

BENEFITS OF PHYSICAL EXERCISE ON SOIL AND LIQUID MEANS ON PAIN IN OBESITY¹

BENEFÍCIOS DO EXERCÍCIO FÍSICO NO SOLO E NO MEIO LÍQUIDO SOBRE A DOR NA OBESIDADE

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ABSTRACT

Being overweight causes consecutive episodes of pain. One of the most important methods for prevention and treatment of pain of obese people is physical exercises. The objective of this work is to search for the literature on the benefits of physical exercise, performed in soil and in the liquid medium on the context of pain in obese individuals. A literature search was conducted at the end of 2018 and early 2019. The articles that make up this review were accessed in the Lilacs, Scielo and Pubmed databases. The descriptors used as basis for the research were: Water exercise and obesity and pain / Exercise and obesity and pain, respecting as inclusion criteria the studies that highlighted the benefits of physical exercise in soil and in the liquid medium and that presented a relationship with pain and obesity. And as exclusion criteria, studies that did not provide information on the association of obesity with physical exercise and pain in the title, abstracts that did not present prominent data, and studies that did not provide important results after reading the full text. A total of 689 studies were found and only 47 were selected, of which 16 were Portuguese and 31 were English (English), between 2002 and 2019. The studies found important benefits of physical exercise, mainly performed in a liquid environment, thus showing that obese people tend to avoid consecutive episodes of pain with exercise.

Keywords: Hydrotherapy, Kinesiotherapy, Obese people.

RESUMO

O excesso de peso ocasiona episódios consecutivos de dor. Um dos métodos mais importantes para prevenção e tratamento da dor de pessoas obesas são os exercícios físicos. O objetivo deste trabalho é fazer uma busca na literatura sobre os benefícios do exercício físico, realizado no solo e no meio líquido sobre o contexto da dor em indivíduos obesos. Foi realizada uma busca na literatura ao final de 2018 e início de 2019. Os artigos que compõem esta revisão foram acessados nas bases de dados Lilacs, Scielo e Pubmed. Os descritores utilizados como base para a pesquisa dos artigos foram: Water exercise and obesity and pain / Exercise and obesity and pain, respeitando como critérios de inclusão os estudos que destacassem os benefícios do exercício físico realizado no solo e no meio líquido e que apresentassem uma relação com a dor e a obesidade. E como critérios de exclusão foram considerados os estudos que não ofereceram informações sobre a associação da

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obesidade com o exercício físico e com a dor no título, os resumos que não apresentaram dados proeminentes e os estudos que não trouxeram resultados importantes após a leitura do texto completo. Foram encontrados 689 estudos e selecionados apenas 47, sendo 16 em português e 31 em inglês, compreendidos entre os anos de 2002 a 2019. Os estudos encontrados mostraram benefícios importantes do exercício físico, realizado principalmente em meio líquido, evidenciando assim, que as pessoas obesas tendem a evitar os episódios consecutivos de dor com a prática de exercício físico.

Palavras-chave: *Hidroterapia, Cinesioterapia, Pessoas obesas.*

INTRODUCTION

Obesity is considered by the world health organization (WHO) an excessive accumulation of fat (LINHARES *et al.* 2012). Being considered one of the multifactorial diseases that is directly linked to the accumulation of adipose tissue in the body in large quantity, generating health risks (CARRARA *et al.* 2008). Obesity can be caused by endocrine-metabolic diseases (endogenous obesity) or nutritional changes (exogenous obesity), which is the most prevalent (ARAÚJO *et al.* 2006). It is not restricted to a region, country or racial group, it affects the rich and the poor, resulting from actions and socio-environmental factors (eating habits, physical activity and psychological conditions) and may be linked to factors of heredity (OLIVEIRA e SANTOS, 2018). In addition, obesity has been a focus of interest in health research, as it has affected a large part of the world's population, and in Brazil, its prevalence is higher in the lower income strata and in the female adult population (MARIANO; MONTEIRO e PAULA, 2013).

The overweight negatively affects the joints of the lower limbs, causing less muscle strength and less mobility, generating postural instabilities and leading to more complications (PINTO *et al.* 2006). This mechanical overload caused by obesity also leads to greater susceptibility to musculoskeletal injuries (CALVETE, 2004) and consequently causes retractions of joint capsules and ligaments (BELL *et al.* 2011; PINTO *et al.* 2006; TAYLOR *et al.* 2006), causing consecutive episodes of pain. This association, between obesity and pain, has significant consequences for the individual, the health system and society (TAYLOR; PERGOLIZZI and RAFFA, 2014) Thus, one of the most important methods for prevention and treatment against obesity is physical exercise, since the benefits they exert on the health of individuals are well established, improving cardiorespiratory fitness, body composition and decreasing pain episodes (BONSTROM *et al.* 2012). The physical exercise positively alters body composition and metabolic activity, favoring an increase in the pain threshold of obese people (ALBERGA; SIGAL e KENNY, 2011; ALBERGA *et al.* 2013). According to Marques *et al.* (2018), the physical exercise in obesity aims to benefit the individual with an improvement in the factors related to their physical conditioning and their general health, being able to use different protocols of treatment composed of aerobic and/or resisted exercise, in the soil or in the water.

It is known that aerobic physical exercise is considered an effective factor to maintain and improve cardiac activity, promote physiological adaptations such as reduction of joint overload

and lubrication of cartilages, providing and improvement on the quality of life and decreasing pain episodes of the obese individual (CIOLAC e GUIMARÃES, 2004). While resistance exercise favors muscle strengthening, showing greater reductions in perceived disability due to musculoskeletal pain (VINCENT *et al.* 2014), besides protecting the obese individual of greater mechanical overload, inducing an improvement in the quality of life, without consecutive episodes of pain (RUSTADEN *et al.* 2019).

Water is an excellent medium for the prevention and treatment of losses caused by obesity and also allows the reduction of the wear common in the exercise performed in the soil, thus, as the physical properties are essential to reach the objectives in a safe and effective environment (DURIGAN *et al.* 2013). The aid of the fluctuation reduces the joint overload and favors a balanced action of the muscles, providing an environment of easy movement and that can potentiate the accomplishment of exercises that would not be possible in soil, mainly in individuals with limitations of force and movement (CARREGARO e TOLEDO, 2008).

The choice of the theme as object of study for a review of the literature was justified by the fact that it is a highly discussed subject and used as a research base in most health care centers, becoming relevant due to the high rate of obesity and its repercussion on health.

Through this, the need arises to investigate on the means that can minimize the episodes of pain provoked by obesity. Thus, the fact that there are two mediums (water and soil) to adopt physical exercise as a method of prevention and treatment of pain of obese is what makes this review relevant, since the authors cite several physiological effects that may have benefits for obese individuals, such as reducing musculoskeletal pain at the end of exercise sessions.

In this sense, the purpose of this review study was to search in the literature, in an integrative way, the benefits of physical exercise performed in soil and water and its influence on the pain context of obese people.

METHODOLOGY

The integrative literature review was used as a method to gather and summarize the scientific knowledge produced on the subject in research, that is, it allows the search, evaluation and synthesis of available scientific evidence that will contribute to the development of conclusions on the subject matter (MENDES; SILVEIRA e GALVÃO, 2008).

The articles that make up this review were accessed in the databases Lilacs, Scielo and Pubmed. The descriptors used as the basis for the research of the articles were: Water exercise and obesity and pain / Exercise and obesity and pain.

A literature search was conducted at the end of the year 2018 and beginning of the year 2019 and the inclusion criteria were those studies that emphasized the benefits of physical exercise performed in the soil and in the liquid medium and that presented a relationship with pain and obesity. Articles were

selected between 2002 and 2019, since it is a period that has brought more relevant publications on the subject in Portuguese and English. And as exclusion criteria, studies that did not provide information on the association of obesity with physical exercise and pain in the title, abstracts that did not present prominent data, and studies that did not provide important results after reading the full text.

RESULTS AND DISCUSSION

A total of 689 studies were found, of which 47 were selected for this review, of which 16 were studies Portuguese and 31 were studies English between 2002 and 2019. For further details on the research and selection of articles, consult the flowchart. (Figure 1).

The studies showed significant benefits of physical exercise, both in the soil and in the liquid medium, showing that exercises are important to aid in the process of reducing the pain of obese individuals. For more details on the main findings highlighted in the selected studies, consult the table. (Table 1).

Figure 1 - Flowchart with the research and selection process.

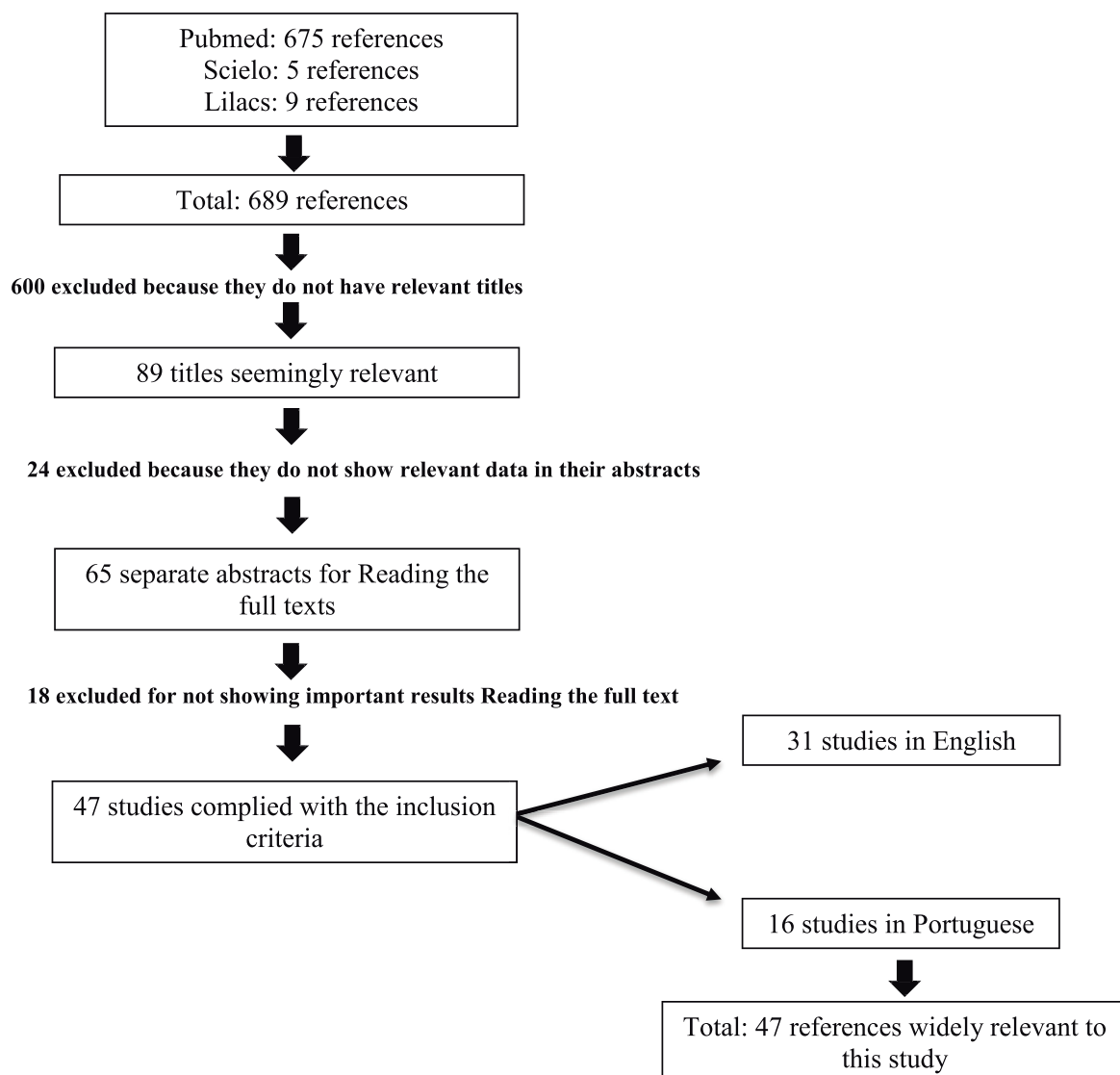


Table 1 - Main findings evidenced in the studies found.

Autores	Tipo de estudo	Principais achados
Alberga, A. <i>et al.</i> 2013	Randomized controlled trial	After 24 sessions of high-intensity and moderate intensity exercise, both applied in the soil, obese individuals increased lean mass and leg force, decreasing episodes of musculoskeletal pain.
Alberga, A. <i>et al.</i> 2011	Literature review	The review showed that obese adolescents prefer resistance training to aerobic exercise; however, it has been shown that working in isolation may not bring benefits, especially on the body composition and musculoskeletal pain of obese adolescents.
Brandalize, M; Leite, N. 2010	Literature review	It has been shown that the early identification of orthopedic alterations in obese individuals is essential so that they receive the prescription of exercises, soil or water correctly.
Brum, C, P. <i>et al.</i> 2004	Series of cases	It showed the main studies conducted by the research group of the Laboratories Physiology and Hemodynamics of Motor Activity of the School of Physical Education and Sports of the University of São Paulo, suggesting that the hypocaloric diet associated to physical exercise should be a strategy of choice for non-pharmacological treatment of obese individuals, aiming among other things, the decrease of pain.
Casilda-lópez <i>et al.</i> 2017	Randomized controlled trial	They evaluated the effects of a dance-based exercise program on the functionality and pain of obese postmenopausal women with knee OA and concluded that 8-week dance exercises significantly improved joint function, decreasing episodes of knee pain of obese postmenopausal women.
Calvete, A, S. 2004	Literature review	It is believed that the prescription of the exercises should contemplate activities with gradual progression, according to the physical conditioning of obese young people, favoring the objectives predicted by the practice of the exercise, such as the reduction of the aggravations present in obesity.
Ciolac, E, G; Guimarães, G, V. 2004	Literature review	It has shown that regular practice of physical exercises has beneficial effects in the prevention and treatment of obesity and its associated factors.
Clarkson, P, M. Hubal, M, J. 2002	Literature review	It has shown that the performance of an eccentric exercise session for obese people induces an adaptation in such a way that the muscle becomes less vulnerable to injury.
Candeloro, J, M; Caromano, F, A. 2007	Randomized controlled trial	It brought about the efficacy of an aquatic exercise program, which showed benefit on the flexibility, muscular strength and pain of elderly women, but found that the positive effects of water exercises can extend to populations affected by problems such as obesity.
Carregaro, L, R; Toledo, M, A. 2008	Literature review	It brought the evidence of the physical properties involved in the aquatic exercises, showing that the population suffering from obesity can benefit from these exercises, since they showed that the aquatic exercise considerably reduces the common impact of the exercises in the soil, preventing episodes of pain during the exercises.
Durigan, Z, J <i>et al.</i> 2013	Randomized controlled trial	It has shown that the use of a plyometric training program induces important adaptations to obese physical exercise participants, since they can improve their performance during the execution of daily tasks.
Hinmann, R, S; Heywood, S, E; Day, A, R. 2007	Randomized controlled trial	It showed that when compared to no intervention, a 6-week aquatic exercise program results in less pain and improves the physical function, strength and quality of life of obese people.
Irandoost e Theri 2015	Randomized controlled trial	They conducted a study with 32 obese elderly men, recruited and randomly assigned to two groups: aquatic training (3 days / week for 12 weeks) or control group. The results of this study showed that the variables of obesity, including BMI, body fat percentage and muscle mass of the aquatic training group decreased significantly. In addition, the authors showed that low back pain also decreased in the individuals after the intervention.
Kelley, G, A; Kelley, K, S. 2013	Systematic review and meta-analysis	They suggest through this systematic review that exercise is effective in reducing body fat in overweight and obese children and adolescents, contributing to the reduction of episodes of musculoskeletal pain.

Kuptniratsaikul <i>et al.</i> 2019	Randomized controlled trial	They applied in their study with 80 obese patients with knee osteoarthritis, daily exercises of quadriceps (performed at home) for 30 minutes (control group) or exercise on submerged mat (intervention group) for 30 minutes / day, three times a week, for four weeks. And as main results, it showed that regardless of the exercise applied, one can have an effective reduction in pain and consequently improve the joint function in obese people with mild to moderate knee osteoarthritis
Linhares, R, S <i>et al.</i> 2012	Cross-sectional study	The study showed the importance of actions to promote health, such as the practice of regular physical activity through interventions in urban spaces, in order to facilitate this practice, and, thus reducing the rate of chronic noncommunicable diseases, in the case of obesity.
Masiero <i>et al.</i> 2018	Clinical trial	They conducted a study with 10 obese patients with knee OA (grade II-III Kelgren-Lawrence scale), who were treated with thermal water exercises (two sessions per week for 8 consecutive weeks). The primary endpoint was pain (VAS), showing decreased pain during walking on a flat surface and climbing / descending stairs. Thus, the authors concluded that exercise in water in a thermal environment for obese patients with knee OA can determine pain relief, improve joint function and improve gait up to 6 months of follow-up.
Marques, G, J <i>et al.</i> 2018	Literature review	It showed that aerobic exercise is capable of acting as a non-pharmacological tool for the prevention and / or treatment of the metabolic syndrome and its comorbidities, reducing the risk factors associated with the disease and improving the functional capacity of the individuals presenting the disease.
Messier <i>et al.</i> 2013	Rndomized, blinded clinical trial	They cited that knee osteoarthritis (OA), a common cause of chronic pain and disability, is exacerbated by obesity, that is, they have shown that obese people can induce chronic continuous pain. Thus, they led an intensive diet intervention plus exercises, showing, at the end, a significant reduction of self-reported pain, mainly due to the reduction of shear forces on the knee joint.
Narouze, S; Souzalnitski, D. 2015	Systematic review	This study examined specific pain management approaches for obese patients, such as physical exercise, and noted that screening for obesity, pain-related disability and behavioral disorders as well as functional performance during exercise should be common in the practice of pain medicine, especially in the case of obese individuals.
Oliveira, A, P, S; Santos, W, L. 2018	Literature review	It showed that the knowledge of the health professional is indispensable to ensure a good follow-up for patients with obesity, and therefore, he said that the professional needs to develop actions to prevent obesity and its associated diseases mainly through physical exercises.
Oliveira, M, A, S; Fernandes, C, S, R; Daher, S, S. 2014	Prospective study	It showed the prevalence of moderate to severe pain in sedentary patients suffering from chronic pain, as in the case of obese individuals.
Paley e Johnson 2016	Narrative review	They concluded that interventions that include exercise prescription demonstrate reduced abdominal fat and systemic inflammation, as well as reducing the musculoskeletal pain of obese individuals
Pozzobon <i>et al.</i> 2018	Meta-analysis	They brought the recognition that the health benefits with participation in regular physical exercise for obese patients with knee or hip OA are multiple, being able to reduce the joint pain.
Saavedra, J, M <i>et al.</i> 2011	Systematic review and meta-analysis	The meta-analysis findings showed that programs based on aerobic exercise lasting more than 12 weeks achieve better results. In general, combined programs fail to achieve improvements in aerobic fitness, or even reduce pain in obese children objectively.
Stanford, K, I; Dewal, S, R. 2018	Experimental: in vivo	It has shown that physical exercise brings important metabolic adaptations, especially on adipose tissue, favoring the decompression of the joint capsules and consequently the episodes of pain of obese individuals.

Tsiros <i>et al.</i> 2014	Case-control study	They showed that obese children present more intense pain and more prevalence in the lower limbs than eutrophic children. Thus, they cite the importance of preventing the obesity index and its aggravations from an early stage with non-pharmacological programs, including the practice of daily physical exercise
Yázigi <i>et al.</i> 2018	Clinical trial	They have shown that obese individuals have knee pain, which affects the ability to ambulate or perform weight-bearing exercises. Thus, the authors suggest that, in addition to strengthening the lower limb, knee pain should be screened in obese individuals, in order to be able to correctly prescribe exercise.

After reading the selected articles, we noticed a wide variety of studies, which ended up bringing extremely relevant discussions about the benefits of physical exercise, performed in soil or water on the pain of obese individuals and this evidences the importance of the subject searched in this review. The studies shown in table 1 include pertinent information about the diseases that obesity can bring, together with discussions that raise the importance of preventing and / or treating with exercise such epidemic, reducing the musculoskeletal pain that accompanies obese individuals in their daily lives. Smith; Sumar and Dixon (2014) reported in their study that chronic pain, obesity, and reduced physical activity may contribute to the worsening of quality of life, thus emphasizing that obesity has a significant impact on the health and well-being of these individuals, and may contribute to ongoing health problems, such as musculoskeletal pain and joint dysfunction throughout life. However, Tamin *et al.* (2018) have shown through a systematic review with meta-analysis that exercise can improve physical function objectively but fails to show an objective reduction of pain in obese patients with chronic musculoskeletal problem. Zdziarski; Wasser and Vincent (2015) evidenced that obesity is associated with general and specific musculoskeletal pain, and there is an interrelationship between mechanical load, chronic pain, inflammation and psychological state in obese people. They have shown, therefore, that multimodal exercise programs can reduce joint pain in obese adults. Yet, the findings of the study of Shiri *et al.* (2013) indicate that both obesity and low level of physical activity are independent risk factors for low back pain. Thus, the authors recommend a moderate level of physical activity for the prevention of low back pain, especially in obese individuals, therefore, the findings imply that obese individuals should remain physically active, so consistent participation in resistance or aquatic exercise programs may contribute positively to a number of factors, including musculoskeletal pain, perceptions of disability due to pain, quality of life, and composition body mass, in addition to presenting higher adhesion rates, indicating that these exercises may provide a greater overall impact on the relevant results for obese patients with low back pain (SHIRI *et al.* 2013).

We can say, therefore, that the exercises in the liquid medium can bring greater benefits to the obese individuals, as shown in the study by Carregaro and Toledo (2008), evidencing that water can influence the levels of pain, by a mechanism to reduce the sensitivity of free nerve endings, and may cause sensory extravasation, given by temperature, friction and pressure.

Candelerio and Caromano (2007) applied a hydrotherapy program with 32 sessions for 16 consecutive weeks in order to verify their effects on the flexibility and strength of a population of elderly people with obesity. The exercise program provided 29 motor activities, with six warm-up activities, 11 activities aimed at exercising flexibility, eight activities aimed at strengthening and four relaxation activities. The authors point out that significant findings of increased range of motion and strength have demonstrated benefits over the pain threshold of obese elderly patients and highlight the important benefit of facilitating exercise in an aquatic environment. Hinman; Heywood and Day (2007) conducted a randomized, controlled study evaluating the efficacy of a twice-weekly aquatic physical therapy program for a six-week period for 71 obese individuals afflicted with hip and knee osteoarthritis. 36 participants were randomly assigned to the aquatic physiotherapy group (intervention group) and 35 participants were randomly assigned to a control group, who received no treatment. The intervention was composed of progressive exercises of open and closed chain discharge of weight, which focused on the quality of the movements. Participants in the intervention group reported a significant reduction of pain on movement and improvement of physical function, influenced by immersion in heated water, which favored muscle relaxation, benefiting the movement gain. And by the increase of muscle strength of the quadriceps femoris and hip abductors, which mainly benefited the joint stability.

Brum *et al.* (2004) mention that physical exercise performed in the soil can improve motor control, with the activation of the muscular and central mechanoreceptors, favoring the increase of the sympathetic activity, increasing the pain threshold of obese people. In addition, it can benefit the user with the improvement of the physical conditioning, presenting positive repercussions in both mental and physical status, because when practiced regularly, it promotes benefits such as improvement of cardiovascular and respiratory systems, causing an increase in bone mineral density, stimulated by osteoblastic activity, aiding in the process of bone remodeling, being, therefore, able to prevent musculoskeletal damage (CLARKSON and HUBAL, 2002). According to Stanford and Dewal (2018), physical exercise causes numerous physical and metabolic adaptations in the body, resulting in protection against obesity. Cross-sectional studies reveal a high correlation between pain and obesity and some longitudinal studies imply obesity as a risk factor for the development of pain (BRANDALIZE and LEITE, 2010). Several studies show that weight reduction can relieve pain, however, the combination of obesity and pain can worsen the functional status and quality of life of a patient more than any other isolated condition (NAROUZE and SOUZDALNITSKI, 2015). According to a meta-analysis of Saavedra *et al.* (2011), the improvement in aerobic fitness triggers a series of physiological stimuli that increase oxygen uptake and the use of fatty acids as an energy source and is responsible for the significant decrease in the episodes of pain associated with being overweight. Stolzman *et al.* (2015) showed that eutrophic or obese adolescents benefit from high-intensity aerobic exercise, especially regarding the reduction of musculoskeletal pain. Through this, Kelley and Kelley (2013) reported on the importance of physical exercise, since it has been used as an important tool in the prevention and

treatment of obesity and its associated factors. Therefore, the practice of physical exercise should be encouraged because it brings benefits not only in reducing pain and improving joint function in obese patients with OA but also for other chronic diseases such as diabetes and hypertension, which are quite common in the obese population (ROSALES *et al.* 2014), thus promoting a series of positive changes in health, reducing, above all, the risk of developing obesity. In addition, regular exercise can be considered a non-pharmacological way to prevent and / or treat obesity and its aggravations such as consecutive episodes of musculoskeletal pain (FERNANDES da CRUZ; PINTO; FERREIRA, 2018).

FINAL CONSIDERATION

This review has brought us a compilation of information regarding obesity and the most effective ways to prevent and / or treat this disease. We showed that the benefits of physical exercise favor the reduction of the pain of obese individuals, especially if performed in the liquid medium, since the studies cited a great advantage of performing exercises where there is a reduction of the impact, favoring the execution of the movements without generating any kind of discomfort, thus, the goals with the practice of physical exercise for obese people are widely achieved. Therefore, it is very important to establish methods of prevention and / or treatment against obesity and, as many studies show, physical exercises performed both in soil and in the liquid medium can influence the reduction of problems associated with obesity, as well as increase the threshold of pain.

Finally, the review has led us to an understanding that the environment in which exercise is performed can more effectively influence the reduction of pain in obese individuals, also showing that working on aerobic or muscle strength exercises alone may not have the same benefits, therefore, we must associate them whenever we want to reduce the pain and thus achieve other goals for obese people.

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