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EFFECTS OF PHYSICAL ACTIVITIES ON OBESITY IN THE ELDERLY – SYSTEMATIC REVIEW SURVEY

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Abstract
The aim of this systematic review was to determine, based on the summary of relevant literature, whether physical activity affects the obesity of the elderly. The sample of respondents were males and females, a total of 1110, older than 65 years. The criteria for the analysis of the papers were as follows: the papers included from 2005 to 2020, that the study was of a longitudinal character and that the respondents were older than 65 years. Based on the set criteria, 20 studies were included in the final analysis, which were analyzed and presented. The analysis of the obtained results can conclude that physical activities have positive effects on obesity in the elderly, but the scope and intensity of the experimental program should be taken into account, while the results of this research can be used by future research to find adequate literature to determine the effects of physical activity on obesity a person.

Key words: PHYSICAL EXERCISE / BMI / BODY WEIGHT / OLDER POPULATION

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INTRODUCTION

Obesity is a leading risk factor for premature death and chronic health hazards, such as in type II diabetes, heart disease and hypertension. The prevalence of overweight is increasing in the industrialized world and is growing dramatically in middle- and low-income countries, especially in urban areas. It is well known that regular physical activity provides health benefits and is considered a major component of primary and secondary prevention in most problems associated with metabolic syndrome and obesity (Donnelly, Blair, Jakicic, Manore, Rankin, & Smith, 2009; Garber, Blissmer, Deschenes, Franklin, Lamonte, Lee, Nieman, & Swain, 2011).

Body mass index is a widely useful piece of information for assessing body weight and obesity. In adults, overweight is defined if the body mass index is in the range of 25-29 kg / m2, while a person is considered obese if the body mass index exceeds 30 kg / m2 (Lementowski & Zelicof, 2008). However, among older adults, there are a large number of individuals who are considered non-obese according to the body mass index, so obesity can be defined on the basis of the percentage of fat (Gomez-Ambrosi, Silva, & Galofre, 2011). According to the World Health Organization, the most commonly used limit for the percentage of fat that defines obesity is more than 25% for men and more than 35% for women (WHO Expert Committee, 1995). The general decline in physiological functions and all motor abilities is an inevitable and progressive process, but also the main characteristic of aging (Lopez, Mathers, Ezzati, Jamison, & Murray, 2006).

Although the aging process is considered a positive development outcome, it can also become a major challenge if proper health monitoring of the elderly is not carried out. As the years increase, physiological changes in body composition occur, including increased body mass index, waist-hip ratio (Slentz, Houmard, Johnson, Bateman, Tanner, McCartney, Duscha, & Kraus, 2007) the cardiovascular system changes, ie. increased systolic and diastolic pressure (Schnabel, Yin, Gona, Larson, Beiser, McManus, Newton-Cheh, Lubitz, Magnani, Ellinor, Seshadri, Wolf, Vasan, Benjamin, & Levy, 2015). Increased body mass index brings with it various problems, which in combination with aging lead to problems of the bone and joint system. Specifically, as obesity increases, the symptoms and severity of joint pain increase (Andersen, Crespo, Bartlett, Bathon, & Fontaine, 2003). There are also psychological problems caused by aging, such as depression, anxiety, decreased self-confidence, all due to reduced physical activity (Windle, Hughes, Linck, Russell, & Woods, 2010). For this reason, physical activity and aerobic exercises of moderate intensity are gaining in importance and because of their application and effects, they give many benefits to the elderly. Aerobic exercise and walking have usefulness in maintaining the physical activity of the elderly population, but also in reducing fat and improving cardiopulmonary function (Ahn, Kim, Kang, Yang, Park, & Kim, 1999) with minimal risk of injury and impact on joints.

According to some authors (Costigan, Eather, Plotnikoff, Hillman, & Lubans, 2016; Wormgoor, Dalleck, Zinn, Borotkanics, & Harris, 2018) the combination of aerobic training and resistance training shows that it significantly improves physical and mental health, both healthy and obese populations. Nordic walking is also a very popular activity of the older population, but also of all populations and age categories, because it activates the muscles of the upper and lower extremities, and when walking with this technique 30-70% more energy is lost compared to regular walking (Schiffer, Knicker, Hoffman, Harwig, Hollmann, & Struder, 2006). Even activities in water can be a great example of physical activity for the elderly, as exercises on dry and in water identical intensity have identical effects when it comes to the obese population (Bergamin, Ermolao, Tolomio, Berton, Sergi, & Zaccaria , 2013). It is very important that the elderly who are already physically active remain physically active, but also that the part of the elderly population that is not physically active becomes physically active as soon as possible, because that would reduce the prevalence of physically inactive elderly people and reduce the obesity rate (Asp, Simonsson, Larm, & Molarius, 2017).

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Based on the above defined facts, the aim of this study is to determine, based on the summary of relevant literature, whether physical activity affects the obesity of the elderly.

METHODS

To collect appropriate literature for research of this type, the following databases were searched: Google Scholar, Mendeley, Science Direct, SCIndeks, KOBSON. The searched papers were published in the period from 2005 to 2020.

Found papers (abstracts or whole papers) were analyzed. In order for the papers to be included in the final analysis, they had to meet the criteria: years of publication, the study was longitudinal, the respondents had to be over 65 years old and different types of physical activity were used in the study. The key words used in the database search were: "*physical exercise", "BMI", "body weight", "older populaton"*, and within the types of physical activities, combinations of the following keywords were used: *"nordic walking", "aerobic training","resistance training","endurance training","water-based exercise"*.

A descriptive method was used to analyze the obtained data, and all titles and abstracts were reviewed. Also, lists of references of previously reviewed and original research were reviewed. Relevant studies were obtained after a detailed review (if they met the inclusion criteria) and the search strategy was modified and adapted to each database and search in order to increase search sensitivity.

RESULTS

After general research of the databases, 152 studies were identified. After deleting the duplicates and eliminating the papers based on the title and abstract, 102 studies did not meet the criteria. An additional 15 studies were eliminated based on exclusion criteria, and the remaining papers were reviewed in detail. A total of 20 studies met pre-defined criteria and were included in a systematic review survey.

A detailed overview of the process of collecting adequate papers based on predefined criteria can be found in Diagram 1.

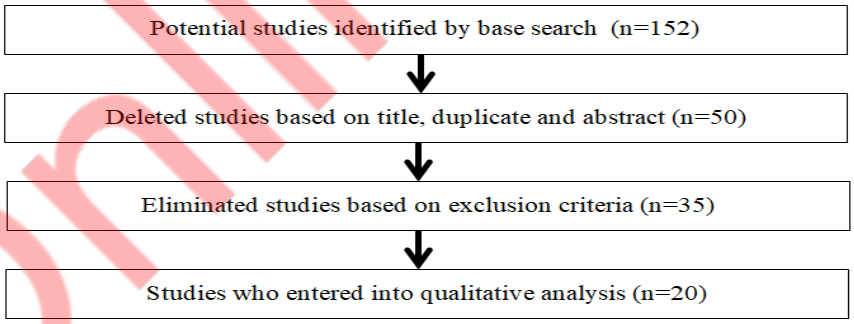

Diagram 1. Presentation of the process of collecting adequate papers based on pre-defined criteria

The final analysis included 20 studies, which were collected and analyzed based on the previously mentioned parameters and methods. Only studies of a longitudinal character were searched. Male and female respondents participated in the research. In order to meet the set criteria, the respondents had to be over 65, that the searched papers were published in the period from 2005 to 2020, and that different types of physical activities were applied in the studies. Table 1 shows 20 studies that met the set conditions.

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Table 1. Overview of studies who entered the qualitative analysis

First author and year of publication	The aim	Sample of participants		Exercise program	Obesity parameters	Results
		Number and groups	Years			
Galvao et al. (2005)	Comparison of one series of high-intensity resistance training with a multiseries and their effects on muscle function and physical performances of the elderly	N-32 E-16 K-16	65-78	20 weeks	TT, BMI, %M, MM	Both groups showed a reduction in% M and fat mass, but without significant significance
Villareal et al. (2006)	Assessment of the effects of weight loss and exercise therapy on physical function and TC in elderly obese individuals	N-27 E-17 K-10	E-69.4±4.6 K-71.1±5.1	26 weeks	BMI, TT, MM, FFM	E significantly reduced TT and fat mass and FFM
Nakamura et al. (2007)	Effects of frequent exercise on functional fitness of older women	N-45 E_1-10 E_2-10 E_3-14 K-11	67.8±4.6	12 weeks	TT, %M, BMI	E_3 significantly reduced TT and% M compared to other groups
Frimel et al. (2008)	Assessment of the effects of additional exercise with a low-calorie diet on changes in appendicular net weight and strength in the elderly and weak	N-30 E_1-15 E_2-15	70±5	6 months	BMI, TT, MM, FFM	Both groups significantly reduced TT and FFM, and E_2 significantly lost FFM
Lambert et al. (2008)	Comparison of the effects of diet and the combination of aerobic training and endurance training on the expression of inflammatory and anabolic genes in the skeletal muscles of elderly, weak and obese people	N-16 E_1-8 E_2-8	69±1	12 weeks	BMI, TT, FFM, MM	In all variables there were statistically significant results in E_1 (diet group)
Kemmler et al. (2010)	Assessment of the effect of a multi-purpose exercise program on the body composition and functional abilities of older women	Ž-296 E-123 K-123	65-80	18 months	TT, %M, LBM	E showed statistical significant improvement in all obesity parameters
Wanderley et al. (2010)	Assessment of the effects of a moderate-intensity walking program on FF, TK, and resting blood pressure in elderly women	Ž-22	65-80	12 weeks	TT, BMI, %M, LBM	There were no statistically significant effects
Villareal et al. (2011)	Assessment of independent and combined effects of exercise on TT loss in the elderly	N-107 E_1-26 E_2-26 E_3-28 K-27	65+	12 months	TT, LBM, FFM	Group E_1 and E_3 significantly reduced TT, compared to E_2 and K
Bergamin et al. (2013)	Assessment of the effects of exercise in warm water on the improvement of overall physical function and muscle mass in a group of healthy elderly	N-53 E_1-17 E_2-17 K-19	71.2±5.4	24 weeks	BMI, TT, MM,FFM	E_1 shows statistically significant results in fat mass and FFM, E_2 statistically increased total FFM and carcass
Kim et al. (2013)	Assessment of the long-term effects of endurance training on obesity	N-20	68-72	12 months	BMI, TT, %M, LBM	All four components have been reduced, % M and LBM significantly
Mazini Filho et al. (2013)	Assessing the effects of exercise programs on blood lipids, blood pressure, anthropometry, and functional autonomy of older women	Ž-54 E-33 K-21	68.9±6.8	16 weeks	BMI	E shows statistically significant effects in the BMI variable
Song et al. (2013)	Assessment of the effects of nordic walking on TC, muscle strength and lipid profile in elderly women	Ž-67 E_1-21 E_2-21 K-25	65+	12 weeks	TT, BMI, %M	E_1 and E_2 show a significant reduction of TT in relation to K, E_1 significantly reduced BMI, compared to E_2 and K
Sousa et al. (2013)	Comparison of long-term aerobic training with combined aerobic training and endurance training, on blood pressure and fat percentage of older men	N-48 E_1-15 E_2-16 K-17	69.1±5.0	32 weeks	BMI, %M	E_2 reduced% M by 2.3%

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Wanderley et al. (2013)	Evaluation of the effects of different training protocols on the reduction of body fat, improvement of autonomic functionaliy and reduction of low-grade inflammation in the elderly	N-50 E_1-11 E_2-20 K-19	68±5.5	8 months	BMI, %M, LBM	E_1 and E_2 show statistically significant results in total% M and% Mtrupa
Villanueva et al. (2014)	Assessing the effects of resistance training, with and without supplementation, on changes in TK, muscle strength, and functional performance	M-22 E_1-7 E_2-7 K-8	68.1±6.1	12 weeks	TT, LBM, MM, %M	E_1 and E_2 show statistically significant results in absolute and LMB, E_2 in fat mass and% M
Emerenziani et al. (2015)	Evaluation of the effects of aerobic exercise on glycemic control, body weight and fitness in elderly women	Ž-30 E-15 K-15	66.8±6.3	12 weeks	TT, %M, BMI, WHR	E shows statistical significance in TT, BMI,% M waist circumference
Irandoust et al. (2015)	Evaluation of the effect of exercises in water on TC and non-specific back pain in older men	M-32	E-68.4±2.9 K-67.6±3.1	12 weeks	BMI, %M, WHR	The E group significantly reduced all variables, relative to K
Kang et al. (2015)	Evaluation of a multicomponent exercise program to improve FF levels in older women	Ž-22 E-11 K-11	65+	4 weeks	BMI	E shows more significant results of FF compared to K, but no significant results were obtained with respect to TK
Park et al. (2015)	Analysis of the impact of nordic and normal walking on the mental and physical health of the elderly	N-24	75.2±6.25	8 weeks	BMI, %M, FFM	E shows more significant effects of time and interaction in% M, BMI and musculoskeletal mass and in the final group comparison
Gadelha et al. (2016)	Assessment of the effect of resistance training on the sarcopenic obesity index of older women	N-113 E-69 K-64	67±5.2	24 weeks	BMI, FFM, MM	E significantly reduced total FFM, significantly reduced% M

Legend: N- total number of respondents, M- male, F- female, E-experimental group, K-control group, FF- physical fitness, TT- body weight, TK- body composition, BMI- body mass index, MM- fat mass, FFM- fat body mass, LBM- lean body mass, % M- percentage of fat, WHR- waist and hip circumference,

DISCUSSION

The aim of this study was to determine on the basis of summarized relevant literature whether physical activity affects the obesity of the elderly, and it was found that physical activity gives people a number of benefits, from preventing obesity and creating a better mood, mental and emotional satisfaction, improving health status, but also improvements in physical and functional fitness (Nakamura et al., 2007). Although aging is an inevitable process, older people find it more difficult to maintain health condition (Lopez et al., 2006), so physical activity is created by discipline and lifestyle, in order to maintain good health in both adulthood and old age. Excessive food intake, physical inactivity and a sedentary lifestyle contribute to the development of obesity, and if this lifestyle lasts for a long period of time, it can lead to serious problems for the organism (Andersen et al., 2003), which increases the risk of developing the disease in physically inactive persons, less in moderately active, and the smallest in highly physically active persons.

In this study, the results of a total of 1110 participants were used. The largest number of respondents was in the study by Kemmler et al. (2010), with 296 subjects, while the smallest number of subjects was 16, in a study by Lambert et al. (2008). The longest experimental program lasted 18 months Kemmler et al., (2010), and in the research of Kang et al., (2015) it was the shortest, 4 weeks.

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Song et al. (2013) and Park et al. (2015) were studies where the main physical activity was nordic walking. The experimental programs lasted 12 and 8 weeks, with an intensity of up to 75%. Studies show positive effects on obesity variables, while study of Song et al. (2013) show with statistical significance in the reduction of fat percentage and body weight, and thus the correction of body mass index. The statistically significant result was due to the fact that the experimental program of the study lasted longer, but also because intensity of the study by Park et al. (2015) progressively increased, so the peak of the study, in intensity, was reached only in the last two weeks of the experimental program.

The main physical activity of the study by Nakamura et al. (2007), Wanderley et al. (2010) and Mazini Filho et al. (2013) was the walking, and in all three studies the subjects were female. Although all three studies adhered to training intensities, the training duration was the shortest in the study by Wanderley et al. (2010) of only 40 minutes, and this study did not show the effects of physical activity on obesity. Effects of walking study Mazini Filho et al. (2013) improved only the variable body mass index, and the authors suggest that this study may be of great importance for future studies, if the intensity is somewhat stronger and the duration of the program is longer. Nakamura et al. (2007) is the most effective study with walking as a physical activity combined with resistance training and recreational activities, because this study significantly reduced the body weight and fat percentage of the respondents.

Bergamin et al. (2013) and Irandoust et al. (2015) applied exercises in water for the physical activity of the elderly, while the study of Bergamin et al. (2013) applied hot water. The authors equated the effects of dry exercise with exercise in water, and weight loss occurred in both studies. It can be said that the study by Irandoust et al. (2015) was more effective in the final result, since the effect had a positive effect on body mass index, waist and hip circumference, fat percentage and torso muscle mass, although the pool water was of normal temperature. Also, it should be taken into account that the trainings were realized three times a week, in relation to Bergamin et al. (2013), where trainings were realized only twice a week.

Studies that took into account caloric intake were Villareal et al. (2006), Frimel et al. (2008), Lambert et al. (2008), Villareal et al. (2011), Villanueva et al. (2014) and Emerenziani et al. (2015). With adequate training regimens or their combination, with the addition of a modified nutrition- diet, studies show a high level of efficiency in obesity variables, ie. percentage of fat, body mass index and body weight.

Aerobic training, resistance training, endurance training, or a combination thereof, were the main physical activities in the studies of Villareal et al. (2006), Frimel et al. (2008), Lambert et al. (2008), Kemmler et al. (2010), Villareal et al. (2011), Sousa et al. (2013), Wanderley et al. (2013), Villanueva et al. (2014), Emerenziani et al. (2015) and Gadelha et al. (2016). The average training intensity in these studies ranged between 70-75%, which was enough for the elderly population to achieve positive effects, and since it is a population over 65, care should be taken about the training intensity, due to possible health problems.

In studies by Galvao et al. (2005) and Kang et al. (2015) there were no statistically significant results, but there was a minimal reduction in the percentage of fat and fatty fats (Galvao et al., 2005) by 22 weeks and a minimal improvement in physical fitness (Kang et al., 2015) in 4 weeks. Therefore, the duration of the experimental program, the type and intensity of exercise, the health status of the respondents, as well as the program that is adequate and adapted for the old population should be taken into account.

Villareal et al. (2006), Frimel et al. (2008), Lambert et al. (2008) and Emerenziani et al. (2015) are studies whose sample of subjects was obese, ie, the body mass index of the subjects exceeded 30 kg / m2, while only one study (Galvao et al., 2005) used supplements in addition to exercise. The reason why there were no statistically significant results is the inadequate selection of exercise programs, since the subjects performed different types of muscle contractions (isotonic, isokinetic and isometric) with weights in addition to muscle endurance exercises. Although contractive exercises with weights can be effective in rehabilitation and diagnosis, this study showed that this type of exercise does not give positive effects on obesity.

The limitation of this study can be attributed to the fact that the authors did not have absolute access to all databases, so the number of studies that entered the systematic review study is small. Also, some studies

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were monitoring caloric intake, some did not, which is why the author decided to summarize all studies under the same set of analyzes. The proposal for further research can be seen in finding a larger number of studies that monitored caloric intake with the realization of physical activities and their effects on obesity in the elderly.

CONCLUSION

The results of the study show that adequate selection of physical activity or their combination, scope and intensity of exercise, optimal duration of the experimental program and adaptation to the old population can give positive effects on obesity, which is also a contribution to future research in which the authors must pay attention to the stated facts. Different types of exercise, such as regular and nordic walking, running, aerobic training and exercises in water are presented as physical activities that have a positive effect on obesity in the elderly, and in addition to these physical activities, adequate nutrition can provide additional benefits.

Based on the presented results, it can be concluded that physical activities have positive effects on obesity in the elderly, and the results of this research can be used in future research to find adequate literature to determine the effects of physical activity on obesity in the elderly.

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