



Review Article



Deliberating Effects of Sedentary Lifestyle on Young Adults: A Review of Literature

Hira Iqrar¹, Maham Mohsin¹, Vaneza Ahmad¹, Misbah Qayum¹ and Wajida Perveen^{1*}¹School of Allied Health Sciences, Combined Military Hospital, Lahore Medical College, Lahore, Pakistan

ARTICLE INFO

Keywords:

Cancer, Cardiovascular Disease, Exercise, Physical Activity, Sedentary Behavior

How to Cite:Iqrar, H., Mohsin, M., Ahmad, V., Qayum, M., & Perveen, W. (2025). Deliberating Effects of Sedentary Lifestyle on Young Adults: A Review of Literature: Effects of Sedentary Lifestyle. *Pakistan BioMedical Journal*, 8(2), 02-08. <https://doi.org/10.54393/pbmj.v8i2.1136>***Corresponding Author:**Wajida Perveen
School of Allied Health Sciences, Combined Military Hospital, Lahore Medical College, Lahore, Pakistan
wajida_perveen@cmhlahore.edu.pkReceived date: 13th September, 2024Revised date: 19th January, 2025Acceptance date: 5th February, 2025Published date: 28th February, 2025

ABSTRACT

The term sedentary behavior means "any activity that occurs during the day that involves sitting, laying, or reclining that requires less energy than or equal to 1.5 metabolic equivalents (METs)." Six or more hours a day of sitting or lying down combined with little or no physical exercise during daily activities define a sedentary lifestyle. According to international guidelines, adults should perform at least 150 minutes of moderately vigorous physical activity each week, which equates to 30 minutes/day for five days/week. Adults also require 2 days of muscle strengthening activity every week. About one-third of adults over the age of 15 worldwide suffer from poor health due to inadequate physical activity. Negative effects of sedentary behaviors include a risk of stroke, cancer, high cholesterol, high blood pressure, cardiovascular disease, obesity, diabetes mellitus, osteoporosis and depression. Short bursts of inactivity paired with irregular physical activity contribute to improved wellbeing.

INTRODUCTION

The term sedentary behavior means "any activity that occurs during the day that involves sitting, laying, or reclining that requires less energy than or equal to 1.5 metabolic equivalents (METs)." Six or more hours a day of sitting or lying down combined with little or no physical exercise during daily activities define a sedentary lifestyle [1]. According to international guidelines, adults should perform at least 150 minutes of moderately vigorous physical activity each week, which equates to 30 minutes/day for five days/week. Adults require muscle-strengthening activities twice a week [2]. About one-third of adults over the age of 15 worldwide suffer from poor health due to inadequate physical activity. Sedentary habits have various adverse consequences for the human body. These include a high risk of cancer, cardiovascular disease, depression all-cause mortality and metabolic disorders i.e. dyslipidemia, hypertension and diabetes

mellitus, musculoskeletal disorders i.e. osteoporosis and arthralgia. It is crucial to reduce sedentary behavior and encourage physical activity to improve public health [3]. According to recent data, 25% of adults and 81% of teenagers do not get enough exercise. When economies develop, the rate of inactivity rises to a staggering ratio of 70% which may partially be linked to changes in transportation, the development of technology for cultural values, business and an increase in sedentary activities [4]. The relationship between sedentary behavior and different health consequences in adults has been the result of multiple longitudinal research studies, but the findings have been conflicting. There is an association between sedentary behaviour and health impacts. It was found that adults (mean age 28.5 years) with high levels of sedentary behavior had higher BMI, waist circumference, and body fat [5]. Long-term television viewing has been linked to



decreased cognitive function in people between the ages of 18 and 30 [6]. However, several research have found no correlation as there was no association between obesity and sedentary time in adults aged 20 to 35 [7]. The amount of time adults (mean age 33.6 years) spent sitting in work environments did not correlate with their cognitive ability [8].

Sedentary lifestyle has emerged as a major global public health concern, particularly among young adults, leading to increased risks of cardiovascular diseases, diabetes, obesity, depression, and other chronic conditions. Although extensive literature describes individual health outcomes of physical inactivity, findings remain inconsistent across studies, and evidence specifically focusing on young adults (18–35 years) is still fragmented. Moreover, most existing research is observational and lacks clarity on dose–response relationships and contextual behavioral patterns of sedentary time. Therefore, this review aims to critically examine and synthesize current evidence on the health effects of sedentary behavior in young adults to provide a comprehensive understanding and guide future preventive strategies and research directions.

The study is a narrative review focusing on the effects of a sedentary lifestyle on young adults. PubMed and Google Scholar were used to search the data. Search terms and keywords used were “sedentary lifestyle”, “sedentary behaviors”, “physical inactivity”, “young adults”, “health effects”, “health risks”, “risk factors”, “psychological impact”, Boolean operators (e.g., AND, OR) were used in refining the search. In Inclusion Criteria, Peer-reviewed, open access literature was considered. Both primary and secondary studies on young adults aged 18–35, published in English language, within the last 10 years, addressing health outcomes linked to sedentary behavior. Policy documents and guidelines were also included in discussing and correlating the findings. Studies focusing on older adults, animal studies, and articles not directly addressing the effects of sedentary behavior were excluded. Ten effects of physical inactivity were found most frequently in the literature including cardiovascular diseases, stroke, high blood pressure, muscle degradation & weakness, diabetes, high cholesterol, obesity, osteoporosis, depression, and cancer (Figure 1).

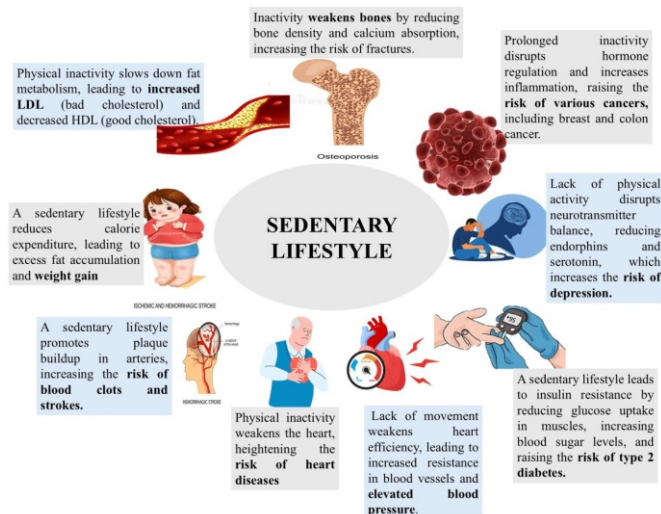


Figure 1: The effects of a sedentary lifestyle on young adults

Cardiovascular Diseases

Cardiovascular disease (CVD) is an aggregate term for various circumstances that influence blood arteries or heart. The most prevalent cardiovascular condition linked to a sedentary lifestyle is coronary artery disease. When the main blood vessels (coronary arteries) that provide your heart with oxygen, nutrients and blood are harmed or diseased, coronary artery disease occurs [4]. Physical inactivity and sedentary behavior are the major modifiable factors for cardiovascular illness and all cause demise worldwide [9]. Being sedentary can cause fat to accumulate in your arteries, which can obstruct them and cause a heart attack [10]. According to study of Wu Jingjie *et al.*, which demonstrated that those in the category with highest sedentary time (median duration: 10.2 hours/day) were more likely to die from CVD-related causes than those in the category with lowest sedentary time (median duration: 2.98 hours/day) [11]. Whitaker *et al.*, found that continuous lack of activity may raise the risk of cardiovascular disease [12]. A meta-analysis of 34 prospective study designs with 1,331,468 individuals found a non-linear relationship between total sedentary time and cardiovascular disease mortality that was independent of level of physical activity [13].

Stroke

A stroke, also referred to as a brain attack or cerebral vascular accident (CVA), occurs when a brain blood vessel ruptures or anything keeps blood away from reaching a specific part of the brain. One of the significant modifiable risk factors of stroke is inactive lifestyle [14]. Sedentary lifestyles are a global issue, particularly in Europe and North America. Unfortunately, the danger of many diseases/disorders, including cerebrovascular diseases, has increased significantly over the past few decades due to an increase in physical inactivity [15]. According to study of 2022, sedentary behavior has been associated positively to an elevated risk of stroke and the risk of stroke increased

by 21% for every hour of extra sedentary time when it exceeded 11 hours per day [16]. A study of 2024 concluded that a sedentary lifestyle is a significant predictor of pathophysiological changes linked to inactivity, which results in decreased muscle mass and strength, increased insulin resistance, and worse cardiac function, all of which raise the risk of cardiovascular diseases [17].

Hypertension

The changes in the cardiac output and total peripheral vascular resistance both, as well as other factors, might affect blood pressure because of sedentary lifestyle. Sedentary behaviour impacts insulin sensitivity and vascular function, promotes the low-grade inflammatory cascade, raises oxidative stress, and activates the sympathetic nervous system. [18]. The fact that 1.56 billion individuals worldwide predicted high blood pressure by 2025, based on conservative estimates, is thrilling [19]. According to a study, they found a correlation between sedentary activity and a higher incidence of high blood pressure (HR, 1.48; 95% CI, 1.01–2.18; P value < 0.03) [20]. The risk of hypertension to be higher for non-interactive habits of inactivity such as watching the television for longer periods of time and taking a nap rather than for the interactive sedentary activities such as driving a car and working on a computer. Various strategies, such as enthusiastically modifying the cardiac output and total peripheral vascular resistance, can be employed to modify blood pressure resulting from a sedentary lifestyle [21].

Muscle Weakness

Muscle deterioration and weakening can result from leading a sedentary lifestyle. Increased levels of inactivity are linked to several musculoskeletal disorders, including osteoarthritis, back pain, and neck/shoulder discomfort, according to epidemiological research [22, 23]. The recovery of the skeletal muscle function and regeneration of the muscle cells are aided by appropriate exercise, which also promotes compensatory muscle hypertrophy, increases muscle strength and elasticity, and trains muscle coordination [24]. According to a study conducted in 2021 it is now known with strong evidence that mitochondrial dysfunction plays a significant role in aging, cancer chemotherapy, muscle degeneration and atrophy brought on by extended periods of inactivity, and muscle wasting in various diseases (including sepsis and cancer) [25]. According to a study conducted in 2016 long-term inactivity of the skeletal muscle linked to the release of calcium from sarcoplasmic reticulum, which raises the levels of free calcium in the cytosol [26].

Diabetes

Long periods of inactivity, high fat and high sugar diets, obesity, high visceral fat, and excessive eating all contribute to sedentary behavior, which negatively influences a person's health by creating diabetes mellitus [27]. Individuals who tend to watch television or work on a computer for more than 40 hours a week are three times

more at risk of developing type 2 diabetes mellitus as compared to those watching less TV or using a computer. Insufficient physical activity levels constitute major public health concerns, increasing the risk of multiple diseases such as type II diabetes [28]. People with type 2 diabetes should engage in physical activity regularly and be encouraged to reduce sedentary time and break up sitting time with frequent activity breaks. Any activities undertaken with acute and chronic health complications related to diabetes may require accommodation to ensure safe and effective participation [29]. Weight management, lack of motivation and pain are key PA motives and barriers in people with obesity and should be addressed in future interventions to facilitate PA initiation and maintenance [30]. The latest Physical Activity Guidelines for Americans are applicable to most individuals with diabetes, including youth, with a few exceptions and modifications. Physical activity undertaken with health complications can be made safe and efficacious, and exercise training undertaken before and after bariatric surgery is warranted and may enhance its health benefits [29].

High Cholesterol

Visceral and abdominal fat grow due to a sedentary lifestyle. The risk of being overweight and gaining belly fat tends to increase with every hour of inactivity. The release of the pro-inflammatory cytokines and reduction of anti-inflammatory signals from the adipose tissue can be facilitated by an increase in the visceral and intermuscular fat, which would catabolize muscle tissue [31]. Inactivity triggers this process, which is considered a stressor mechanism. It causes the muscles to use less glucose, become more insulin resistant, and use less energy when the muscles are not working. These fat-packed adipocytes activate their metabolism and generate anti-inflammatory chemicals while inhibiting release of adiponectin, which is an anti-inflammatory substance [32]. Sedentary behavior hindered the activity of lipoprotein lipase enzyme, and this was associated with less levels of HDL as well as lower levels of plasma triglyceride uptake. Still, prolonged treatments are necessary to modify the levels of lipids. Consequently, it proves that an inactive lifestyle and a lack of exercise are bad for the metabolism of lipids in the body. Over time, these factors may cause visceral and central abdominal fat to accumulate, which increases the risk of developing several cardiovascular illnesses [33].

Obesity

An abnormal or excessive build-up of fat that puts at risk one's health is referred to as obesity. It is a body mass index also known as BMI more than the value of 30 [34]. An excessive or abnormal amount of fat negatively affects an individual's health. Obesity and other co-morbidities are on the rise due to rapid urbanization and industrialization, which has revealed hidden predisposing genetic features through physical inactivity. Changing calorie intake as well as energy expenditure is necessary to reduce obesity.

Physical activity will help to better match energy expenditure and intake at lower body weights [35]. The risk of being overweight and belly fat increases with every hour of physical inactivity [36]. According to a study of 2024 by Musijowska and Edyta, they concluded that students who were enrolled in physical education showed highest levels of physical activity and the lowest percentage of obesity. Furthermore, this study also highlights the necessity of putting preventive measures and programs in areas with high rates of sedentary behavior to help prevent obesity [37]. Research performed at Silesian Medical University revealed that the percentage of 19.2 students do not participate in the necessary amount of physical activity [38].

Osteoporosis

Osteoporosis develops when bone mass and bone mineral density decrease. This can weaken the bones, leading to an increased risk of fractures. Because it is often undetected until a symptomatic fracture occurs, osteoporosis is referred to as a "silent disease" [39]. The amount of 20% to 40% of an adult's peak bone mass is thought to be influenced by lifestyle factors, and adverse lifestyle choices can result in inadequate bone deposition, which raises the risk of osteoporosis and related fractures [40]. Maintaining bone mass can be achieved with regular exercise, hence maintaining physical activity is favorable to establishing a sedentary lifestyle [41].

Depression

One common mental health condition is depression. It is estimated that around 5% of adults worldwide suffer from this condition. Its prominent features are long-term sorrow and a loss of excitement or delight in once satisfying or enjoyable activities. It can also disrupt your sleep and appetite. Fatigue and difficulty concentrating are also common [42]. Sedentary behavior may increase the risk of depression by reducing social gatherings and reducing engagement in physical activities. These are some possible mechanisms for the relation between sedentary behavior and depression [43]. Kim J *et al.*, stated that a positive association found between the prevalence of depression and sedentary habits [44].

Cancer

Cancer occurs when certain cells in the body grow and attack other areas of the body. As the human body consists of trillions of cells, cancer can occur almost anywhere. Sedentary behavior is an independent risk factor, being active lowers your risk of cancer. You are still more likely to develop cancer even if you exercise for at least half an hour each day if you spend many of your days sitting down [45]. One-third of the global population aged fifteen years and above executes insufficient physical activities, which affects health on general. Sedentary behaviors lead towards a variety of adverse effects on the human body including but not limited to increased all-cause mortality and cancer risk [46]. In 2020, World Health Organization

provided guidelines for Physical Activity based on the latest evidence on sedentary behavior and health, along with interactions between sedentary behavior and Moderate to Vigorous Physical Activity [47].

This review is limited by its reliance on secondary literature and narrative synthesis, which may introduce selection bias and lack quantitative comparison between studies. Additionally, variability in study designs, measurement tools for sedentary behavior, and population characteristics may affect the consistency of findings. Most included studies are cross-sectional, limiting causal interpretations. Future research should focus on longitudinal and interventional studies to establish causality and quantify safe thresholds of sedentary time. It is also recommended to standardize measurement tools for sedentary behavior and explore culturally specific lifestyle patterns in young adults to develop targeted prevention strategies.

CONCLUSIONS

Sedentary lifestyles have several detrimental implications on health, such as increased risk of cancer, cardiovascular disease, obesity, diabetes mellitus, high cholesterol, high blood pressure and musculoskeletal conditions like osteoporosis. Longer daily inactive periods have a more detrimental influence on health. This is why it is critical to minimize the amount of time spent inactively. The results of research identifying the worst kind of sedentary behavior differed from study to study. According to studies, short bursts of inactivity paired with irregular physical activity, basic muscle training or minimal exercise, periodic breaks from inactivity during rest, and work when combined with physical activity all contribute to improved wellbeing.

Authors' Contribution

Conceptualization: HI, MM, VA, MQ

Methodology: HI, MM, VA

Formal analysis: HI, MM

Writing and Drafting: HI, MM, WP

Review and Editing: HI, MM, WP

All authors approved the final manuscript and take responsibility for the integrity of the work.

Conflicts of Interest

All the authors declare no conflict of interest.

Source of Funding

The author received no financial support for the research, authorship and/or publication of this article.

REFERENCES

- [1] Vallance JK, Gardiner PA, Lynch BM, D'Silva A, Boyle T, Taylor LM, et al. Evaluating the Evidence on Sitting, Smoking, and Health: Is Sitting Really the New Smoking? *American Journal of Public Health*.2018; 108(11): 1478–82. doi: 10.2105/ajph.2018.304649.
- [2] CDC. Physical Activity for Adults: An Overview. Physical Activity Basics. 2024. [Last cited: 29th Dec 2024]. Available at: www.cdc.gov/physical-activity-basics/guidelines/adults.
- [3] Park JH, Moon JH, Kim HJ, Kong MH, Oh YH. Sedentary Lifestyle: Overview of Updated Evidence of Potential Health Risks. *Korean Journal of Family Medicine*.2020;41(6):365–73.doi:10.4082/kjfm.20.0165.
- [4] World Health Organization. Physical Activity. World Health Organization.2024.[Last cited: 29th Dec 2024].Available at: www.who.int/news-room/fact-sheets/detail/physical-activity.
- [5] Vaara JP, Vasankari T, Wyss T, Pihlainen K, Ojanen T, Raitanen J, et al. Device-Based Measures of Sedentary Time and Physical Activity Are Associated with Physical Fitness and Body Fat Content. *Frontiers in Sports and Active Living*.2020;2:587789. doi: 10.3389/fspor.2020.587789.
- [6] Hoang TD, Reis J, Zhu N, Jacobs DR, Launer LJ, Whitmer RA, et al. Effect of Early Adult Patterns of Physical Activity and Television Viewing on Midlife Cognitive Function. *JAMA Psychiatry*.2016; 73(1): 73. doi: 10.1001/jamapsychiatry.2015.2468.
- [7] Staiano AE, Martin CK, Champagne CM, Rood JC, Katzmarzyk PT. Sedentary Time, Physical Activity, and Adiposity in a Longitudinal Cohort of Nonobese Young Adults. *The American Journal of Clinical Nutrition*.2018;108(5):946–52.doi:10.1093/ajcn/nqy191.
- [8] Carter SE, Draijer R, Thompson A, Thijssen DHJ, Hopkins ND. Relationship Between Sedentary Behavior and Physical Activity at Work and Cognition and Mood. *Journal of Physical Activity and Health*. 2020; 17(11): 1140–52. doi: 10.1123/jpah.2019-0632.
- [9] Lavie CJ, Ozemek C, Carbone S, Katzmarzyk PT, Blair SN. Sedentary Behavior, Exercise, and Cardiovascular Health. *Circulation Research*.2019; 124(5): 799–815. doi: 10.1161/circresaha.118.312669.
- [10] British Heart Foundation. Physical Inactivity. British Heart Foundation.2019. [Last cited: 29th Dec 2024] Available at: www.bhf.org.uk/information-support/risk-factors/physical-inactivity.
- [11] Jingjie W, Yang L, Jing Y, Ran L, Yiqing X, Zhou N. Sedentary Time and Its Association with Risk of Cardiovascular Diseases in Adults: An Updated Systematic Review and Meta-Analysis of Observational Studies. *BMC Public Health*.2022; 22(1): 286. doi: 10.1186/s12889-022-12728-6.
- [12] Whitaker KM, Pettee Gabriel K, Buman MP, Pereira MA, Jacobs Jr DR, Reis JP, et al. Associations of Accelerometer-Measured Sedentary Time and Physical Activity with Prospectively Assessed Cardiometabolic Risk Factors: The CARDIA Study. *Journal of the American Heart Association*.2019; 8(1): e010212. doi: 10.1161/jaha.118.010212.
- [13] Patterson R, McNamara E, Tainio M, de Sá TH, Smith AD, Sharp SJ, et al. Sedentary Behavior and Risk of All-Cause, Cardiovascular and Cancer Mortality, and Incident Type 2 Diabetes: A Systematic Review and Dose Response Meta-Analysis. *European Journal of Epidemiology*.2018;33(9):811–29.doi:10.1007/s10654-018-0380-1.
- [14] Dubey P, Yadav SS, Gujjar A. A Study of Risk Factors of Cerebrovascular Accident at a Tertiary Care Centre in Western UP. *IMSEAR*.2019.[Last cited:29th Dec 2024].Available at: pesquisa.bvsalud.org/portal/resource/pt/sea-189319.
- [15] Prajapati D, Khunt S, Patel T, Rathod V. Physical Activity and Energy Expenditure Among Older Adults. *International Archives of Integrated Medicine*.2022; 9(8): 1–9.
- [16] Wang Z, Jin X, Liu Y, Wang C, Li J, Tian L, Teng W. Sedentary Behavior and the Risk of Stroke: A Systematic Review and Dose-Response Meta-Analysis. *Nutrition, Metabolism and Cardiovascular Diseases*.2022;32(12):2705–13.doi:10.1016/j.numecd.2022.08.024.
- [17] Tejada CJ, Mora JF, Acevedo AM, Rodriguez JC, Padilla MD, Garcia LM, et al. Sedentary Lifestyle in the Elderly and Its Association with the Development of Cerebrovascular Disease. *Health Science Journal*. 2023; 17(4): 1–5. doi: 10.36648/1791-809x.17.4.1006.
- [18] Shimbo D. Dietary and Lifestyle Factors in Hypertension. *Journal of Human Hypertension*. 2016; 30(10): 571–2. doi: 10.1038/jhh.2016.57.
- [19] Singh C, Bandre G, Gajbe U, Shrivastava S, Tiwade Y, Bankar N, Moizuddin K. Sedentary Habits and Their Detrimental Impact on Global Health: A Viewpoint. *National Journal of Community Medicine*.2024; 15(2): 154–60. doi: 10.55489/njcm.150220243590.
- [20] Zhang K, Huang S, Feng D, Lang X, Wang Q, Liu Y. Sedentary Behavioral Studies of Young and Middle-Aged Adults with Hypertension in the Framework of Behavioral Epidemiology: A Scoping Review. *International Journal of Environmental Research and Public Health*.2022;19(24):16796.doi:10.3390/

- ijerph192416796.
- [21] Kerr J, Anderson C, Lippman SM. Physical Activity, Sedentary Behavior, Diet, And Cancer: An Update and Emerging New Evidence. *The Lancet Oncology*. 2017Aug;18(8):e457-71. doi:10.1016/S1470-2045(17)30411-4.
- [22] Lee SH, Son C, Yeo S, Ha IH. Cross-Sectional Analysis of Self-Reported Sedentary Behaviors and Chronic Knee Pain Among South Korean Adults Over 50 Years of Age in KNHANES 2013-2015. *BMC Public Health*. 2019; 19(1): 1. doi: 10.1186/s12889-019-7653-9.
- [23] Stefansdottir R and Gudmundsdottir SL. Sedentary Behavior and Musculoskeletal Pain: A Five-Year Longitudinal Icelandic Study. *Public Health*. 2017; 149: 71-3. doi: 10.1016/j.puhe.2017.04.019.
- [24] He N and Ye H. Exercise and Muscle Atrophy. *Physical Exercise for Human Health*. 2020: 255-67. doi: 10.1007/978-981-15-1792-1_17.
- [25] Hyatt HW and Powers SK. Mitochondrial Dysfunction Is a Common Denominator Linking Skeletal Muscle Waste Due to Disease, Aging, and Prolonged Inactivity. *Antioxidants*. 2021; 10(4): 588. doi: 10.3390/antiox10040588.
- [26] Gungor-Orhan I, Akin S, Powers SK, Olgaz-Bingol S, Demirel HA. Sedentary Lifestyle Induces Oxidative Stress and Atrophy in Rat Skeletal Muscle. *Experimental Physiology*. 2024 Jan. doi: 10.1101/2024.09.27.615390.
- [27] Sofra X and Badami S. Adverse Effects of Sedentary Lifestyles: Inflammation, and High-Glucose Induced Oxidative Stress—A Double Blind Randomized Clinical Trial on Diabetic And Prediabetic Patients. *Health*. 2020Aug;12(8):1029-48. doi:10.4236/health.2020.128076.
- [28] Lu AS, Pelarski V, Alon D, Baran A, McGarrity E, Swaminathan N, Sousa CV. The Effect of Narrative Element Incorporation on Physical Activity and Game Experience in Active and Sedentary Virtual Reality Games. *Virtual Reality*. 2023;27(3):1607-22. doi:10.1007/s10055-023-00754-7.
- [29] Kanaley JA, Colberg SR, Corcoran MH, Malin SK, Rodriguez NR, Crespo CJ, et al. Exercise/Physical Activity in Individuals with Type 2 Diabetes: A Consensus Statement from the American College of Sports Medicine. *Medicine and Science in Sports and Exercise*. 2022; 54(2): 353-68. doi: 10.1007/s00125-012-2677-z.
- [30] Baillot A, Chenail S, Barros Polita N, Simoneau M, Libourel M, Nazon E, et al. Physical Activity Motives, Barriers, and Preferences in People with Obesity: A Systematic Review. *PLOS One*. 2021; 16(6): e0253114. doi: 10.1371/journal.pone.0253114.
- [31] Wullems JA, Verschueren SMP, Degens H, Morse CI, Onambélé GL. A Review of the Assessment and Prevalence of Sedentarism in Older Adults, Its Physiology/Health Impact and Non-Exercise Mobility Countermeasures. *Biogerontology*. 2016;17(3):547-65. doi: 10.1007/s10522-016-9640-1.
- [32] Gray CL, Messer LC, Rappazzo KM, Jagai JS, Grabich SC, Lobdell DT. The Association Between Physical Inactivity and Obesity Is Modified by Five Domains of Environmental Quality in U.S. Adults: A Cross-Sectional Study. *PLOS One*. 2018; 13(8):e0203301. doi: 10.1371/journal.pone.0203301.
- [33] Young DR, Hivert MF, Alhassan S, Camhi SM, Ferguson JF, Katzmarzyk PT, et al. Sedentary Behavior and Cardiovascular Morbidity and Mortality: A Science Advisory from the American Heart Association. *Circulation*. 2016;134(13). doi:10.1161/cir.0000000000000440.
- [34] Azizi Z, Alipour P, Raparelli V, Norris CM, Pilote L. The Role of Sex and Gender in Hypertension. *Journal of Human Hypertension*. 2022;37(8):589-95. doi:10.1038/s41371-022-00789-4.
- [35] Flashner BM, Rifas-Shiman SL, Oken E, Camargo CA, Platts-Mills TJ, Workman L, et al. Obesity, Sedentary Lifestyle, And Exhaled Nitric Oxide in An Early Adolescent Cohort. *Pediatric Pulmonology*. 2020 Feb; 55(2): 503-9. doi: 10.1002/ppul.24597.
- [36] Park JH, Joh HK, Lee GS, Je SJ, Cho SH, Kim SJ, et al. Association Between Sedentary Time and Cardiovascular Risk Factors in Korean Adults. *Korean Journal of Family Medicine*. 2018; 39(1): 29. doi: 10.4082/kjfm.2018.39.1.29.
- [37] Musijowska M and Edyta K. Association Between Physical Activity Level, Body Composition, and Phase Angle in University Students from Bioelectrical Impedance Analysis. *Journal of Clinical Medicine*. 2024; 13(10): 2743-3. doi: 10.3390/jcm13102743.
- [38] Dąbrowska-Galas M, Ptaszkowski K, Dąbrowska J. Physical Activity Level, Insomnia and Related Impact in Medical Students in Poland. *International Journal of Environmental Research and Public Health*. 2021; 18(6): 3081. doi: 10.3390/ijerph18063081.
- [39] Wang XS, Chen Y, Zhao YW, Chen MW, Wang H. Assessing the Association Between a Sedentary Lifestyle and Prevalence of Primary Osteoporosis: A Community-Based Cross-Sectional Study Among Chinese Population. *BMJ Open*. 2024 Jun; 14(6): e080243. doi: 10.1136/bmjopen-2023-080243.
- [40] Booth FW, Laye MJ, Roberts MD. Lifetime Sedentary Living Accelerates Some Aspects Of Secondary Aging. *Journal Of Applied Physiology*. 2011 Nov; 111(5): 1497-504. doi: 10.1152/jappphysiol.00420.2011

- [41] Abid F, Khalid H, Qasim F, Qazi A, gul Asif M, Mustafa M. Determining the Relative Risk of Smoking and Physical Inactivity in Developing Osteopenia and Osteoporosis. *Allied Medical Research Journal*. 2023 Jun; 1(2): 50-60. doi: 10.1016/j.bone.2021.116128.
- [42] Xu Z, Xu Q, Wang Y, Zhang J, Liu J, Xu F. Association of Sedentary Behavior and Depression Among College Students. *International Journal of Environmental Research and Public Health*. 2020 May; 17(10): 3545. doi: 10.3390/ijerph17103545
- [43] Huang Y, Li L, Gan Y, Wang C, Jiang H, Cao S, et al. Sedentary Behaviors and Risk of Depression: A Meta-Analysis of Prospective Studies. *Translational Psychiatry*. 2020; 10(1): 1-10. doi: 10.1038/s41398-020-0715-z.
- [44] Kim J, Kim H, Jang SI, Park EC. Association Between Sedentary Behavior and Depression Among South Korean Adolescents. *BMC Psychiatry*. 2022; 22(1): 62. doi: 10.1186/s12888-022-04262-x.
- [45] Lee J, Lee JY, Lee DW, Kim HR, Kang MY. Sedentary Work and Breast Cancer Risk: A Systematic Review and Meta-Analysis. *Journal of Occupational Health*. 2021; 63(1): e12239. doi: 10.1002/1348-9585.12239.
- [46] Park JH, Moon JH, Kim HJ, Kong MH, Oh YH. Sedentary Lifestyle: Overview of Updated Evidence of Potential Health Risks. *Korean Journal of Family Medicine*. 2020; 41(6): 365-73. doi: 10.4082/kjfm.20.0165.
- [47] Dempsey PC, Biddle SJ, Buman MP, Chastin S, Ekelund U, Friedenreich CM, et al. New Global Guidelines on Sedentary Behaviour and Health for Adults: Broadening the Behavioral Targets. *International Journal of Behavioral Nutrition and Physical Activity*. 2020; 17: 1-2. doi: 10.1186/s12966-020-01044-0.