

# Leadership and Benefits of Physical Activity for Elderly People with Diabetes Mellitus

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**Abstract** Aging is a physiological process that presents an increase in the incidence and prevalence of chronic degenerative diseases, including diabetes. This study is relevant given the increase in life expectancy at a global level. The main objective of this study is to show the benefits of physical activity for the elderly, especially those with diabetes mellitus. The methodology used to carry out the research was based on retrospective studies based on bibliographic research, namely, the investigation of theoretical material on the subject. The main result obtained has shown that the regular practice of physical exercises provides health and prevents the complications of diabetes in the elderly, in addition to providing healthier aging and improving self-esteem, due to the increase in muscle strength, cardiopulmonary reserve, balance, and flexibility, thus contributing to the maintenance of autonomy and independence of this older population. Physical activity also helps in the control of hypertension, obesity, and dyslipidemia in these individuals who are always associated with diabetes mellitus, thus contributing to the reduction of the risk of cardiovascular diseases in the elderly with this metabolic pathology. Physical activities are also responsible for the social integration of the elderly.

**Keywords** Aging, Diabetes, Physical Activity, Benefits, Social Integration

## 1. Introduction

In the age of global aging, the World Health Organization is concerned with increasing life expectancy, due to fears of the greatest health adversities associated with aging: disability and dependence. The main causes of disability in old age are chronic-degenerative diseases, including the sequels of strokes, fractures, rheumatic diseases, and cardiovascular diseases [1]. We can define Chronic-degenerative diseases as those with a long latency period, slow clinical course, and multiple and complex risk factors, such as cardiovascular pathologies, diabetes, arterial hypertension, and various types of cancers [2]. Carvalhais Neto [3] defines aging as "the set of changes that occur progressively in adult life and that frequently, but not always, reduce the individual's viability".

Cardiovascular diseases cover several conditions, such as coronary artery disease, cerebral vascular disease, and peripheral vascular disease. Cardiovascular diseases are, nowadays, the main cause of morbidity and mortality among the elderly, especially in developed countries. According to Silva et al [2], Diabetes Mellitus is an aggravating condition for cardiovascular diseases, which are the main cause of mortality in people with diabetes. The relative risk of death from cardiovascular complications, adjusted for age, is about three times higher than for the general population. The strict control of hyperglycemia and hypertension can reduce both mortality and complications of diabetes mellitus.

In this context, it is important to highlight the need to find viable solutions accessible to all to combat the health problems that tend to appear with the aging of people worldwide. A widespread possibility, but still little considered by the majority of the elderly, is the daily practice of physical exercises controlled by health professionals. This study focuses on showing the benefits that these activities can bring to individuals with more advanced age, through a methodology capable of proving how the health problems mentioned here can be reduced to guarantee the improvement of the quality of life of this portion more and more significant of the population.

## 2. Materials and Methods

To cope with this analysis, the option was for a bibliographic study, which addresses the benefits of physical activity for elderly individuals with diabetes mellitus. According to Silva et al [2], in Brazil, it would be wise to add, in the world, there is a lack of studies aimed at the elderly population, including regarding diabetes and cardiovascular risk factors. The frequent exclusion of the elderly from clinical studies makes it difficult to know the pathologies and complications that affect this age group. More health professionals must dedicate themselves to researching the elderly, better knowing the metabolism of these individuals and the behavior of diseases in this age group, so that the care and quality of life of this population can benefit.

### Instruments

The choice of bibliographic research was due to the need to build a scientific work with content that contained several important teachings and that provided the reader with substantial learning when consulted during the interaction with the text. It also contributed to this choice the fact that the researcher did not have, at the time of the beginning of the elaboration of this work, a fixed research universe, from which a sample of the population could be extracted.

### Procedures

It is worth noting that there was a review of the existing literature on the subject, without exhausting it, however, given the immensity of available data, both in print and online, this vast amount of literature is one of the reasons for this review, as it allows to condense the most relevant among those studied. For its preparation, it has sought through thorough research work with magazines, books, articles, newspapers, monographs, theses, dissertations, and in electronic form, the theoretical foundations that would ensure the mentioned theme, namely: aging, diabetes mellitus, and physical activity in old age. Initially, several scientific works with titles or themes referring to the subjects of interest in the research were selected from the media already mentioned. After a superficial reading of

such works, those that did not fully fit with the intention of the project were separate - which were discarded - from those whose content most resembled the research proposal.

After this first analysis with a more meticulous reading of the remaining works, topics were constructed, and annotations/records about the main thoughts of the authors were submitted for appreciation to later articulate them with each other and introduce their considerations. The results from the knowledge acquired with the study build the body of this monograph after the selection of the selected material. The structure of the work was set up based on quotes from authors and the researcher's observations, seeking to complement the research needs.

It is important to emphasize that the bibliographic research aims to know the various forms of scientific contribution carried out on a given subject and, because of the multiplication of published works that deal with the benefits of physical activity for elderly individuals with diabetes mellitus. The bibliographic survey and the resulting scientific reflection are fundamental for the development of knowledge in medicine, geriatrics, and gerontology to provide greater access and speed in the recovery of information on the subject, greatly facilitating professional updating.

## 3. Results

Individuals aged 60 and over grew rapidly while the number of young people is declining or stagnant. This is a phenomenon called demographic transition. According to data from the Brazilian Institute of Geography and Statistics [4], at the end of the last century, an estimated 590 million individuals in this age group were projected in 2025 to amount to 1 billion and 200 million, reaching 2 billion in 2050. Brazil, in particular, has been experiencing a rapid aging process, with the elderly growing about eight times more than the younger population. It has been estimated that in 2025 our country will be the sixth in absolute number of elderly people in the world, with approximately 34 million people in this age group, around 15% of our total population.

**Table 1.** Elderly People Projections in Brazil

Brazilian Institute of Geography and Statistics/ Elderly People/ Projection	
End 20th century	590 million individuals aged 60
2025	to 1 billion and 200 million
2050	2 billion

The elderly are a very heterogeneous group because, in the same age group, we can find several presentations of general status among individuals [4]. After all, there is not necessarily an agreement between the chronological and biological ages of these people. Chronological age, as the name suggests, is that counted from the moment of birth.

Biological age, on the other hand, refers to the state of conservation of organs and tissues, closely related to lifestyle, the environment, and the genetic load of each one. For example, we can have a person with advanced chronological age, presenting a much lower biological age for having cultivated good eating habits, physical exercises, physical and mental hygiene, and preserving the quality of their body structure. In the same way, we can find younger people with higher biological ages, due to the wear and tear caused by a more unruly lifestyle [4].

By creating setting goals and indicating new interests, the elderly are reinforcing their affectivity and their self-esteem. Therefore, maintaining positive attitudes towards life will improve your quality of life [5]. In this sense, Geriatrics and Gerontology have the fundamental principle, according to Carvalho & Scatolini[6], to keep the elderly active, providing conditions for them to live intensely and satisfactorily within their possibilities and limitations, which are of great importance in contemporary times. Geriatrics is a medical specialty related to the care of the elderly, whose objective goes beyond the treatment of diseases, with therapy being one of the elements that compose it, together with the promotion of health, maintenance of independence, autonomy, and self-esteem of the individuals of that age group. The major contribution of this specialty is in the systematization of care for the elderly, providing them with comprehensive care according to the most advanced medical knowledge, and Gerontology, a branch of science that studies aging.

Both Gerontology and Geriatrics are disciplines that recently began to arouse interest in the scientific community more concerned with the study of development and not so much with the study of degenerative processes (which make us lose qualities). With development as one of the research areas of theories about the aging process, they concern with the quality of life and with the elderly's understanding of this phenomenon [7]. Gerontology has considered a modern applied science that studies the elderly, including the biological, psychological, neuro-psycho-somatic, socio-cultural, and economic phenomena resulting from aging, as well as its consequences. It represents a set of integrated disciplines that study the aging process.

An inter-professional team, according to Ramos & Neto [8], is the ideal model for comprehensive care for the elderly, as it works with the collaboration of the members of this team, with a horizontal hierarchy, sharing the same tasks and responsibilities, with negotiations and agreements, always aiming at the same objective, which is the well-being of the long-lived. When the term inter-professional or interdisciplinary team is used, what is aimed, in effect, is an ideal type of health care for the elderly, in which several professionals work together, within their specific areas, to improve the overall condition as a final good patient's health, understood as a situation of physical, psychological and social well-being [1].

The role of health professionals who care for the elderly

is to prevent situations in which there is functional loss. The gerontologist team is responsible for always guiding the elderly patient in the execution of their physical activity, including the basic recommendations that must be followed when performing the exercises. The doctor's role in the interdisciplinary team consists of recommending the practice of physical exercises, as well as assessing the risk factors present, from visual and auditory acuity to more in-depth investigations regarding your health; physical fitness, emotional, cognitive, and cardiovascular status [1].

## 4. Discussion

According to Hoffmann [9], every multicellular organism has a limited life span and undergoes physiological changes over time. The life of a multicellular organism is divided into three phases: the growth and development phase, the reproductive phase, and senescence, or aging. During the first phase, there is the development and growth of specialized organs, the organism grows and acquires functional skills that make it able to reproduce. The next phase is characterized by the individual's ability to reproduce, which guarantees the survival, perpetuation, and evolution of the species itself. The third phase, senescence, is characterized by the decline in the functional capacity of the organism. Thus, development, reproduction, and aging are natural stages in the life of each species, which occur sequentially and interdependently: the beginning of senescence is dependent on reproductive life, which, in turn, is dependent on development.

Functional capacity can be defined as "the ability to maintain the physical and mental skills necessary for an independent and autonomous life" [10]. For Ramos & Neto [8] functional capacity is the key point of action for Geriatrics and would add Gerontology, which means, the main problem faced by the old-aged. The author defines functional capacity as the degree of preservation of the ability to perform, independently and autonomously, activities of daily living (ADLs) related to one's care - walking, dressing, getting out of bed, eating, taking bathing, looking after - and the instrumental activities of daily living (IADLs), which is more complex and requires physical and mental skills - managing finances, shopping, calling, using public transport, driving, cooking, cleaning the house, etc.

Aerobic capacity, that is, the ability to deliver oxygen to tissues, is the major contributor to the maintenance of functional independence in elderly individuals. According to Freitas et al [11], there is an increase in cardiac mass between 30 and 90 years, around 60 to 90 grams, with mild hypertrophy of the left ventricle and the interventricular septum. This occurs due to the increase in afterload determined by greater resistance in the aorta and the peripheral arterial network, responsible for the increase in mean arterial pressure. There is also an increase in the stiffness of the myocardial wall, especially in the left

ventricle, due to collagen deposition, decreasing its compliance, changing the diastolic function, and increasing the time of ventricular relaxation and contraction.

Freitas et al [11] agree that a sedentary lifestyle during the aging process mainly affects the individual's body composition, including the fat, muscle, and bone masses. The growing loss of muscle mass, also called sarcopenia, leading to less muscle strength, associated with the increase in the amount of fat in the aged organism contributes to the appearance of diseases, functional limitations, and disabilities in this population. Ramos & Cendoroglo [12], talking about physical activity in the elderly, point out that the decrease in muscle strength with aging happens in both men and women, but with greater intensity in the lower than in the upper limbs. This difference may be explained by the greater disuse of the legs than the arms in elderly individuals.

According to Murman [13], among the first symptoms resulting from aging is also brain aging, comprising "cognitive declines" (decreased memory, perception, memory, concentration) and, as the progression of this degenerative process, there is also a decline in the functions of the autonomic nervous system, initiating a picture of metabolic decline, decreased muscle strength and the ability to perform work. These first signs, resulting from the decline in brain function, in most cases, occur between the 5th and 6th decades of life [11].

### Diabetes Mellitus

Diabetes is one of the most common chronic diseases that affect the elderly, thus representing a major public health concern. According to Chaimowicz [14], diabetes is among the ten main causes of hospitalization among the elderly of all age groups, alongside respiratory, cardiac, cerebrovascular, renal, and infectious diseases, among others, according to the data from the Unified Health System. Corroborating this idea, Freitas et al [11] speak of the high cost of hospital admissions for diabetes mellitus and its complications, which generally demand complex procedures and increase the rate of hospital stay.

This disease is subdivided into two groups, type 1 (DM1) and type 2 (DM2) diabetes mellitus, which is mostly found in long-lived individuals. DM1, although it can affect individuals of any age group, occurs more frequently in children, adolescents, and young adults, with its diagnosis generally occurring until the third decade of life. With aging, there is an increase in insulin resistance, leading to glucose intolerance, arterial hypertension, dyslipidemia, and metabolic syndrome, all of which contribute enormously to the increased risk of cardiovascular disease [15].

Cardiovascular diseases have been the biggest cause of death in practically the entire industrialized world, since the first half of the 20th century. Corroborating this information, Rocha & Libby [16], point out that, despite the efforts of more developed countries to produce studies for the knowledge of the pathogenesis and treatment of

atherosclerosis and its risk factors, cardiovascular disease remains in the 21st century as the leading cause of mortality in most developed nations and most developing countries.

LDL-cholesterol (bad cholesterol) is considered the most notable raw material for forming atherosclerotic plaque. Its high concentrations, per se, constitute a relevant cause of atherosclerosis. Its structure needs to be modified, through oxidation, so that it is incorporated by macrophages in the arterial intima by receptors called scavengers, responsible for the formation of foam cells (macrophages full of lipid particles) that, grouped, form the fatty streak, a precursor lesion of atherosclerosis [16].

The classic symptoms of diabetes, such as polyuria, polydipsia, polyphagia, and unexplained weight loss, are not always present in long-lived individuals. These can be asymptomatic or present muscle pain, fatigue, weakness, adynamia, urinary incontinence, and the confusional state as symptoms of this disease, making diagnosis difficult [17]. Other manifestations of diabetes in the elderly are the painful limitation of shoulder movements, due to increased protein glycosylation and unusual infectious complications, such as malignant external otitis (caused by *Pseudomonas*) and papillary necrosis related to urinary tract infection [17].

The diagnosis of diabetes occurs when there is an elevation, after fasting for eight to 12 hours, of blood glucose levels above 126mg/dl, or blood glucose above 200mg/dl after two hours of oral glucose overload or at random, regardless of the time of meals, in addition to the symptoms of diabetes. There is also a state of impaired glucose tolerance, previously called pre-diabetes, when fasting blood glucose values fluctuate between 100 and 125mg/dl, and postprandial or post-glucose overload, greater than 140 and less than 200mg/dl [18].

Indicators of greater risk are age over 45 years, overweight, central or abdominal obesity, and historic diabetes in first-degree relatives. It includes arterial hypertension when systolic blood pressure (SBP) is greater than or equal to 140 mmHg and/or diastolic blood pressure (DBP) is greater than or equal to 90 mmHg, low high-density cholesterol (HDL), high triglycerides, history of macrosomia or gestational diabetes, previous diagnosis of polycystic ovary syndrome, cardiovascular, cerebrovascular disease or diagnosed peripheral vascular disease also points out that, with aging, there are problems that can affect the treatment of diabetes. Among them, we can mention:

- 1) Brain aging, which translates into changes in cognitive functions or even dementia to any degree, influencing the care related to diet, pharmacological treatment, personal hygiene, and, often, limiting physical activity [12];
- 2) Reduction of counter-regulatory hormones, mainly catecholamines, and cortisol, causing instability of glycemic control with a higher risk of hypoglycemia [19];

- 3) Reduction of hepatic glycogen due to malnutrition and decreased appetite, causing the hepatic glycogen reserve to become compromised, resulting in insufficient glycogenolysis, which, in association with the deficit in catecholamines and cortisol, may predispose to hypoglycemia, with a potential lesion of vital organs, mainly brain and heart [20];
- 4) Cataract, which is the opacification of the lens, occurs more frequently in the population with diabetes, and when associated with diabetic retinopathy, it can seriously impair visual acuity, making it difficult to use insulin or even oral medications, limiting the capacity functional of the individual [21];
- 5) Cardiovascular diseases, mainly represented by coronary artery disease and cerebrovascular disease (frequently associated with diabetes), in which hypoglycemic episodes can precipitate acute events (in these situations, it is worth remembering, the glycemic control goals must be less strict);
- 6) Reduced survival potential, that is, very elderly patients, especially those with important comorbidities, which can compromise the patient's quantity and quality of life, should be treated less aggressively, including more liberal diets, allowing for goals and more flexible blood glucose levels.

### Physical Activity and Aging

In old age, maintaining autonomy has been linked to quality of life. Therefore, one way of trying to quantify the quality of life of an elderly individual is through the degree of autonomy with which he/she performs day-to-day functions, a fact that makes him/her independent within his/her socioeconomic and cultural context. It is important to remember that hereditary, environmental and lifestyle factors are determinants of health status. Physical exercise can positively influence the body, slowing the physiological, mental, and social loss for the elderly, and even taking into account individual differences, age as such is not a contraindication for physical exercise [22].

A sedentary lifestyle would be a reduced state of physical activity, in which body movement is minimal, and which can compromise, even, the maintenance of good health conditions. The author reports that, according to the Brazilian Institute of Geography and Statistics, 80.8% of Brazilian adults are sedentary, worrying data, since their association with cardiovascular diseases, obesity and diabetes has been known. Individuals that discontinue a sedentary lifestyle can decrease the risk of death from cardiovascular disease by up to 40%. Besides, it is necessary to associate exercise with a balanced and adequate diet that can reduce the risk of progression of type II diabetes by up to 58%, demonstrating that a small behavior change can cause a great improvement in the health and quality of life of the elderly [23].

Caspersen, Powell & Christenson [24] define physical activity as "anybody movement performed by skeletal muscles that result in energy expenditure", such as walking,

washing clothes, and climbing stairs, among others. The concept of physical exercise has been inserted in a subcategory of physical activity, characterized by "planned, structured and repetitive movements, which result in improvement or maintenance of one or more variables of physical fitness - cardiovascular fitness, strength, and muscular endurance, which favor better quality of life and continuous independence in aging". Despite having different concepts, we use the two terms interchangeably, physical activity and physical exercise, as the understanding in its entirety will not be changed.

From an extensive literature review on exercise and aging, Matsudo & Matsudo [25] cite the main benefits in the different components of physical fitness about anthropometric variables, there is a decrease in body fat, an increase in mass muscle, maintenance of bone density, and strengthening of connective tissue. Concerning the neuromotor system, there is an increase in muscle strength and flexibility regarding metabolism, an increase in stroke volume, oxygen consumption, and pulmonary ventilation, an improvement in the lipid profile, and a decrease in resting heart rate and blood pressure. In the psychological area, we can realize a notable reduction in stress and anxiety, with less consumption of medications, improved sleep quality, and increased self-esteem, besides satisfaction with body image, improved cognitive functions, and socialization [26].

For the practice of physical activities, it is necessary, especially for the elderly with diabetes, for the physical well-being of the individual, to use comfortable shoes, which avoid blisters and calluses, and adequate and comfortable clothing, preferably light. One should avoid smoking or using sedatives before the activity is performed, as well as respecting the individual organic limits, informing the appearance of any symptoms during the performance of the exercise. The elderly and their advisor must adjust the type of exercise to room temperature and allow the body to adapt gradually to the exercises, starting them more slowly and increasing them gradually.

An exercise program must start with the search for a professional so that together they can establish objectives and goals to be achieved. There is not the best activity in general, considering the desire of an elderly person and their clinical possibility of carrying out the idealized exercise. The best exercise should be one that brings pleasure to your practitioner, as this way, your practice will become regular and sustainable. Activities that please the patient, such as walking and dancing, should be encouraged [26].

Categorically, the authors preach that all patients should make a medical evaluation before beginning physical activity. It must be observed a detailed history and clinical examination, analyzing previous physical fitness, level of independence, auditory and visual acuity, cognition, and factors of cardiovascular risk, requiring a resting electrocardiogram and, whenever possible, an exercise test, or, if it is not possible, echo-doppler or myocardial

scintigraphy under pharmacological stress.

Another important aspect is that systematically doing moderate activities gives better results than intense activities over a short period, that is, the increase in exercises should occur gradually, based on the individual lifestyle, avoiding intense tiredness and pain, aiming to develop resistance and maintain acceptable levels of physical training. According to the recommendations of the Society of Brazilian Diabetes, it has been suggested to perform 30 minutes of daily physical practice/physical activity or, at least, three times a week.

Therefore, it is advisable to practice physical exercises daily at moderate intensity such as changing your daily habits to continuous or accumulated activities [27]. It has to add up to 30 minutes of physical activities such as walking with the dog, using cars less to travel, washing the car, climbing stairs, or practicing half an hour of brisk walking or 15 minutes of running. A practical way of controlling, for the general population, the intensity of physical activity is to be able to speak during the exercise. However, the most relevant benefits in health conditions can be obtained with more intense and programmed exercises.

Physical exercises in the elderly - the population most susceptible to joint and muscle injuries - should be preceded by a warm-up phase, with stretching, joint mobility, and walking, lasting approximately 10 minutes [27]. Its completion should be gradual, with the return to rest done calmly, also preceded by stretching. High-impact exercises for the elderly, especially women, should be avoided due to the greater possibility of osteoarticular damage [11].

The gains provided by regular physical activity during aging are effective and surprising, claim Ramos & Cendoroglo [12] when they quote Colcombe et al [26], demonstrating a positive relationship between cardiovascular fitness, which can be substantially improved with physical training, and brain structure and function. Regarding flexibility and balance, quote Ramos & Cendoroglo [12] that studies show an improvement at the level of flexibility of various joints with dance, aerobic exercises, and others that involve stretching. The elderly must initiate the stretches with a somewhat limited extension, progressing to the maximum bearable extension [17].

### Physical Activity and Diabetes Mellitus

Regular practice of physical activities provides the elderly with diabetes a series of benefits, such as increased self-esteem and well-being, stress relief, stimulated social life, improved muscle strength, contributing to the strengthening of bones, and the full functioning of the immune system. In addition, it protects against obesity, diabetes, cardiovascular disease, some types of cancer, and some mental disorders. Therefore, encouraging physical activity is a priority action in promoting healthy habits [18].

The recommendation for elderly people with diabetes is to practice at least 30 minutes of moderate physical activity, five times a week. The exercise should focus on moving large muscle groups concurrently. Hiking and water exercises (water aerobics and swimming) are good options and are well-accepted by the elderly. Weight training with large loads in these patients should be avoided due to the risk of retinal hemorrhage [12].

The guidelines for the practice of physical activity in elderly people with diabetes follow the recommendations for healthy adults, considering, however, some peculiarities. The exercise should be started gradually, such as walking for 5 to 10 minutes on flat ground, increasing each week until reaching 30 to 60 minutes daily, five to seven days a week; the intensity of physical activity should increase progressively, to reach moderate intensity (between 60 and 80% of the maximum heart rate).

The improvement, with physical activity, in the action of insulin and glucose uptake is not understood totally. It has believed that:

**Table 2.** The action of insulin and glucose uptake with physical activity

1) There is an increase in blood flow to the muscles during physical exercise, facilitating the action of the hormone and glucose uptake.
2) There is an increase in the aggregation of insulin to its receptor, as there is a greater number of glucose receptors and transporters.
3) Potentiation of the non-oxidative glucose metabolism occurs, increasing its uptake.

The beneficial effect of physical exercise is due to the metabolic adaptations that contribute to weight loss, increasing resting metabolism, and the oxidation of glucose and lipids, in addition to increasing insulin sensitivity [26]. After 20 to 30 minutes of physical exercise, fat becomes the main source of energy (until then glucose), decreasing its amount in fat cells, and, consequently, helping to reduce obesity. For the control of dyslipidemia, non-pharmacological measures were indicated, such as diets, weight loss, physical activities, and glycemic control, and there may be an association with medications, when necessary.

In addition to all the physical benefits already proven for the elderly with diabetes mellitus, aerobic exercise is also responsible for releasing neurochemical substances, such as endorphins, into the bloodstream, which reduces anxiety and depression, improving the patient's subjective well-being, individual, their self-esteem, decreasing the use of medication in this population, which can promote, in addition to the quality of life, better glycemic control [28].

## 5. Conclusions

The conclusions and the research responses to this study have many implications, limitations, and research contributions.

First of all, it has been observed that during this

bibliographic review, a wide variety of concepts were raised around the definitions of the elderly person and the specific characteristics of the aging process, the functional capacity of individuals of this age group, diabetes mellitus, and its complications, highlighting the importance of the activity physical health for the elderly, both with this pathology and health. It was also shown that although the losses resulting from aging are inevitable, the elderly who practice physical activities have healthier aging due to the improvement of their self-esteem and functional capacity for the prevention and control of various diseases such as diabetes, hypertension, and osteoporosis. In this sense, helping to preserve autonomy and independence, is essential for the quality of life of this population.

Still among the contributions of physical activity to a healthier life and, consequently, with quality, the decrease in body fat stood out, also improving the lipid profile of the elderly individual, with subsequent reduction in the risk of developing diseases or their complications, mainly metabolic and cardiovascular, including diabetes, strokes, myocardial infarction, among many. It was realized that, in addition to the numerous advantages for healthy elderly people, physical exercises help in the prevention and control of diabetes mellitus in this population, preventing complications through the immediate and late benefits that they provide. Among the immediate subjects, the increase in the action of insulin, the greater uptake of glucose by the muscles during and after exercise, reduced glycemia, and increased cellular sensitivity to insulin were noteworthy.

It was possible to deduce, then, that physical activity provides a healthier life, especially for the elderly with diabetes mellitus. A healthier life, in turn, allows the maintenance of the autonomy and independence of the elderly, making them free and providing a social life in perfect harmony with their family and friends. In this way, the elderly will enjoy their old age more pleasantly and intensely, that is, with a better quality of life. In summary, it was suggested that the elderly with diabetes mellitus who practice physical activity, in addition to improving their health and functional capacity, will be much more satisfied with their longevity.

The present study sought to contribute to the dissemination of the benefits of physical activity for the consolidation of active and healthy aging in the elderly with diabetes mellitus. Because of the explosion of technical and scientific literature in the area of health of the elderly and diabetes, and given the limited time required to read all publications on human aging, it is suggested, therefore, that further research be carried out on the relationship between physical exercise, old age, and diabetes, given the benefits brought by this practice to elderly individuals with such pathology, also because human aging still needs an understanding of the countless aspects that they involve.

In this sense, the main conclusion of this academic work is to highlight physical activity as a source of health for the elderly, based on studies already carried out that prove the

relationship between aging and diabetes. As there is a large amount of theoretical and practical studies on the relationship between these themes, it shows the necessity of further research must be directed to understand the factors involved in the aging process of the human being. This is a very important social aspect since the number of elderly people in the world tends to increase because of the fall in birth rates and technologies associated with medicine in general that have increased the average life span of the world's population

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