

Physical activity and erectile dysfunction: a systematic review

Atividade física e disfunção erétil: uma revisão sistemática

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ABSTRACT

Defined as the constant or recurrent inability to attain or maintain a satisfactory erection, erectile dysfunction (ED) has multifactorial causes. Regular physical activity can be used as a preventive tool for ED. In this sense, the main objective of this study was to analyze the scientific literature, published in the last ten years (2004-2014), about the relationship between physical activity, ED and the associated factors among men older than 17 years in cross-sectional studies, randomized clinical trials and cohort studies. A systematic review was performed in articles published in the Bireme, ScienceDirect, and PubMed/Medline databases, in the SciELO electronic library and in the Portal of the Coordination for the Improvement of Higher Education Personnel (CAPES) Journal and written in Portuguese, English and Spanish. A total of 230 studies were identified, and only 19 met the inclusion criteria, all of which were published in English. ED was diagnosed in all studies. Concerning physical activity, 17 studies identified a significant association with a lower incidence of ED, including cross-sectional and quasi-experimental studies and randomized clinical trials. ED appeared to be associated with different factors related to men's lifestyle, particularly their level of education, non-communicable chronic diseases, body mass index and age.

KEYWORDS

Motor Activity; Men; Penile Erection; Sexual Health; Reproductive Health.

RESUMO

Entendida como a incapacidade constante ou recorrente de alcançar ou manter uma ereção satisfatória, a disfunção erétil (DE) tem causas multifatoriais. A prática de atividade física pode ser utilizada como uma medida preventiva para a DE. Nesse sentido, o principal objetivo do presente estudo foi analisar a literatura científica, publicada nos últimos dez anos (2004 a 2014), sobre a relação entre atividade física, DE e os fatores associados em homens a partir de 17 anos e em estudos de corte transversal, ensaios clínicos randomizados e estudos de coorte. A análise dos artigos foi feita por meio de uma revisão sistemática de artigos publicados nas bases de dados Bireme, ScienceDirect, PubMed/Medline, na biblioteca eletrônica SciELO e no Portal de Periódicos da Coordenadoria de Aperfeiçoamento de Pessoal de Nível Superior (CAPES) em português, inglês e espanhol. Identificou-se 230 estudos, sendo que apenas 19 preencheram os critérios de inclusão. Todos publicados em inglês. Em todos os estudos analisados, foi diagnosticada a presença de DE. No que diz respeito à atividade física, em 17 estudos, ela esteve significativamente associada à menor ocorrência de DE, tanto nos estudos com delineamento transversal quanto nos quase-experimentais e ensaios clínicos randomizados. A DE pareceu estar associada a diferentes fatores relacionados ao estilo de vida do homem, nomeadamente, nível de escolaridade, doenças crônicas não transmissíveis, índice de massa corporal e também à idade.

PALAVRAS-CHAVE

Atividade motora; Homens; Ereção peniana; Saúde sexual; Saúde reprodutiva.

INTRODUCTION

Erectile dysfunction (ED) can be defined as the constant or recurrent inability to attain or maintain a satisfactory erection in at least 50% of attempts of sexual intercourse¹. Although not posing a risk to one's life, ED has a negative impact on self-esteem, quality of life and interpersonal relationships². It is estimated that approximately 152 million men worldwide currently suffer from ED³ and that such prevalence is expected to reach nearly 322 million by 2025⁴. In a study conducted in Brazil, 45.1% of men had a certain level of ED, of which 31.2% were minimal; 12.2%, moderate; and 1.7%, complete⁵.

ED has multifactorial causes, which may be organic, psychogenic or mixed. Thus, it is possible to associate it with mental disorders⁶; hormonal disorders such as diabetes⁷, the reduction in testosterone levels⁸; hypertension⁹; smoking¹⁰; alcoholism¹¹, obesity¹² and even cardiovascular diseases¹³, which are one of the most frequent causes¹⁴.

The literature indicates that ED is found in men aged 18 years and older¹⁵⁻¹⁷ and it most frequently occurred between the ages of 40 and 70 years¹⁸. According to the Brazilian Urology Society, the prevalence of ED is 1% in men younger than 19 years; 3%, in those aged 45 years; 6.7%, in those aged between 45 and 55 years; and 25%, in those aged until 75 years¹⁹. It could also be affirmed that age increases both the prevalence of ED and its severity⁵.

Several pharmacological and surgical advances have been made in the treatment of ED. In this sense, there has been an increase in the demand for specialized clinical services, as both health professionals and lay people are becoming more interested in this theme²⁰. Studies indicate that, in addition to the specialized services and advances in the treatment of ED, physical activity has also been considered as a relevant treatment for this disease²¹⁻²³, as it provides benefits to the cardiovascular system, such as the reduction in vascular diseases, improvement in endothelial functions and increase in blood flow in certain vascular beds²⁴. These effects can stimulate penis vascularization²⁵.

Apart from the above mentioned benefits, it is known that regular physical activity is also an important factor to prevent and fight the onset of certain diseases, such as diabetes²⁶, heart diseases²⁷, obesity²⁸, depression²⁹ and hypercholesterolemia³⁰, as these are associated with the development of ED^{22,31,32}.

In this sense, physical activity and, consequently, a good physical condition can be considered as a preventive and therapeutic measure to control ED and diseases associated with a higher cardiovascular risk³³. According to this perspective, the present study aimed to analyze the scientific literature published in the last ten years (from 2004 to 2014) regarding the relationship between physical activity, ED and associated factors in men aged 17 years and older found in cross-sectional studies, randomized clinical trials and cohort studies.

METHODS

The present study was characterized as a systematic review of research projects that analyzed the relationship between physical activity and ED. Aiming to display data in a more technical way, the recommendations from the Preferred Reporting Items for Systematic Reviews and Meta-analysis – PRISMA³⁴ were followed. Through an electronic search, articles from the follow-

ing databases and electronic libraries and published in the last ten years (from 2004 to 2014) were selected: PubMed/Medline, Bireme, ScienceDirect, SciELO (Scientific Electronic Library Online) and (CAPES – Coordination for the Improvement of Higher Education Personnel). The search for studies was conducted between March and May 2014.

The key words used in this search and based on health science descriptors (DESCs) were as follows: “physical activity” and “erectile dysfunction”, present in the titles, abstracts and key words. The AND Boolean operator was applied for term combination. The following search strategies were used in each database and electronic library: PubMed/Medline, “physical activity AND erectile dysfunction”; Bireme, “actividad física AND disfunción erétil/ atividade física AND disfunção erétil”; ScienceDirect, “physical activity AND erectile dysfunction”; SciELO, “atividade física AND disfunção erétil”; and CAPES, “physical activity AND erectile dysfunction”.

The following were considered as inclusion criteria: 1) articles published in Portuguese, English and Spanish; 2) articles including the previously mentioned descriptors; 3) articles available online; 4) articles with a cross-sectional design, randomized clinical trial, quasi-experimental design, cohort studies and prospective studies; 5) articles that studied individuals aged 17 years and older; and 6) articles that directly or indirectly used a particular measure to assess physical activity.

A secondary search was conducted in the bibliographical references of the selected articles, aiming to identify other sources not detected through the initial search. The following were excluded from this study: monographs, theses, dissertations, abstracts, systematic reviews and opinion-based articles. After excluding the articles that did not meet the inclusion criteria, apart from duplicate articles, all articles selected were filed to organize the reading.

To increase the reliability of this study, the entire process of search in the electronic databases, study selection, article reading and information gathering was performed by two researchers. This process of article search and selection was replicated by the same researchers independently and blindly and there were no divergences regarding the final selection of articles. These selected studies were subsequently catalogued according to: year, periodical, sample, methods, instruments and results.

The risk of bias in the studies included was assessed independently by the same two reviewers. The scale proposed by Downs and Black³⁵ was used. This scale is comprised of 27 items that include communication, external validity, internal validity (bias), internal validity (confounding factors) and statistical power³⁵, aimed at the methodological assessment of studies that performed an intervention. A score of zero (0) was assigned to each question if the article did not meet the requirements being assessed, while a score of one (1) was given if these requirements were met. The exception was question five, which is about the main confounding factors described in the articles, when a score of two (2) was assigned if the question was met by these articles. As a result, the maximum score that an article could achieve was 28 points. Among the studies that did not include an intervention, an adapted version of this scale was used, as previously adopted by international studies on systematic reviews^{36,37}. According to this scale, questions 4, 8, 13 to 15, 19, 23 and 24 were excluded because they referred to clinical trials. Thus, 19 items were assessed, totaling a maximum score of 20 points.

The main data extracted from each study were as follows: the study design, the number of individuals, the instruments used to assess physical activity and ED, the covariables and the main findings. Prevalences, means, standard deviations, odds ratio (OR) and relative risk were adopted to show the study results.

With regard to ethical aspects, the present study was based on a bibliographical search that used public databases exclusively. Therefore, as no human beings were involved, this study did not have to be submitted and approved by a Research Ethics Committee.

RESULTS

The flow chart used to select the articles is shown in Figure 1. A total of 230 studies were identified, of which 29 were in the Bireme database, 43 in the portal of the Journal, 99 in PubMed, three in Scielo, 55 in ScienceDirect, and one in the references of articles. Thus, 43 duplicate studies were excluded and 187 titles and abstracts were assessed. After this process, 166 articles were excluded, of which 118 through the analysis of titles not related to reviews, 14 that were review studies, two that were opinion-based articles, 27 that were published out of the period of time defined in the methods, and five that only had the abstract available. Consequently, 21 studies remained and could be fully read subsequently. Out of these 21 studies, two were excluded because they were published in languages that had not been defined in the methods. Finally, 19 articles were included in this review.

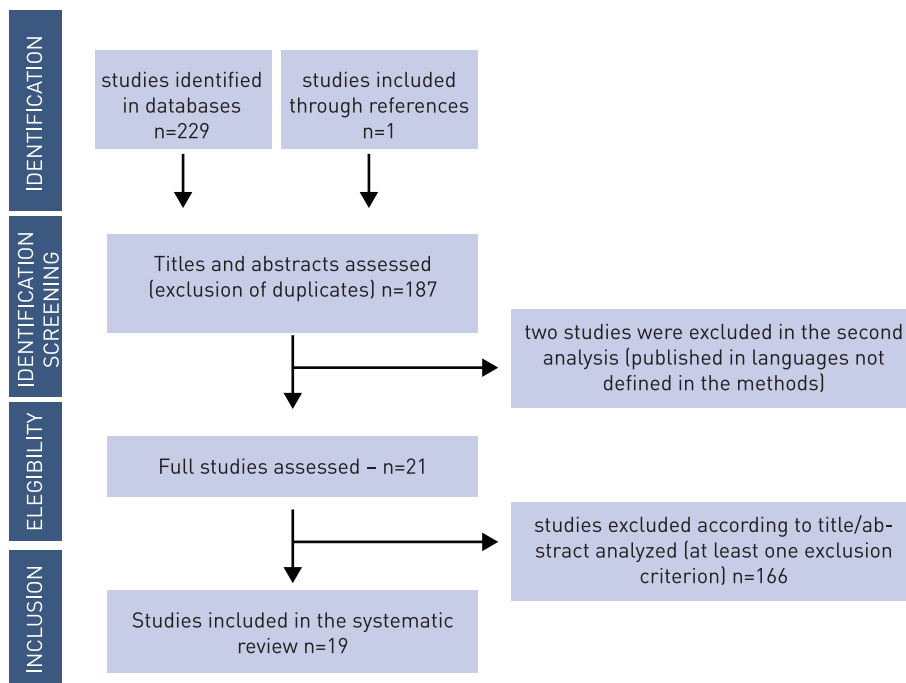


FIGURE 1 – Flow chart of the screening process and selection of articles to be included in the review.

The analysis of studies according to methodological procedures and results is shown in Chart 1. Of all articles analyzed, the majority ($n=11$)^{10,21,31-33,39,41,43,45-48} were characterized as cross-sectional studies.

CHART 1 – Type of research, sample, measures and results of studies on the relationship between physical activity and erectile dysfunction, published between 2004 and 2014.

Study (year)	Location	Design	Sample	PA Measure***	ED Measure	Covariables	Results	Score*
Esposito, et al. (2004) ²⁵	Italy	Randomized, double-blind.	110 men aged 35-55 years.	Intervention: Guidance to increase the level of physical activity (walking; swimming; soccer) – duration: 2 years.	International Index of Erectile Function (IIEF).	Intervention: Calorie intake guidance program – duration: 2 years.	After intervention, there was a decrease in body mass index (from 36.9±2.5 to 31.2±2.1), increase in physical activity level (from 48±10 to 195±36 min./week) and improvement in the IIEF score (from 13.9±4 to 17±5) in the intervention group.	22**
Mirone, et al. (2004) ³¹	Italy	Cross-sectional	12,558 men aged between 17-98 years.	Questions about the frequency of physical activity per week.	Structured interview about sexual performance to assess erectile function.	Socio-demographic (personal and lifestyle characteristics – age; weight; height; marital status; level of education) and clinical-historical questionnaire.	A total of 19.9% of men were diagnosed with ED. The frequency of ED increased with age (from 4.6% in men aged less than 25 years to 37.6% in those aged more than 74 years). Physical activity for at least two hours/week decreased the risk of ED (OR 0.8, 95%CI= 0.7- 0.9)	13#
Zheng, et al. (2006) ³²	China	Cross-sectional	327 men.	Structured questions about physical activity.	Structured questions about erectile function.	Blood collection; psychological assessment; socio-demographic questionnaire (age; weight; height; alcohol and tobacco consumption).	A total of 129 men were diagnosed with ED, the risk of developing ED was significantly associated with low levels of physical activity (OR = 1.67, 95%CI= 1.15–3.03).	17#
Bacon, et al. (2006) ³⁸	USA	Cohort study	22,086 men aged between 40-75 years.	Questionnaire validated to assess physical activity.	Questionnaire to assess sexual function.	Questionnaire about self-perception of health and alcohol consumption.	Physical activity was associated with a lower risk of ED (RR 0.7, 95%CI 0.7–0.8).	16#
Cheng e Ng (2007) ²¹	China	Cross-sectional	1,506 men aged between 26-70 years.	Questions about physical activity level (according to frequency, duration and type of activity).	International Index of Erectile Function (IIEF).	Questionnaire about socio-demographic characteristics (body mass index; age; level of education; marital status; use of medication; psychological stress; alcohol and tobacco consumption).	Inactive men with a BMI <18.5 had a higher risk of developing ED (OR=2.99, 95%CI= 1.01-8.86), as well as those with a BMI ≥25.0 (OR=2.47, 95%CI = 1.08–5.67).	16#
Selvin, et al. (2007) ³⁹	USA	Cross-sectional	2,126 men aged more than 20 years.	Questions about physical activity.	Individual interview to assess ED.	Blood collection; socio-demographic information (age; ethnic group; marital status; tobacco consumption); arterial pressure; total cholesterol; questions about cardiovascular risk.	There was a prevalence of 18.4% of ED in the sample (95%CI=16.2-20.7). ED was significantly associated with low levels of physical activity (23.3% 95%CI= 20.0-27.0).	17#

Study (year)	Location	Design	Sample	PA Measure***	ED Measure	Covariables	Results	Score*
Revnice, et al. (2007) ⁴⁰	Romania	Quasi-experimental	42 men aged between 66-76 years.	16-week physical activity program.	Clinical assessment to determine ED.	Geriatric Depression Scale (GDS); electromyography to assess muscle strength.	The physical activity program improved participants' psychological and physical aspects and their erectile function.	12**
Kratzik, et al. (2009) ⁴¹	Austria	Cross-sectional	674 men aged between 45-60 years.	Physical activity through Paffenbarger's Score.	International Index of Erectile Function (IIEF).	Urological clinical assessment; endocrine measures.	Positive correlation between the IIEF score and Paffenbarger's score [$r = 0.164$, $p < 0.001$]. The development of ED decreased 82.9% in active individuals (3,000kcal/week), (OR = 0.171, $p = 0.018$).	18#
Araujo, et al. (2009) ⁴²	USA	Prospective observational cohort study	1,709 men aged between 40-70 years.	Questionnaire about physical activity.	Structured questionnaire to assess ED.	Anthropometric measures; blood collection; questionnaire about socio-demographic characteristics (history of chronic diseases, alcohol and tobacco consumption; nutritional information).	Age, BMI, alcohol and tobacco consumption, physical activity, self-perception of health, hypertension and diabetes were associated with ED.	15#
Holden, et al. (2010) ⁴³	Australia	Cross-sectional	5,990 men aged more than 40 years.	Questionnaire about physical activity (type, intensity and frequency in the previous week).	Questions about sexual function.	Questions about socio-demographic characteristics (age; marital status; ethnic group; occupation; level of education; weight; height; alcohol and tobacco consumption) and lifestyle.	Individuals categorized as inactive were more likely to have ED (OR 1.5, 95%CI=1.2-1.8).	16#
Kupelian, et al. (2010) ⁴⁴	USA	Epidemiological study	2,301 men aged between 30-79 years.	Physical Activity Scale for the Elderly (PASE).	International Index of Erectile Function (IIEF).	Questionnaire about socio-demographic characteristics (ethnic group; socioeconomic level; level of education; BMI).	Lifestyle was associated with age and ED was associated with all study covariables and physical activity.	12#
La Vignera, et al. (2011) ²³	Italy	Quasi-experimental	50 men aged between 48-62 years.	Protocol of aerobic physical activity (150min/week).	International Index of Erectile Function (IIEF).	Blood collection (total cholesterol; triglycerides; HDL cholesterol).	After three months of aerobic physical activity, the intervention group had a significantly higher IIEF score, showing a lower prevalence of ED (from 11.0 ± 1.0 to 16.5 ± 1.0).	16**
Agostini, et al. (2011) ³³	Brazil	Cross-sectional	180 men aged between 40-75 years.	International Physical Activity Questionnaire (IPAQ-short version).	International Index of Erectile Function (IIEF-short version).	Anthropometric measures; physical fitness measure (VO_{2max}); assessment of cardiac frequency at rest; socio-demographic questionnaire.	The majority of individuals who had ED were inactive (95.6%) whereas the minority were highly active (9.1%) - $p < 0.001$.	15#

Study (year)	Location	Design	Sample	PA Measure***	ED Measure	Covariables	Results	Score*
Pohjantähti-Maaroos, et al. (2011) ⁴⁵	Finland	Cross-sectional	120 men with a mean age of 50 years.	Structured questionnaire about physical activity (type, intensity and frequency).	International Index of Erectile Function (IIEF).	Laboratory exams.	Individuals who practiced physical activity regularly (>kcal/day) were less likely to have ED (OR 0.12, 95%CI=0.017-0.778, p=0.027).	17#
Liao, et al (2012) ⁴⁶	China	Cross-sectional	1,776 men aged between 20-77 years.	Questions about the weekly practice of physical activity.	International Index of Erectile Function (IIEF).	Anthropometric measures; blood collection (triglycerides; HDL cholesterol); tobacco consumption.	The prevalence of ED was 47.6%. ED was more prevalent in individuals who were older, smokers and hypertensive.	19#
Wu, et al. (2012) ¹⁰	China	Cross-sectional	2,686 men aged between 17-88 years.	Questionnaire to assess physical activity level.	International Index of Erectile Function (IIEF).	Questionnaire about smoking habit; BMI; blood collection (total cholesterol; HDL cholesterol; triglycerides).	The prevalence of ED was 49.5%. Individuals who did not practice physical activity had a higher risk of developing ED (OR 1.13, 95%CI=0.97-1.32)	15#
Garimella, et al. (2013) ⁴⁷	USA	Cross-sectional	5,994 men aged more than 65 years.	Physical Activity Scale for the Elderly (PASE).	International Index of Erectile Function (IIEF).	Anthropometric measures; socio-demographic questionnaire (age; level of education; marital status; ethnic group).	Prevalence of moderate to severe ED was 56%. There was a relationship between ED and body mass index.	19#
Banks, et al. (2013) ¹³	Australia	Cohort study	95,038 men aged more than 45 years.	Questions about physical activity.	Questions about sexual health.	Questions about socio-demographic information, lifestyle, body mass index, clinical history, functional capacity.	Men with high levels of physical activity had lower ED indices.	16#
Weber, et al. (2013) ⁴⁸	Australia	Cross-sectional	108,477 men aged more than 45 years.	Medical Outcomes Study Physical Functioning Scale (MOS-PF).	Interview to assess EF.	Questionnaire about socio-demographic characteristics (place of residence; marital status; level of education, presence of disease).	The higher the physical activity level, the lower the occurrence of ED (OR 0.47; 95%CI= 0.43-0.50).	16#

* Downs and Black's methodological quality scale score³⁵

** Downs and Black's total scale score

#Downs and Black's adapted scale score

*** PA: physical activity

With regard to the locations where the studies were performed, most of them originated from the United States^{38,39,42,44,47}, followed by China^{10,21,32,46} and only one from Brazil³³.

In terms of the instruments used to measure ED, the one most frequently adopted was the International Index of Erectile Function (IIEF) (n=11)^{10,13,21,23,25,33,41,44-47}. Different instruments were used to analyze physical activity, such as the IPAQ-short version³³; closed questions about physical activity^{10,13,21,31,39,42,46,47}, the Physical Activity Scale for the Elderly (PASE)^{44,47}; the Questionnaire about Lifestyle Factors⁴³; Paffenberger's Physical Activi-

ty Questionnaire⁴¹; and also three studies that performed interventions with physical activity programs^{23,25,40}.

Among all 19 studies assessed, the presence of ED was found to be directly associated with lifestyle characteristics of the populations studied, such as alcohol^{31,38,42,46,48} and tobacco consumption^{10,13,21,33,38,39,43}; the presence of certain diseases, mainly arterial hypertension^{10,25,31,32,39,41-43,46,47}, diabetes^{10,13,31-33,39,42,43,47,48} and cardiovascular diseases^{13,31,33,39,42,43,47,48}. With regard to the age group of occurrence of ED, this condition was recurrent in individuals aged between 20 and 98 years^{10,13,21,31-33,39,41,42,44,46-48}.

A total of 17 studies showed a significant association between physical activity and lower levels of ED^{10,13,21,23,25,31,32,33,38-45,48} and only two studies did not find significant associations between these variables^{46,47}.

In quasi-experimental studies and randomized clinical trials, there was a significant improvement in ED levels after a period of physical activity intervention. This occurred when the same group was compared in the beginning and in the end of this program, as well as when the intervention and control groups were compared. With regard to cross-sectional studies, the associations between ED and physical activity were observed when considering the physical activity level primarily. The majority of studies reported that the higher the physical activity level, the lower the occurrence of ED. Additionally, physical activity also had a positive effect on ED in cohort and prospective studies.

Regarding the methodological assessment of review articles, the score found in studies on interventions varied between 12 and 22 points, with a mean of 17 points. In addition, the main gaps were observed in components associated with communication, external and internal (bias) validity, as well as not showing the actual probability values, blinding attempts and random selection of participants. Moreover, with regard to the studies that did not perform intervention, the score varied from 12 to 19 points, with a mean of 15.5 points.

Additionally, it was observed that gaps were also associated with communication aspects and how actual probability and internal validity (bias) values were shown, referring to the results based on analyses not defined a priori.

DISCUSSION

Erectile dysfunction and associated factors

Based on the literature analyzed in this review, a high prevalence of ED was found. In one of the studies, 56% of men had a moderate to severe level of ED⁴⁷. With regard to a possible relationship between ED and physical activity, 17 studies revealed that physical activity was associated with a lower prevalence of such dysfunction.

In order to assess the presence and severity of ED, the majority of studies analyzed used the IIEF (n=11)^{10,13,21,23,25,33,41,44-47}. Other studies applied an interview^{31,39,48}, clinical assessment⁴⁰, questionnaires^{32,38,42} and telephone interviews⁴³ to conduct this evaluation. In the majority of these studies, the severity of ED symptoms was categorized as severe, moderate, minimal and none^{10,13,23,33,41,44,46-48}.

When the erectile function was assessed through a single question, namely "How would you describe your ability to attain and maintain an adequate

erection for satisfactory sexual intercourse?”, the categorization of symptoms varied from “always capable” or “almost always capable”, “usually capable”, “sometimes capable” to “never capable”³⁹; very poor, poor, fair, good and very good³⁸; and sometimes (moderate) or never (severe)⁴³ capable of obtaining and maintaining an erection considered satisfactory for sexual intercourse. Furthermore, some studies categorized individuals into with or without ED^{21,25,31,32,42,45} exclusively, and only one study⁴⁰ identified the presence or absence of ED through a clinical assessment.

The occurrence of ED affected individuals aged between 20 and 88 years, ranging from 18.4% to 49.5% of this population. Older men showed a higher prevalence of ED, indicating a positive association with age in the majority of studies^{10,13,21,31-33,38,39,41,43-45}. According to Weber, Smith, O’Connell . (2013)⁴⁸, as age advances, there is an annual increase in 11.3% in the chance of developing ED, and the occurrence of ED is one in every six men between the ages of 40 and 70 years⁴⁹. These findings can be the result of the natural aging process, which includes, among other things, a steady reduction in testosterone levels in the blood that in its turn influences the development of ED and other sexual dysfunctions⁴⁶.

In the studies analyzed, ED was also positively associated with the occurrence of certain diseases, among which the following were the most frequently mentioned: arterial hypertension^{10,25,31,32,39,41-43,46,47}, diabetes^{10,13,31,32,39,42,43,47,48} and cardiovascular diseases^{13,31,39,42,43,47,48}. According to Galvão and Chagas (2005)⁵⁰, the risk factors for cardiovascular diseases and ED can be considered as similar, so that the greater the occurrence of cardiovascular conditions, the higher the prevalence of ED. Such dysfunction is the initial manifestation in patients with cardiovascular diseases⁵⁰ and diabetes⁵¹. Moreover, with regard to diseases, hyperglycemia, dyslipidemia, prostate cancer and hypercholesterolemia were found to be associated with the occurrence of ED^{31,33,46,47}, apart from psychological disorders such as anxiety and depression^{32,43,48}. According to Moreira, Abdo and Torres . (2001)¹⁷, these disorders are associated with the occurrence of ED as they can lead to the reduction in sexual libido.

Unhealthy life habits such as smoking and alcohol drinking were also associated with ED^{31,38,42,46,48}. However, when analyzed independently, some studies reported a positive association with tobacco consumption^{10,13,21,33,38,39,43} exclusively. With regard to alcohol consumption, Banks, Joshy, Abhayaratna . (2013)¹³ found a positive association with ED and suggested that this occurs due to the fact that alcohol reduces plasma testosterone and increases serum estrogen, which may harm the erectile function in the long term⁵².

According to Bacon et al. (2006)³⁸, these data are important to motivate individuals to adopt a healthier lifestyle, including physical activity and a balanced diet, thus avoiding an immediate problem. It should be emphasized that many men do not adopt such behavior as they argue that negative aspects for one’s health and wellbeing only occur in older individuals³⁸.

The Body Mass Index (BMI) was also observed as a determining factor for the development of ED. A high BMI was associated with a greater occurrence of ED^{25,32,38,39,41,42,47,48}, as obesity directly affects the circulatory system in general, including the blood flow in the penile vessels⁴⁷. Additionally, in the studies conducted by Cheng and Ng (2007)²¹ and Holden, McLachlan, Pitts . (2010)⁴³, apart from obesity, low weight can also lead to a higher risk of development of ED as it is connected to the reduction in blood testosterone.

The prevalence of ED was also associated with level of education^{10,13,31,39,42,48}. According to Abdo, Oliveira Jr, Scanavino (2006)⁵, individuals with a low level of education have lower access to health care and less knowledge about the sexual function and what is harmful to sexual performance. It should be emphasized that these factors vary according to the environment and culture in which individuals are included.

In this sense, ED prevention is required through interventions that promote changes in lifestyle, such as smoking cessation, reduction in alcohol consumption and body weight control, in addition to encouraging the adequate treatment of cardiovascular diseases, diabetes and hypertension. Moreover, regular physical activity seems to play a very important role.

Physical activity and erectile dysfunction

Physical activity appeared to be directly associated with ED in 17 studies and the majority of them showed that such practice was also associated with a lower risk of development of ED. In one of the studies, categorized as cross-sectional, individuals considered to be active were found to have significantly lower levels of ED than those who were inactive or insufficiently active³³. Following the same methodological design, similar results were obtained by Pohjantähti-Maaroos, Palomäki, Hartikainen (2011)⁴⁵, revealing that ED was less frequent in active individuals, thus enabling researchers to consider regular physical activity as a protective factor against the development of ED⁴⁵.

Despite the differences in methodological designs, namely cohort³⁸, cross-sectional^{39,41} and quasi-experimental studies⁴⁰, the intensity of physical activity was also found to influence ED levels, with the greatest benefits resulting from moderate⁴⁰ to vigorous^{38,39,41} levels of activity. According to Kratzik, Lackner, Mark . (2009)⁴¹, the intensity, type, duration and frequency of physical activity are factors that must be considered for the treatment of ED. In the cross-sectional study conducted by Mirone (2004)³¹, men who practiced at least 120 minutes of weekly physical activity had a lower risk of developing ED.

With regard to the type of activity, quasi-experimental studies showed that aerobic physical activity was effective in the reduction of ED levels in individuals who previously had high levels²³. Similar results were observed with walking, climbing stairs as a means of transport, and leisure sports⁴¹. These activities are associated with an improvement in erectile function, as they can provide physical and mental benefits, such as better endothelial function and vascularization and lower depressive state⁴³.

Studies have shown that physical activity was associated with ED according to the BMI of certain populations^{21,23,38,43,44}. Physical activity was found to influence the risk of developing ED in individuals with a higher BMI. In some cases, obese men with low levels of physical activity had a higher risk of development of ED when compared to those with an average BMI and same levels of physical activity^{21,38}. In their study, Bacon, Mittleman, Kawachi . (2006)³⁸ emphasize that obesity and excessive body weight increase the risk of ED at any level of physical activity.

It should be noted that this association was not exclusive among men with a high BMI. Among the studies analyzed, eutrophic and underweight men who did not perform any physical activity also had a higher risk of develop-

ment of ED^{21,43}. According to Holden, McLachlan, Pitts . (2010)⁴³, this finding can be justified by the fact that low weight can harm a man's body, including a significant reduction in blood testosterone levels, which can cause other male sexual function disorders, apart from the higher risk of ED. In this sense, it could be affirmed that the body weight of insufficiently active men can be a risk factor for the development of ED²¹.

Only two studies^{46,47} did not find significant associations between physical activity and ED levels. This response must be due to the fact that the majority of the sample studied was aged between 30 and 39 years, when ED is less frequent and severe¹⁰. However, interventions associated with physical activity should be included in this stage of life, considering the evidence that indicates a steady increase in ED with age^{31,32,39}.

The present review study had some limitations. The first one was associated with the way articles were obtained. Data could have been collected using other inclusion criteria. It should be emphasized that the methodology adopted by the articles to assess physical activity had some limitations, as the majority evaluated physical activity through questionnaires. In such cases, participants can overestimate this behavior as it is a practice considered to be desirable⁵⁴. Additionally, it should be noted that this review only identified three cohort studies, two quasi-experimental studies and one clinical trial, whereas the majority of studies had a cross-sectional observational design. This gap could be due to the fact that the latter more easily include a great number of individuals. However, the results may not be as reliable as those found in cohort studies and randomized clinical trials.

Finally, a lack or low level of physical activity can be considered to be predictors of ED²¹. In this sense, changes in lifestyle through the promotion of physical exercising can lead to a reduction in ED²⁵. Taking these arguments into consideration, the need for greater care for men's sexual health should be emphasized, due to the impact that this disease has on their quality of life. Nonetheless, it must be noted that men's concern about sexual health and their openness to deal with such issues are relatively recent.

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