



Importance of Physical Activity in Preventing Lifestyle Diseases

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Abstract:

Lifestyle diseases such as cardiovascular disease, type 2 diabetes, obesity, and certain cancers are among the leading causes of mortality worldwide. Sedentary behavior and other lifestyle factors that can be changed are highly associated with these non-communicable diseases. Physical activity has been consistently shown to play a critical role in the prevention and management of these conditions. Regular exercise improves cardiovascular health, enhances insulin sensitivity, regulates body weight, reduces inflammation, and lowers the risk of premature death. Additionally, exercise has a good impact on cognitive performance and mental wellness. Despite its proven benefits, global levels of physical inactivity remain high. This paper explores current research on how physical activity prevents lifestyle diseases, highlights the mechanisms involved, and emphasizes the need for integrating exercise into daily life. Public health strategies and education systems must prioritize physical activity to reduce the burden of lifestyle-related diseases and improve population-wide health outcomes.

Introduction:

The 21st century has witnessed an alarming rise in lifestyle diseases, also known as non-communicable diseases (NCDs), including cardiovascular disease, type 2 diabetes, obesity, hypertension, and various types of cancer. These diseases have become the leading cause of death globally, accounting for nearly 74% of all deaths worldwide as of 2022, according to the World Health Organization (**WHO, 2022**). Unlike infectious diseases, lifestyle diseases are largely preventable and are driven by behavioral risk factors such as poor diet, tobacco use, harmful alcohol consumption, and physical inactivity.

Among these, physical inactivity has emerged as one of the most critical and modifiable risk factors contributing to this global health crisis.

According to WHO (2010), physical activity is any movement of the body made by the skeletal muscles that involves the use of energy. It is crucial for maintaining physical fitness as well as for managing and preventing chronic illnesses. Despite its proven benefits, global levels of physical inactivity remain high. The WHO reports that more than 1 in 4 adults and 4 in 5 adolescents worldwide do not meet the recommended levels of physical activity (**WHO, 2020**). If current trends

continue, an estimated 500 million new cases of preventable NCDs could occur between 2020 and 2030, with the majority affecting low- and middle-income countries **(WHO, 2022)**.

The increasing urbanization, mechanization, and digitalization of daily life have contributed significantly to reduced levels of physical activity. Modern lifestyles often involve prolonged periods of sitting at desks, in vehicles, or in front of screens which can lead to what researchers refer to as “sedentary behavior patterns”. These patterns not only reduce calorie expenditure but also have independent negative effects on metabolism, circulation, and hormonal balance **(Booth et al., 2012)**.

The benefits of regular physical activity span across physiological, psychological, and social domains. Physically active individuals have lower risks of heart disease, stroke, high blood pressure, type 2 diabetes, certain cancers (particularly breast and colon), and obesity **(Warburton & Bredin, 2017)**. In addition to these physical benefits, exercise plays a vital role in enhancing mental health by reducing symptoms of depression, anxiety, and stress, and improving self-esteem and cognitive function, especially among older adults **(Reiner et al., 2013)**.

Moreover, the mechanisms through which physical activity confers protection against disease are multifaceted. Exercise improves insulin sensitivity, lipid metabolism, vascular function, and helps regulate body weight. It also reduces systemic inflammation, boosts immune function, and positively influences

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hormonal balance **(Pedersen & Saltin, 2015)**. All of these factors work together to lower the risk and advancement of chronic illnesses. Longitudinal studies have provided compelling evidence of the protective role of physical activity. For instance, the Caerphilly Cohort Study conducted in Wales followed middle-aged men over a period of 30 years and found that those who engaged in regular exercise had significantly lower rates of vascular disease, diabetes, dementia, and cancer **(Elwood et al., 2013)**. Similarly, a meta-analysis by **Arem et al. (2015)** involving over 660,000 adults concluded that even modest levels of physical activity were associated with substantial reductions in all-cause mortality.

In recognition of these findings, global and national health agencies have developed evidence-based physical activity guidelines. The WHO recommends that adults aged 18-64 years engage in at least 150-300 minutes of moderate-intensity aerobic activity or 75-150 minutes of vigorous-intensity activity per week, along with muscle-strengthening activities on two or more days **(WHO, 2020)**. However, adherence to these guidelines remains inconsistent, particularly among women, older adults, and individuals in low-income communities.

There are serious financial repercussions when physical activity is not prioritized as a public health approach. According to research in The Lancet Global Health, the direct costs of physical inactivity to healthcare systems worldwide were projected to be over \$54 billion in

2013 alone. This figure also includes productivity losses from premature mortality (**Ding et al., 2016**). These numbers are expected to increase significantly if immediate action is not taken.

This paper aims to explore the critical role of physical activity in preventing lifestyle diseases, examining its physiological mechanisms, reviewing current research evidence, and emphasizing policy and behavioral strategies needed to combat rising levels of inactivity. By understanding and addressing this issue, individuals and societies can work toward healthier, longer, and more productive lives.

Review of Literature:

The importance of physical activity in preventing lifestyle-related diseases has been extensively documented in scientific literature. Physical inactivity is recognized as a leading risk factor for non-communicable diseases (NCDs) such as cardiovascular disease, type 2 diabetes, obesity, certain cancers, and mental health disorders (**Lee et al., 2012**). Numerous studies have demonstrated that engaging in regular physical activity significantly reduces the risk and severity of these conditions.

Among the most well-established health advantages of physical activity are those related to the cardiovascular system. **Warburton et al. (2006)** reviewed evidence showing that regular aerobic exercise improves endothelial function, reduces blood pressure, and improves lipid profiles, leading to a lower risk of

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coronary artery disease and stroke. Additionally, **Myers et al. (2015)** shown that physical fitness is a more accurate predictor of death than traditional risk factors such as high blood pressure or smoking.

Numerous studies have also been conducted on the function that physical activity plays in the management and prevention of type 2 diabetes. The Diabetes Prevention Program Research Group (2002) reported that lifestyle interventions emphasizing increased physical activity reduced the incidence of type 2 diabetes by 58% among high-risk individuals. This effect is mediated through improved insulin sensitivity and reduction in visceral fat (**Hawley & Lessard, 2008**).

Obesity prevention is closely linked to physical activity, as it influences energy balance by increasing caloric expenditure. Physical activity also aids weight maintenance after loss, reducing the risk of obesity-related complications (**Jakicic & Davis, 2011**). Moreover, physical activity has been associated with lower risks of certain cancers, particularly breast and colon cancer, possibly through hormonal regulation, immune modulation, and reduction of inflammation (**Friedenreich & Orenstein, 2002**).

In addition to physical benefits, recent literature highlights mental health advantages, including reduced symptoms of depression and anxiety, and improved cognitive function (**Schuch et al., 2016**). Mechanistically, these benefits are linked to increased neurogenesis, release of

neurotransmitters, and reduced systemic inflammation (**Cotman et al., 2007**).

Globally, physical inactivity rates are still high despite the overwhelming evidence in favor of physical activity (**Guthold et al., 2018**). This has led to global health initiatives promoting physical activity as a public health priority, with guidelines emphasizing at least 150 minutes of moderate-intensity activity per week for adults (**World Health Organization, 2020**).

Health Benefits of Physical Activity:

Regular physical activity is widely recognized as a cornerstone of good health and one of the most effective tools for preventing and managing a wide range of lifestyle-related diseases. Its benefits extend beyond physical fitness, encompassing cardiovascular health, metabolic regulation, mental well-being, immune function, and overall quality of life. This section outlines the major health benefits supported by scientific research.

Cardiovascular Health:

Regular physical activity is one of the most effective lifestyle interventions for promoting cardiovascular health and preventing cardiovascular diseases (CVD), which remain the leading cause of mortality worldwide. The World Health Organization (2022) estimates that cardiovascular diseases (CVDs) account for 17.9 million deaths annually, or 32% of all fatalities worldwide. These include conditions such as coronary artery disease, heart failure, stroke, hypertension, and peripheral artery disease. Fortunately, many of these conditions are preventable

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or manageable through consistent engagement in physical activity.

Physiological Benefits of Physical Activity:

Physical activity enhances cardiovascular function through several key mechanisms. First, it makes the heart muscle stronger, which makes it possible for the heart to pump blood more effectively with each beat and lowers the resting heart rate. Regular aerobic exercise also improves endothelial function, facilitating better dilation of blood vessels and promoting healthy blood pressure regulation (**Green et al., 2004**).

Exercise also significantly improves lipid profiles by increasing levels of high-density lipoprotein (HDL) cholesterol and reducing low-density lipoprotein (LDL) cholesterol and triglycerides. These changes reduce the formation of arterial plaques and the risk of atherosclerosis, a major contributor to heart attacks and strokes (**Kodama et al., 2007**). Furthermore, physical activity enhances insulin sensitivity, reduces inflammation, and promotes weight control, all of which are critical in reducing cardiovascular risk.

Impact on Hypertension and Blood Pressure:

Physical activity has a direct effect on lowering systolic and diastolic blood pressure, particularly in individuals with hypertension. Meta-analyses have shown that aerobic exercise can reduce systolic blood pressure by an average of 5-7 mmHg, which can significantly lower the risk of stroke and heart disease (**Cornelissen & Smart, 2013**). Even light-

to-moderate activity, such as brisk walking, has been associated with meaningful reductions in blood pressure in both hypertensive and normotensive individuals.

Reduced Risk of Cardiovascular Events and Mortality:

Numerous studies confirm that individuals who engage in regular physical activity have a substantially lower risk of cardiovascular events. A large prospective study by **Sattelmair et al. (2011)**, involving over 33,000 men and women, found that 150 minutes of moderate-intensity exercise per week was associated with a 14% reduction in coronary heart disease risk, while greater amounts of exercise conferred even more protection.

Moreover, physical inactivity is associated with a higher risk of sudden cardiac death, particularly in individuals with existing heart conditions. Regular physical activity contributes to cardiac remodeling, reduced arrhythmia risk, and improved heart rate variability, all of which enhance cardiac resilience and reduce mortality (**Warburton & Bredin, 2017**).

Type 2 Diabetes and Metabolic Syndrome:

Type 2 diabetes (T2D) and metabolic syndrome are among the most prevalent and costly lifestyle-related health conditions worldwide. Both are closely associated with insulin resistance, obesity, physical inactivity, and poor dietary habits. As of 2021, over 537 million adults globally were living with diabetes, with Type 2 accounting for approximately 90-

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95% of all cases (**International Diabetes Federation [IDF], 2021**). Almost 25 percent of adults worldwide suffer from metabolic syndrome, a group of disorders that includes dyslipidemia, increased fasting glucose, hypertension, and abdominal obesity. It dramatically raises the risk of both type 2 diabetes and cardiovascular disease (**Alberti et al., 2009**).

Physical Activity's Contribution to the Prevention of Type 2 Diabetes:

Extensive research demonstrates that regular physical activity significantly reduces the risk of developing T2D. Physical activity enhances insulin sensitivity, allowing muscle cells to better absorb glucose from the bloodstream without the need for excessive insulin production (Hawley & Lessard, 2008). Even a single bout of moderate-intensity aerobic exercise improves insulin action for up to 48 hours, highlighting the immediate metabolic benefits of movement (**Mikines et al., 1988**).

The Diabetes Prevention Program (DPP), a large-scale clinical trial conducted in the U.S., found that lifestyle intervention involving 150 minutes of moderate physical activity per week, along with a modest reduction in body weight, reduced the incidence of T2D by 58% in high-risk individuals compared to a 31% reduction in those treated with the medication metformin alone (**Knowler et al., 2002**). These findings underscore the superior preventive power of lifestyle changes, especially physical activity.

Physical Activity and Glycemic Control in People with T2D:

Physical activity is crucial for controlling blood glucose levels, enhancing HbA1c, a measure of long-term glycemic management, and lowering the requirement for insulin or oral medicines in people with Type 2 diabetes (**Colberg et al., 2016**). Both aerobic (e.g., walking, cycling) and resistance training (e.g., weightlifting) have been shown to improve glucose uptake by muscle cells, reduce visceral fat, and decrease systemic inflammation.

Meta-analyses have shown that regular exercise can lower HbA1c by an average of 0.6%, which is comparable to the effect of many antidiabetic drugs (**Umpierre et al., 2011**). Importantly, combining aerobic and resistance training provides greater benefits than either form of exercise alone (**Church et al., 2010**).

Impact on Metabolic Syndrome:

Physical activity is also a powerful tool in combating metabolic syndrome. It improves several of the syndrome's defining criteria: lowering blood pressure, improving lipid profiles (increasing HDL and lowering triglycerides), and reducing abdominal obesity. A systematic review by **Kelley & Kelley (2008)** found that aerobic training led to significant improvements in multiple metabolic syndrome components in both men and women.

Additionally, physical activity helps reduce low-grade chronic inflammation, which is believed to be a key driver of insulin resistance and metabolic dysfunction (**Pedersen & Saltin, 2015**). Exercise modulates

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inflammatory markers such as C-reactive protein (CRP) and tumor necrosis factor-alpha (TNF- α), contributing to improved metabolic outcomes.

Obesity and Weight Management:

One of the biggest issues facing public health in the twenty-first century is obesity. Characterized by an excessive accumulation of body fat, obesity significantly increases the risk of a variety of non-communicable diseases (NCDs), including type 2 diabetes, cardiovascular disease, stroke, hypertension, osteoarthritis, and several cancers. The World Health Organization (**WHO, 2022**) reports that worldwide obesity has nearly tripled since 1975, with over 650 million adults classified as obese and more than 1.9 billion as overweight. Importantly, obesity is largely preventable and reversible, with physical activity playing a central role in both its prevention and management.

Role of Physical Activity in Weight Regulation:

Physical activity promotes energy balance, which is crucial for weight control. Whenever calorie intake gradually surpasses energy expenditure, weight gain results. Exercise increases total daily energy expenditure, both during the activity itself and through subsequent metabolic effects such as elevated post-exercise oxygen consumption (EPOC) and muscle repair processes (**Donnelly et al., 2009**).

Furthermore, regular physical activity helps preserve lean body mass during periods of caloric restriction, which

is important for maintaining basal metabolic rate (BMR) a key factor in long-term weight maintenance **(Stiegler & Cunliffe, 2006)**. Without exercise, weight loss through dieting alone often leads to a significant loss of muscle mass, reducing metabolism and increasing the risk of weight regain.

Exercise for Weight Loss:

While dietary changes are typically more effective for short-term weight loss, exercise is essential for sustained weight loss and prevention of weight regain. More than 90 percent of members in the National Weight Control Registry (NWCR), which monitors people who have successfully sustained significant weight loss, regularly exercise, frequently for more than 200–300 minutes per week **(Catenacci et al., 2008)**.

Aerobic activities such as walking, cycling, and swimming are effective for burning calories and improving cardiovascular health, while resistance training helps build and preserve muscle mass, further aiding fat loss. A combination of both exercise types is recommended for optimal results.

According to meta-analyses, weight loss from dietary interventions plus physical activity is noticeably higher than that from diet alone. For example, a systematic review by **Johns et al. (2014)** found that individuals in combined diet and exercise interventions lost an average of 1.5-3.0 kg more than those in diet-only groups after 12 months.

Prevention of Weight Regain:

Weight regain is a common challenge following weight loss. Physical
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activity is a key predictor of successful long-term maintenance. Regular moderate-to-vigorous physical activity helps counteract metabolic adaptations (e.g., reduced resting energy expenditure) that occur after weight loss and contributes to appetite regulation and improved psychological resilience **(MacLean et al., 2015)**.

Additional Health Benefits Beyond Weight Loss:

Importantly, even when significant weight loss is not achieved, regular physical activity can reduce visceral fat, improve cardio metabolic health, and lower the risk of disease. This underscores the value of promoting exercise for health benefits regardless of body weight **(Ross et al., 2020)**.

Cancer Prevention:

In 2020 alone, cancer claimed around 10 million lives, making it a major source of morbidity and mortality globally **(WHO, 2021)**. While genetic predisposition plays a role, lifestyle factors, including physical inactivity, poor diet, tobacco use, and obesity, are major modifiable risk factors. Increasing evidence highlights that regular physical activity is a potent, low-cost strategy for reducing the risk of several types of cancer.

Physical Activity and Cancer Risk Reduction:

Epidemiological studies consistently show that physically active individuals have a lower risk of developing several common cancers, especially breast, colon, and endometrial

cancers (**McTiernan, 2008; Friedenreich et al., 2016**). A meta-analysis by **Moore et al. (2016)**, which pooled data from over one million participants, found that higher levels of physical activity were associated with a 7-20% reduced risk for 13 different cancer types.

Breast Cancer: Physical activity reduces breast cancer risk by approximately 20-30%, potentially through mechanisms such as decreased circulating estrogen levels, improved immune function, and reduced inflammation (**Friedenreich & Orenstein, 2002**). Women who are premenopausal or postmenopausal both exhibit this protective effect.

Colorectal Cancer: Regular exercise is associated with a 20-25% lower risk of colorectal cancer. Physical activity enhances bowel motility, reducing the time carcinogens remain in contact with the intestinal lining, and improves insulin sensitivity, which modulates cell growth (**Wolin et al., 2009**).

Endometrial Cancer: Physical activity is linked to a 30% reduction in endometrial cancer risk, likely due to its role in reducing body fat and regulating hormones such as estrogen and insulin, which can influence endometrial cell proliferation (**Zhao et al., 2017**).

Biological Mechanisms:

Several Biological Mechanisms Explain How Physical Activity May Reduce Cancer Risk: Hormonal Regulation: Exercise decreases levels of hormones such as estrogen and insulin-like growth factors, which promote the growth of some tumors (**McTiernan, 2008**).

Immune System Enhancement: Physical activity boosts immune surveillance by increasing the activity of natural killer cells and other immune components that help identify and destroy malignant cells (**Pedersen & Hoffman-Goetz, 2000**).

Reduction of Inflammation: Chronic low-grade inflammation contributes to tumor development. Exercise reduces inflammatory markers like C-reactive protein (CRP) and interleukin-6 (IL-6), thereby reducing cancer-promoting inflammation (**Campbell et al., 2019**).

Improved DNA Repair and Antioxidant Defense: Physical activity enhances DNA repair mechanisms and antioxidant enzyme activity, protecting cells from genetic mutations that can lead to cancer (**Thompson et al., 2008**).

Physical Activity After Cancer Diagnosis:

Physical activity is also beneficial for cancer survivors, improving quality of life, reducing fatigue, and lowering the risk of cancer recurrence and mortality (**Schmitz et al., 2010**). Exercise programs tailored to individual abilities are now a standard part of survivorship care plans.

Public Health Implications:

Given the strong evidence, major health organizations, including the World Cancer Research Fund/American Institute for Cancer Research (WCRF/AICR) and the American Cancer Society, recommend adults engage in at least 150 minutes of moderate-intensity or 75 minutes of vigorous-intensity physical activity per week to reduce cancer risk (**Rock et al., 2020**).

Mental Health, Bone and Cognitive Benefits:

Physical activity is widely recognized not only for its physical health benefits but also for its profound positive impact on mental health, bone health, and cognitive function. These benefits contribute significantly to overall well-being across the lifespan.

Mental Health Benefits:

Engaging in regular physical activity is strongly associated with improved mental health and psychological well-being. Exercise helps reduce symptoms of depression, anxiety, and stress by modulating neurotransmitter systems such as serotonin, dopamine, and endorphins the body's natural mood elevators **(Paluska & Schwenk, 2000)**. A meta-analysis by **Schuch et al. (2016)** found that exercise has a large, clinically significant antidepressant effect comparable to psychotherapy and pharmacotherapy for mild to moderate depression.

Physical activity also enhances self-esteem, sleep quality, and resilience to stress, contributing to overall emotional stability **(Biddle & Asare, 2011)**. In adolescents and young adults, exercise is associated with improved mood and reduced risk of developing mental disorders **(Lubans et al., 2016)**.

Bone Health:

Physical activity plays a crucial role in bone development and maintenance, helping to prevent osteoporosis and reduce fracture risk, especially in older adults. Weight-bearing and resistance exercises, such as walking,

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jogging, and strength training, stimulate bone formation by applying mechanical stress that promotes osteoblast activity **(Kohrt et al., 2004)**.

Regular exercise during childhood and adolescence helps maximize peak bone mass, which is a key determinant of future bone health **(Matkovic et al., 2001)**. For older adults, physical activity helps maintain bone density, improve balance and coordination, and reduce the risk of falls and fractures **(Howe et al., 2011)**.

Cognitive Benefits:

Throughout life, physical activity also has a significant impact on brain health and cognitive performance. Exercise enhances neuroplasticity, promotes the release of brain-derived neurotrophic factor (BDNF), and increases cerebral blood flow, which supports learning, memory, and executive function **(Voss et al., 2013)**.

Regular aerobic exercise is associated with reduced risk of cognitive decline, dementia, and Alzheimer's disease in older adults **(Ahlskog et al., 2011)**. Studies suggest that physical activity can delay the onset of neurodegenerative diseases by preserving hippocampal volume and improving synaptic function **(Erickson et al., 2011)**. Additionally, exercise supports attention, processing speed, and working memory in children and adults, contributing to better academic performance and daily functioning **(Hillman et al., 2008)**.

Conclusion:

Physical activity plays a crucial role in preventing and managing a wide

range of lifestyle-related diseases, including cardiovascular disease, type 2 diabetes, obesity, certain cancers, and mental health disorders. The extensive evidence from both short- and long-term studies highlights that regular exercise improves metabolic function, cardiovascular health, immune response, and cognitive well-being. Furthermore, even modest levels of physical activity can lead to significant health benefits, emphasizing the importance of promoting active lifestyles across populations.

International guidelines from organizations such as the World Health Organization and national health bodies provide clear recommendations for physical activity, yet global adherence remains suboptimal. Addressing barriers like sedentary behavior, urban infrastructure limitations, and socio-economic inequalities is essential to enhance participation. Policy initiatives that integrate physical activity promotion into education, urban planning, and healthcare systems are critical to achieving these goals.

Understanding the biological mechanisms through which physical activity influences health further supports its role as a cornerstone of preventive medicine. Through improvements in insulin sensitivity, cardiovascular function, inflammation reduction, and brain health, physical activity serves as a powerful and accessible intervention for reducing the burden of chronic diseases.

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