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An overview of the significance of physical activities in academic scholarship of students

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Abstract- The academic performance of students is influenced by several factors which range from such as students' interest, parental attitude and, interaction with peers and teachers to conducive environment required for studies and academic activities both at home and at the learning institutes.In recent decades, increased accessibility to social media and computer orientedrecreations have greatly suffered affectedstudents' participation in physical activities. Lack of engagement in physical activities are often associated with negative implications on students' physical health which indirectly correspond to their emotional, psychological and behavioral changes. These changes could lead to reduced academic performance of students which might further stimulate the deterioration of their emotional and psychological health. The objectives of this paper is to highlight the significance of physical activities in improving academic and scholastic performance of students by reviewing up to dated empirical and review work done on the subject.

Keywords:sports, social media addiction, academic grades, behavior, emotional stability

I. INTRODUCTION

Physical activities and regular exercises are known to impart several beneficial effects on the health of individuals and are considered as the key factors in preventing many health problems such as obesity and overweight (Steinbeck, 2001), cardiovascular disorders (Thompson et al., 2003), diabetes and several other problems associated with inactive lifestyle (Sigal et al., 2004; Blair, 2009). Besides managing physical diseases, effect of physical activities on theimprovement of various types of psychological and mental health problems have also been documented which suggests that physical activity have some role in the psychological and mental wellbeing of students and general youth (Paluska and Schwenk, 2000). Schomer and Drake in 2001 pointed out that physically active people experienced better health, reduced anxiety and depression. Castelli et al. in 2007 evaluated the relation between physical fitness (through physical activities) and academic performance of 259 students which revealed beneficial effects on the academic activities and students achieved better grades. Biddle and Asare (2011) searched out that physical activities had positive association with self-esteem, cognitive functioning, anxiety and depression of adolescents with consequent improvement in their academic performance.

Fit and physically active individuals have been widely perceived to perform better in academic activities because of better mental, emotional and physical health (Castelli et al., 2007). Stress wither whether physical or mental, negatively influences students' peer relation, motivation for study and academic performance.

Many studies have found that psychological stresses, depression and anxiety result in poor academic achievements (Ng and Lee, 2010; Owens et al., 2012). Andrews and Wilding (2004) asserted that financial problems lead to anxiety and depression in British students which proceeded to low academic performance. Hysenbegasi et al. (2005) observed significantly reduced grade point average (GPA) of university undergraduate students diagnosed with depression and anxiety. On the other hand, exercises and physical activities have been widely reported to improve major depressions and psychological health problems of students with healthy effects on their academic activities (Thome and Espelage, 2004; Warburton et al., 2006; Hillman et al., 2008; Trudeau and Shephard, 2008). The aim of this review is to highlight the role of physical activities in promoting psychological health and its consequent effect on academic performance of students.

II. SEDENTARY BEHAVIOR AND ITS IMPLICATIONS

The term sedentary behavior is used for activities which require low level of energy expenditure and include sitting, television viewing, using internet and laying down (Edwardson et al., 2001). Sedentary behavior is common both and children and aged group of people. In-active and sedentary lifestyle lead to physical as well as psychological health problems of children, adolescent men and women.It has been observed in several studies that in-active people, both children and adolescents, are at risk to many types of health issues such as obesity, diabetes, cardiac and vascular cardiovascular diseases, hypertension, and cancers (Hallal, et al., 2006; Hillman et al., 2008). Physical in-activity has been identified as one of the leading non-genetic causes of diabetes type II (Hu et al., 2001; Tuomilehto et al., 2001). Similarly, diet factors and in-active physical behavior are considered as determining elements in obesity –often associated with diabetes II and hypertension in most of the European population (Martínez-González, et al., 1999; Astrup, 2001). It has been documented that most of the breast, colon, kidney, liver, pancreatic and gallbladder cancers show some relations with obesity which is directly or indirectly determined by physical inactivity and sedentary life style of individuals (Anand et al., 2008). There is also sufficient evidence that physically inactive individuals are posed with higher rates of cardiovascular diseases, brain strokes, and congestive heart failures than physically active ones (Warren et al., 2010; Wilmot et al., 2012). Martinez-Gonzalez et al. (2001) revealed that 40.7-91.9% of the population of European Union were physically inactive during leisure time and attributed physical inactivity in adults to major health problems. Warren et al. (2010) estimated that physical inactivity in USA alone was regarded as the second most prevalent cause of death following smoking because of different types of diseases promoted by sedentary life of American peoples.

Besides physical health implications, sedentary lifestyle and inactive behavior is also of great concern in the context of growing cases of psychological problems which are reported every year (Tremblay et al., 2010). Excessive sitting and spending leisure time to watch TV have been associated with depression, anxiety, psychological distress, low self-esteem and loneliness (Hoare et al., 2016). There is some evidence that individuals with sedentary behavior are more prone to depression than physically active ones (Teychenne et al., 2010). Moreover, social isolation and low self-esteem among a significant proportion of individuals are characterized by physical inactivity which could be potentially improved by physical engagement (Richardson et al., 2006). Vallance et al. (2011) outlined that increased sedentary time could potentially develop depression in a population of adults. Thomée et al. (2012) found that computer and internet use among male and female subject caused sleep disturbance and different mental health problems. Women were more at risk of depression than male individuals. Hamer and Stamatakis (2014) reported that TV watching time and internet based activities contributed to development of depression. de Rezende et al. (2014) described that sedentary behavior in adults and children contribute to emotional instability, depression and other mental health problems. Zhai et al. (2015) asserted that sedentary functions and depression were associative in nature among 110152 individuals. More recently, Madhave et al. (2017) reported that among a population of US adults, spending more time in watching TV was a leading cause of depression.

III. PHYSICAL ACTIVITIES AND HEALTH PROMOTION

Engagement in physical activities is often associated with several health benefits.Physical activities which involve different exercises, sport, dance, running, swimming and many other muscular activities which

consume high level of energy than at rest are important health determinants (Thompson et al., 2003; https://www.nhlbi.nih.gov/health/health-topics/topics/phys). Many studies have established that major physical and psychological health problems can be managed by regular physical activities (Bouchard et al., 1994; Warburton et al., 2001; Warburton et al., 2006). Results of empirical studies suggest that active engagement in physical activities on regular basis improves physical and mental health of individuals of different ages(Penedo and Dahn, 2005).Findings of different studies conducted in different population subjects outline that clinical patients of diverse health issues felt significant health improvement after participation in regular physical activities (Fox, 1999; Elley et al., 2003; Weuve et al., 2004). Dunn et al. (2001) concluded from their review that physical activities had association with reduced depression and anxiety symptoms of different aged subjects. Thompson et al. (2003) correlated lower incidence of cardiovascular diseases among male and female subjects to varied nature of physical activities and fitness. Eckel et al. (2005) argued that metabolic syndrome and obesity were linearly correlated which could be managed by excessive participation in physical activities. Strong et al. (2005) recommended at least 60 minutes daily regimes of regular physical activities for students to achieve better health performance. Church et al. (2007) attributed improvement in menopausal abnormalities and overweight disorders in women to regular participation in supervised aerobicexercises. Goodpaster et al. (2010) revealed significant weight loss in patient with severe obesity in response to physical activities and diet modification factors. Lavie et al. (2014) regarded high prevalence of obesity and associated cardiovascular disorders to inactive life style and suggested that those problems could be lowered by adapting appropriate physical exercises. Myers et al. (2014) strongly advocated that increasing physical exercises could lower cardiorespiratory disorders. In general, regular physical activities have been found to be helpful for the management of obesity, diabetes, cardiac and vascular diseases, hypertension, and different types of cancers (Martínez-González, et al., 1999; Astrup, 2001; Hallal, et al., 2006; Hillman et al., 2008).

IV. PHYSICAL ACTIVITIES AND ACADEMIC SCHOLARSHIP OF STUDENTS

From the perspectives of academic activities, stable physical and psychological health of students is crucially required for developing good learning behavior, scholastic attitude and academic scoring. Our thorough review on the topic shows that many studies on the association between physical activities and academic achievement of college and university students are indicative of the importance of physical education in academia and regular participation of students in such activities. Students with differential health problems might face difficulties in concentrating on their academic activities with subsequent poor grades and overall scholastic attitudes. Since many authors have argued that physical and psychological health issues show some correlation (Scott et al., 2016), it is strongly imperative to focus on students' health problems. In school children of different ages, a positive association between physical activities of different types during school time and gain in GPA, self-esteemand overall enhancement of academic performance have been documented in previous studies (Tremblay et al., 2000; Dwyer et al., 2001; Trudeau and Shephard, 2008). Coe et al. (2006) ruled out the significance of physical education; however, they acknowledged that rigorous physical activities among students were strongly linked with better academic grades. Castelli et al. (2007) found positive correlation between physical fitness attained though series of aerobic physical activities with academic achievement of third and fifth grade students of public schools. Barros et al. (2009) suggested provision of class time break of more than 15 minutes daily for physical activities corresponded to better academic and class behavior ratings of students aged between 8 and 9 years. Donnelly and Lambourne (2011) proved 6% enhancement in academic achievement and general cognitive improvement in response to physical activity and they linked the academic and cognitive parameters to physical activity. In their meta-analysis of 50 studies,Rasberry et al. (2011) documented 50.5% positive association between physical activities and academic parameters such as academic achievement, academic behavior, students' attitude and their cognitive skills while 48% studies showed no relation between the academic parameters and physical activities. Attention deficit disorder, a major hindering factor in academic performance of students, wassuccessfully managed by motivating students to participate in 20 minutes physical exercise (Pontifex et al., 2013). Booth et al.(2013) determined that experimental groups (physically active) and control (non-active) selected from students of high school at East Spain during 2007 showed significantly different cognitive performance measured in terms of verbal and non-verbal reasoning, abstract and numerical performance. Students engaged in physical activities were cognitively more functional than control group.

Kantomaa et al. (2013) outlined that physical inactivity directly stimulates obesity which indirectly influence academic performance at adolescent level that can be reversed by regular participation in aerobic exercises. Similar arguments supported by empirical evidence have also been suggested by Ardoy et al. (2014). In a recent study, Donnelly et al. (2017) reported that physical education in curriculum and participation of students in elementary school in East Kansas significantly elevated math, spelling and reading performance than non-active control students.

V. CONCLUSION AND FUTURE DIRECTIONS

In this study we have surveyed the available published reports on the role of physical activities and physical education on the scholastic performance of school students. Majority of the studies carried out on the topic suggested that physical activities were the key determinants in maintaining physical and behavioral health of students. While it was evident from the findings of many reports that sedentary life caused different health problems such as obesity, hypertension, cardiovascular diseases, bone abnormalities and psychological problems such as anxiety, depression, behavioral changes and low self-esteem, a direct or indirect link between these problems and academic suffering had been assumed. It was also clearly perceptible that active engagement of individuals in regular exercise could lead to reduced risk of physical and psychological health issues. The role of physical education as part of curriculum had also positive role in contributing to better academic performance. On the basis of the available data regarding the association between physical activities and academic performance of students, it is concluded that physical activities have beneficial role in maintaining physical and behavioral health of students which directly influence their academic activities. Major behavioral issues of students which improve as result of physical activities include loneliness, low self-esteem and attention deficit disorder. Thus, meta review analysis suggests that physical activities promote general health, academically desired behavior and overall scholastic performance of students and should be an integral component of curriculum of academia. Since, results reviewed in this review were concerned with school students; future studies are directed for finding association between physical activities and academic achievement at college and university level. Moreover, it is also desirous that link between the gender of students, type of physical activity and duration of physical activity be worked out to fully understand their influence on the academic performance.

REFERENCES

1. Anand, P., Kunnumakara, A. B., Sundaram, C., Harikumar, K. B., Tharakan, S. T., Lai, O. S., & Aggarwal, B. B. (2008). Cancer is a preventable disease that requires major lifestyle changes. *Pharmaceutical Research*, 25(9), 2097-2116.
2. Andrews, B., & Wilding, J. M. (2004). The relation of depression and anxiety to life-stress and achievement in students. *British Journal of Psychology*, 95(4), 509-521.
3. Ardoy, D. N., Fernández-Rodríguez, J. M., Jiménez-Pavón, D., Castillo, R., Ruiz, J. R., & Ortega, F. B. (2014). A physical education trial improves adolescents' cognitive performance and academic achievement: the EDUFIT study. *Scandinavian Journal of Medicine & Science in Sports*, 24(1), e52-e61.
4. Astrup, A. (2001). Healthy lifestyles in Europe: prevention of obesity and type II diabetes by diet and physical activity. *Public health nutrition*, 4(2b), 499-515.
5. Barros, R. M., Silver, E. J., & Stein, R. E. (2009). School recess and group classroom behavior. *Pediatrics*, 123(2), 431-436.
6. Biddle, S. J., &Asare, M. (2011). Physical activity and mental health in children and adolescents: a review of reviews. *British Journal of Sports Medicine*, 45(11), 886-895.
7. Blair, S. N. (2009). Physical inactivity: the biggest public health problem of the 21st century. *British Journal of Sports Medicine*, 43(1), 1-2.
8. Booth, J. N., Leary, S. D., Joinson, C., Ness, A. R., Tomporowski, P. D., Boyle, J. M., & Reilly, J. J. (2014). Associations between objectively measured physical activity and academic attainment in adolescents from a UK cohort. *British Journal of Sports Medicine*, 48(3), 265-270.

9. Bouchard. C., & Shephard, R.J. (2012). Physical activity fitness and health: the model and key concepts. In: Bouchard C, Shephard RJ, Stephens T, editors. Physical activity fitness and health: International proceedings and consensus statement. Champaign (IL): Human Kinetics; 1994. p. 77-88.
10. Castelli, D. M., Hillman, C. H., Buck, S. M., & Erwin, H. E. (2007). Physical fitness and academic achievement in third-and fifth-grade students. *Journal of Sport and Exercise Psychology,* 29(2), 239-252.
11. Church, T. S., Earnest, C. P., Skinner, J. S., & Blair, S. N. (2007). Effects of different doses of physical activity on cardiorespiratory fitness among sedentary, overweight or obese postmenopausal women with elevated blood pressure: a randomized controlled trial. *Jama*, 297(19), 2081-2091.
12. Coe, D. P., Pivarnik, J. M., Womack, C. J., Reeves, M. J., & Malina, R. M. (2006). Effect of physical education and activity levels on academic achievement in children. *Medicine & Science in Sports & Exercise*, 38(8), 1515-1519.
13. de Rezende, L. F. M., Lopes, M. R., Rey-López, J. P., Matsudo, V. K. R., & do Carmo Luiz, O. (2014). Sedentary behavior and health outcomes: an overview of systematic reviews. *PloS One*, 9(8), e105620.
14. Donnelly, J. E., & Lambourne, K. (2011). Classroom-based physical activity, cognition, and academic achievement. *Preventive Medicine*, 52, S36-S42.
15. Donnelly, J. E., Hillman, C. H., Greene, J. L., Hansen, D. M., Gibson, C. A., Sullivan, D. K., & Herrmann, S. D. (2017). Physical activity and academic achievement across the curriculum: Results from a 3-year cluster-randomized trial. *Preventive Medicine*, 99, 140-145.
16. Dunn, A. L., Trivedi, M. H., & O'Neal, H. A. (2001). Physical activity dose-response effects on outcomes of depression and anxiety. Database of Abstracts of Reviews of Effects (DARE): Quality-Assessed Reviews [Internet].
17. Dwyer, T., Sallis, J. F., Blizzard, L., Lazarus, R., & Dean, K. (2001). Relation of academic performance to physical activity and fitness in children. *Pediatric Exercise Science*, 13(3), 225-237.
18. Eckel, R. H., Grundy, S. M., &Zimmet, P. Z. (2005). The metabolic syndrome. *The lancet*, 365(9468), 1415-1428.
19. Edwardson, C. L., Gorely, T., Davies, M. J., Gray, L. J., Khunti, K., Wilmot, E. G., & Biddle, S. J. (2012). Association of sedentary behaviour with metabolic syndrome: a meta-analysis. *PloS one*, 7(4), e34916.
20. Elley, C. R., Kerse, N., Arroll, B., & Robinson, E. (2003). Effectiveness of counselling patients on physical activity in general practice: cluster randomized controlled trial. *Bmj*, 326(7393), 793.
21. Fox, K. R. (1999). The influence of physical activity on mental well-being. *Public Health Nutrition*, 2(3a), 411-418.
22. Goodpaster, B. H., DeLany, J. P., Otto, A. D., Kuller, L., Vockley, J., South-Paul, J. E., ... & Lang, W. (2010). Effects of diet and physical activity interventions on weight loss and cardiometabolic risk factors in severely obese adults: a randomized trial. *Jama,* 304(16), 1795-1802.
23. Hallal, P. C., Victora, C. G., Azevedo, M. R., & Wells, J. C. (2006). Adolescent physical activity and health. *Sports Medicine*, 36(12), 1019-1030.
24. Hamer, M., & Stamatakis, E. (2014). Prospective study of sedentary behavior, risk of depression, and cognitive impairment. *Medicine and Science in Sports and Exercise*, 46(4), 718.
25. Hillman, C. H., Erickson, K. I., & Kramer, A. F. (2008). Be smart, exercise your heart: exercise effects on brain and cognition. *Nature reviews. Neuroscience*, 9(1), 58.
26. Hoare, E., Milton, K., Foster, C., & Allender, S. (2016). The associations between sedentary behaviour and mental health among adolescents: a systematic review. *International Journal of Behavioral Nutrition and Physical Activity*, 13(1), 108.
27. Hu, F. B., Manson, J. E., Stampfer, M. J., Colditz, G., Liu, S., Solomon, C. G., & Willett, W. C. (2001). Diet, lifestyle, and the risk of type 2 diabetes mellitus in women. *New England Journal of Medicine*, 345(11), 790-797.
28. Hysenbegasi, A., Hass, S. L., & Rowland, C. R. (2005). The impact of depression on the academic productivity of university students. *Journal of Mental Health Policy and Economics*, 8(3), 145.
29. Kantomaa, M. T., Stamatakis, E., Kankaanpää, A., Kaakinen, M., Rodriguez, A., Taanila, A., &Tammelin, T. (2013). Physical activity and obesity mediate the association between childhood motor function and adolescents' academic achievement. *Proceedings of the National Academy of Sciences,* 110(5), 1917-1922.
30. Lavie, C. J., McAuley, P. A., Church, T. S., Milani, R. V., & Blair, S. N. (2014). Obesity and cardiovascular diseases: implications regarding fitness, fatness, and severity in the obesity paradox. *Journal of the American College of Cardiology*, 63(14), 1345-1354.

31. Madhav, K. C., Sherchand, S. P., &Sherchan, S. (2017). Association between screen time and depression among US adults. *Preventive Medicine Reports*.
32. Martínez-González, M. Á., Alfredo Martinez, J., Hu, F. B., Gibney, M. J., & Kearney, J. (1999). Physical inactivity, sedentary lifestyle and obesity in the European Union. *International Journal of Obesity & Related Metabolic Disorders*, 23(11).
33. Martinez-Gonzalez, M. A., Varo, J. J., Santos, J. L., Irala, J. D., Gibney, M. J., Kearney, J., & Martinez, J. A. (2001). Prevalence of physical activity during leisure time in the European Union.
34. Myers, J., McAuley, P., Lavie, C. J., Despres, J. P., Arena, R., & Kokkinos, P. (2015). Physical activity and cardiorespiratory fitness as major markers of cardiovascular risk: their independent and interwoven importance to health status. *Progress in cardiovascular diseases*, 57(4), 306-314.
35. Ng, E., & Lee, K. (2010). Children's task performance under stress and non-stress conditions: A test of the processing efficiency theory. *Cognition and Emotion*, 24(7), 1229-1238.
36. Owens, M., Stevenson, J., Hadwin, J. A., & Norgate, R. (2012). Anxiety and depression in academic performance: An exploration of the mediating factors of worry and working memory. *School Psychology International*, 33(4), 433-449.
37. Paluska, S. A., &Schwenk, T. L. (2000). Physical activity and mental health. *Sports medicine*, 29(3), 167-180.
38. Penedo, F. J., & Dahn, J. R. (2005). Exercise and well-being: a review of mental and physical health benefits associated with physical activity. *Current opinion in psychiatry*, 18(2), 189-193.
39. Pontifex, M. B., Saliba, B. J., Raine, L. B., Picchietti, D. L., & Hillman, C. H. (2013). Exercise improves behavioral, neurocognitive, and scholastic performance in children with attention-deficit/hyperactivity disorder. *The Journal of pediatrics*, 162(3), 543-551.
40. Rasberry, C. N., Lee, S. M., Robin, L., Laris, B. A., Russell, L. A., Coyle, K. K., &Nihiser, A. J. (2011). The association between school-based physical activity, including physical education, and academic performance: a systematic review of the literature. *Preventive medicine*, 52, S10-S20.
41. Richardson, C. R., Faulkner, G., McDevitt, J., Skrinar, G. S., Hutchinson, D. S., &Piette, J. D. (2005). Integrating physical activity into mental health services for persons with serious mental illness. *Psychiatric services*, 56(3), 324-331.
42. Schomer, H. H., & Drake, B. S. (2001). Physical activity and mental health. *International SportMed Journal*, 2(3), 1-9.
43. Scott, K. M., Lim, C., Al-Hamzawi, A., Alonso, J., Bruffaerts, R., Caldas-de-Almeida, J. M., & Kawakami, N. (2016). Association of mental disorders with subsequent chronic physical conditions: world mental health surveys from 17 countries. *JAMA psychiatry*, 73(2), 150-158.
44. Sigal, R. J., Kenny, G. P., Wasserman, D. H., & Castaneda-Sceppa, C. (2004). Physical activity/exercise and type 2 diabetes*. Diabetes care*, 27(10), 2518-2539.
45. Steinbeck, K. S. (2001). The importance of physical activity in the prevention of overweight and obesity in childhood: a review and an opinion. *Obesity reviews*, 2(2), 117-130.
46. Strong, W. B., Malina, R. M., Blimkie, C. J., Daniels, S. R., Dishman, R. K., Gutin, B., ... & Rowland, T. (2005). Evidence based physical activity for school-age youth. *The Journal of pediatrics*, 146(6), 732-737.
47. Teychenne, M., Ball, K., & Salmon, J. (2010). Sedentary behavior and depression among adults: a review. *International journal of behavioral medicine*, 17(4), 246-254.
48. Thome, J., &Espelage, D. L. (2004). Relations among exercise, coping, disordered eating, and psychological health among college students. *Eating behaviors*, 5(4), 337-351.
49. Thomée, S., Härenstam, A., & Hagberg, M. (2012). Computer use and stress, sleep disturbances, and symptoms of depression among young adults–a prospective cohort study. *BMC psychiatry*, 12(1), 176.
50. Thompson, P. D., Buchner, D., Piña, I. L., Balady, G. J., Williams, M. A., Marcus, B. H., & Fletcher, G. F. (2003). Exercise and physical activity in the prevention and treatment of atherosclerotic cardiovascular disease. *Circulation*, 107(24), 3109-3116.
51. Tremblay, M. S., Colley, R. C., Saunders, T. J., Healy, G. N., & Owen, N. (2010). Physiological and health implications of a sedentary lifestyle. Applied Physiology, *Nutrition, and Metabolism*, 35(6), 725-740.
52. Tremblay, M. S., Inman, J. W., &Willms, J. D. (2000). The relationship between physical activity, self-esteem, and academic achievement in 12-year-old children. *Pediatric exercise science*, 12(3), 312-323.
53. Trudeau, F., & Shephard, R. J. (2008). Physical education, school physical activity, school sports and academic performance. *International Journal of Behavioral Nutrition and Physical Activity*, 5(1), 10.

54. Trudeau, F., & Shephard, R. J. (2008). Physical education, school physical activity, school sports and academic performance. *International Journal of Behavioral Nutrition and Physical Activity*, 5(1), 10.
55. Tuomilehto, J., Lindström, J., Eriksson, J. G., Valle, T. T., Hämäläinen, H., Ilanne-Parikka, P., &Salminen, V. (2001). Prevention of type 2 diabetes mellitus by changes in lifestyle among subjects with impaired glucose tolerance. *New England Journal of Medicine*, 344(18), 1343-1350.
56. Vallance, J. K., Winkler, E. A., Gardiner, P. A., Healy, G. N., Lynch, B. M., & Owen, N. (2011). Associations of objectively-assessed physical activity and sedentary time with depression: NHANES (2005–2006). *Preventive medicine*, 53(4), 284-288.
57. Warburton, D. E., Gledhill, N., & Quinney, A. (2001). The effects of changes in musculoskeletal fitness on health. *Canadian Journal of Applied Physiology*, 26(2), 161-216.
58. Warburton, D. E., Nicol, C. W., & Bredin, S. S. (2006). Health benefits of physical activity: the evidence. *Canadian medical association journal*, 174(6), 801-809.
59. Warren, T. Y., Barry, V., Hooker, S. P., Sui, X., Church, T. S., & Blair, S. N. (2010). Sedentary behaviors increase risk of cardiovascular disease mortality in men. *Medicine and science in sports and exercise*, 42(5), 879.
60. Weuve, J., Kang, J. H., Manson, J. E., Breteler, M. M., Ware, J. H., &Grodstein, F. (2004). Physical activity, including walking, and cognitive function in older women. *Jama*, 292(12), 1454-1461.
61. Wilmot, E. G., Edwardson, C. L., Achana, F. A., Davies, M. J., Gorely, T., Gray, L. J., & Biddle, S. J. (2012). Sedentary time in adults and the association with diabetes, cardiovascular disease and death: systematic review and meta-analysis. *Diabetologia*, 55(11), 2895-2905.
62. Zhai, L., Zhang, Y., & Zhang, D. (2015). Sedentary behaviour and the risk of depression: a meta-analysis. *British Journal of Sports Medicine*, 49(11), 705-709.