et al.,* 2006). Furthermore, it was evident that ART can induce increased mitochondrial toxicity with a consequent rise of the final product of anaerobic glycolysis, the lactate (MARLINK, 2001). This growth leads to increased acidosis, burning sensation, and a disruption of fat metabolism, thus promoting an excessive decrease in energy, which contributes to the loss of muscle mass (MARLINK, 2001; GRINSPOON, 2005). In face of the conditions imposed by the action of the HIV, the practice of physical exercise, isolated or along with ART, represents a fundamental intervention in the treatment of this population (ACSM, 2014).

Strength Training

Resistance exercises are characterized by body movements that demand voluntary contractions of the skeletal muscles of a certain body segment against some external resistance (FORJAZ *et al.,* 2003). Another term used in resistance training is "force", which, besides being considered a constant in the field of physics, can be presented by the product of mass and acceleration (F = m x a), which is also characterized as the capacity of the skeletal muscle for generating tension (Dias *et al.,* 2006). The production of force can be classified as exogenous or endogenous. The former is defined by the forces generated by the external environment and has a direct impact on our body, like gravity. The latter can be explained by the forces generated by our body to perform movements on the resistance of the tension imposed by the body tissues (ARRUDA, 2000). In view of that, Bossi (2014) states that for the body to generate force through the musculoskeletal tissues it is necessary to use force levers that can be classified in three classes. The first class (or interfix) is when there is a support between the powers and the resistance, like the movement of cervical extension. The second class (or inter-resistant) is when the resistance lies between the support and the power, such as plantar flexion exercises. Finally the third class (or interpotent) is when the power lies between the support and the resistance; this is the most used by our body in the production of strength, like the extension and flexion of elbows, adduction and abduction of shoulders, flexion and extension of knees and flexion and extension of the hip. Moreover, the muscle actions in the production of force can be divided into two phases: concentric and eccentric. In the former, the target muscle produces force against the force of gravity, and the latter is defined as the muscle stretching against the resistance attributed in the same direction of the gravitational force (BOSSI, 2014).

Anatomically, the responses generated by the resistance training may be different because of the kind of muscular fibers, which can be classified into two types. Type 1 are fibers of greater resistance, displaying less force of contraction and characterized by their reddish coloration, besides having a higher concentration of mitochondria, which characterizes it as a fiber where the aerobic/oxidative metabolism prevails. Type 2 fibers, in turn, are subdivided into type 2a and type 2b. The former is considered mixed and intermediate, because of their unique characteristic of combining resistance and power stimuli; and the latter consists of fibers of a fast contraction nature only, having a greater potential in generating a large amount of force, and related to the phosphatic and glycolic energy systems (BOSSI, 2014). In addition to the benefits stimulated by the practice of resistance exercise in various body tissues, especially in striated muscles, several studies claim that the practice of resistance physical exercise as a non-medicated intervention yields positive results in several clinical conditions, such as obesity, diabetes mellitus type 1 and 2, cardiac dysfunctions (angina, infarction, aortic stenosis and others), dyslipidemias and cancer, especially in individuals with HIV (ACSM, 2014).

Strength training in individuals with HIV/AIDS

The practice of strength training has varied effects on the body, both anatomical and physiological, and has the purpose of improving physical conditioning, performance, aesthetics and health promotion (FLECK, KRAEMER, 2006). Patients

diagnosed as HIV-positive presented dyslipidemias and disorders in the glycemic metabolism, which characterizes the Metabolic Syndrome, although the treatment itself (ART) may contribute to these alterations. The practice of physical exercise is a tool that contributes to the improvement of this clinical picture (SANTOS *et al.,* 2016). The American College of Sports Medicine - ACSM (2016) indicate that it is essential for individuals with glycemic changes and dyslipidemias to emphasize the maintenance of the ideal weight; despite the indication of the prevalence of aerobic exercise, strength training is indicated as auxiliary training. Layne *et al*. (2011) investigated the practice of strength training for eight weeks and its impact on glycemic tolerance in individuals with Metabolic Syndrome. Their findings did not show significant anthropometric differences in waist circumference and body mass index (BMI); the metabolic results such as glycaemia and serum lipids, though, showed an increase in muscle strength, and fat-free mass was seen.

Supporting these results, Stensvold *et al*. (2010) analyzed the influence of strength training three times per week at the intensity of 80% of 1RM with repetitions between 8 and 12 for a period of 12 weeks in individuals with metabolic disorders. The intervention was effective in reducing the anthropometric data evaluated in the waist circumference, also an increase in HDL and in muscle strength was observed in the post intervention evaluation, but no beneficial effects were observed in blood pressure, blood glucose and serum lipids. With a longer-term intervention protocol, 32 weeks, Bateman *et al*. (2011) evaluated the influence of strength training in individuals with Metabolic Syndrome. The results found in this study were similar to those of previous works, where no decrease in waist circumference, blood glucose, blood pressure and serum lipids was observed, but only a rise in muscle strength. Potteiger *et al*. (2012), in addition to evaluating the influence of strength training, intervened with dietary modification for 24 weeks in individuals diagnosed with Metabolic Syndrome.

The results showed that the training-diet association was effective in reducing blood glucose, blood pressure and muscle strength, besides increasing fat-free mass. Although strength training alone does not have a full contribution to the improvement of dyslipidemias and glycemic disorders, it presents good results when associated with aerobic training and dietary intervention (TOMPSON *et al.,* 1997; ZMUDA *et al.,* 1998 JURCA *et al.,* 2004). Despite the fact that the treatment with ART in HIV-positive individuals act in a beneficial way, it has been documented that weight loss and body mass occur (MARLINK, 2001; GRINSPOON, 2005). Thus, the practice of strength training is regarded as a good intervention (STENSVOLD *et al.,* 2010; LAYNE *et al.,* 2011; BATEMAN *et al.,* 2012) because of its anabolic effect of promoting adaptations to the increase of strength, muscle hypertrophy, fat-free mass growth, and body fat reduction (DIAS *et al.,* 2005; FLECK *et al.,* 2006). The ACSM (2016) indicate the practice of physical exercise for patients diagnosed with AIDS with the objective of improving body composition, reducing fat in the abdominal region and total fat mass, consequently increasing total lean mass, developing cardiorespiratory fitness, insulin sensitivity and improving VO2max. In addition, it increases strength and muscle endurance, decreases anxiety and depression, and stimulates the acquisition of healthy lifestyle habits. The ACSM (2014) also recommend the practice of aerobic exercise (intensity between 40 and 60% VO2max or HRR) as often as three to five days per week associated with the practice of strength training (intensity of approximately 60% of 1RM) two or three days a week. Driscoll *et al*. (2004) evaluated the effect of strength training on serum-positive individuals on the treatment with ART. The training was performed three times a week for three months and, at the end of study, no differences were found in the variables of total body mass, trunk fat and visceral abdominal fat. Confirming these findings, Yarasheshki *et al*. (2001), after a 16-week intervention with resistance exercise, did not observe differences in adipose tissue, but an increased lean mass. On the other hand, Santos *et al*. (2013) evaluated the effect of progressive resistance training on anthropometric variables (body mass index, waist/hip ratio, conicity index, fat percentage, fat mass and lean mass) of people living with HIV/AIDS and submitted to ART. The sample consisted of 30 subjects and the anthropometric parameters were evaluated after the 60-session protocol (70-80% 1RM).

However, when strength training (65-80% of 1RM) is associated with aerobic exercise (50-65% HRmax), after 24 weeks the results demonstrate a reduction in the anthropometric variables (SANTOS *et al.,* 2016). Similarly, Mendes *et al*. (2013) investigated the impact of 24 weeks of resistance exercise associated with the aerobic component on anthropometric and functional parameters in patients with HIV undergoing ART. The results indicated reduction in the sum of the seven skinfolds evaluated and in the percentage of fat and fat mass, and increased muscle strength and improved cardiorespiratory fitness. Therefore, although resistance training has positive effects on strength and lean mass gain, in individuals with HIV the association between strength training and aerobic exercise is presented as a better non-drug intervention when compared to resistance training alone because of the effects mentioned above.

Conclusion

As established and recommended by the ACSM, the practice of strength training should be an auxiliary component and work together with aerobic exercise in subjects diagnosed with HIV to have a beneficial effect on the metabolic changes that they present. However, more studies are necessary to check if the intensity and volume of strength training would influence the physiological components that are altered because of HIV infection and treatment with ART.

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