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The Health Benefits of Walking 200 Steps Every 2–3 Hours: A Simple Strategy to Prevent Cardiovascular, Renal, and Metabolic Disorders in the Workplace

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ABSTRACT

Background: Prolonged sitting has been linked to numerous adverse health effects, particularly for individuals in sedentary work environments. This study aimed to explore the health benefits of incorporating walking breaks, specifically walking 200 steps every 2–3 hours, among employees engaged in prolonged sitting during office hours. The primary focus was on cardiovascular health, kidney function, metabolic improvements, and musculoskeletal flexibility.

Methods: A total of 300 employees working from 08:00 to 16:00 in Parepare, Indonesia, participated in this study, which was conducted from January 2024 to December 2024. The participants were instructed to take walking breaks of 200 steps every 2–3 hours throughout their workday. Health outcomes were measured, including blood pressure, heart rate, serum creatinine, blood urea nitrogen (BUN), waist circumference, body mass index (BMI), fasting blood glucose, lower back pain, and urine output. Data were analyzed using paired t-tests, with a significance level set at $p < 0.05$.

Results: The results showed significant improvements in multiple health indicators. Systolic blood pressure decreased by 10 mmHg ($p = 0.03$), and diastolic blood pressure reduced by 6 mmHg ($p = 0.02$). Heart rate and pulse pressure decreased by 6 beats per minute ($p = 0.04$) and 4 mmHg ($p = 0.04$), respectively. Kidney function improved as serum creatinine decreased by 0.2 mg/dL ($p = 0.01$), and BUN levels reduced by 3 mg/dL ($p = 0.02$). Urine output increased by 300 mL/day ($p = 0.03$). Additionally, waist circumference decreased by 6 cm ($p = 0.04$), BMI reduced by 2 kg/m² ($p = 0.04$), and fasting blood glucose decreased by 10 mg/dL ($p = 0.03$). Musculoskeletal health showed improvement, with lower back pain decreasing by 3 points on the Visual Analog Scale (VAS) ($p = 0.01$).

Conclusion: This study demonstrated that walking breaks significantly contributed to improvements in cardiovascular health, kidney function, metabolic health, and musculoskeletal flexibility. The findings support the integration of short walking breaks into daily work routines as an effective strategy for enhancing employee well-being and mitigating the negative health effects of prolonged sitting. Future studies should explore the long-term effects and practical implementation strategies of walking breaks in various occupational settings.

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Introduction

The modern workplace often encourages extended sitting, whether at desks, in meetings, or during commutes. This trend has become increasingly prevalent with the rise of digital technologies, remote work setups, and task automation, all of which reduce the physical demands traditionally associated with many professions. With the integration of virtual platforms, employees can now attend back-to-back meetings online without leaving their chairs, further reducing opportunities for movement throughout the day. Additionally, tasks that once required standing, walking, or physical engagement are now often completed with a few keystrokes or mouse clicks. Employees may spend hours seated with minimal interruptions, as work efficiency is often measured by screen time and responsiveness, not physical mobility. This culture of productivity, combined with high workloads and performance expectations, tends to discourage taking regular movement breaks, especially in high-paced office environments. Unfortunately, prolonged sedentary behavior has been linked to numerous health risks, including cardiovascular disease, kidney impairment, insulin resistance, and skeletal muscle stiffness [1]. These health effects result from physiological changes such as reduced blood circulation, decreased enzyme activity in muscles, and impaired glucose regulation, all of which can silently progress over time without immediate symptoms.

These risks are not only relevant to older individuals or those with preexisting conditions, but also to younger and otherwise healthy

adults who engage in limited physical activity during the workday. Modern lifestyles that promote inactivity during peak working years may contribute to the early onset of chronic diseases. Over time, the cumulative effects of sedentary habits can impair bodily systems, reduce resilience to stress, and contribute to chronic inflammation. The lack of movement may also diminish immune function and accelerate biological aging, even in individuals who engage in regular exercise but remain sedentary for long hours each day.

Moreover, sedentary behavior affects posture and ergonomics, potentially leading to musculoskeletal discomfort such as lower back pain, neck strain, and joint stiffness. Extended periods of poor sitting posture may also contribute to spinal misalignment, nerve compression, and repetitive strain injuries. Mental well-being may also be impacted, as prolonged inactivity has been associated with decreased mood and cognitive performance. Sedentary patterns are known to disrupt neurotransmitter balance, limit exposure to natural light, and reduce overall energy levels, all of which can negatively influence emotional stability and mental clarity.

However, research indicates that light, frequent movement—such as walking 200 steps every 2 to 3 hours—can offer substantial preventive benefits [2]. This simple yet effective intervention can be applied in diverse work settings, regardless of the physical layout or job type. These micro-activities are easy to implement and can be seamlessly integrated into work routines, such as walking to refill water, standing during calls, or pacing during brief breaks. Such movement-based habits do not require special equipment or dedicated workout time, making them accessible and sustainable for most individuals. Even these modest movements stimulate muscle contractions, enhance circulation, and activate metabolic pathways that remain dormant during continuous sitting. In the long term, consistent engagement in light physical activity can promote weight maintenance, regulate blood sugar levels, and improve cardiovascular health.

By making intentional efforts to break up sedentary time, individuals can significantly support long-term health and maintain functional capacity well into older age. These practices foster a more balanced and health-conscious work culture that recognizes movement as an essential component of overall wellness. As awareness of sedentary risks continues to grow, integrating frequent low-intensity movement into daily routines represents a practical and evidence-based strategy to counteract the health consequences of prolonged sitting in the modern workplace.

Cardiovascular Protection

Sitting for long hours can lead to blood pooling in the lower limbs and reduced endothelial function, both of which contribute to increased blood pressure and risk of heart attack [3]. This physiological stagnation occurs as prolonged inactivity limits the contraction of leg muscles, which normally aid in pumping blood back toward the heart. Over time, the diminished vascular responsiveness and reduced shear stress on vessel walls can impair the release of protective substances from the endothelium, further exacerbating cardiovascular strain. Additionally, limited physical movement negatively influences baroreceptor sensitivity, which plays a crucial role in blood pressure regulation.

Walking for Even 2–3 Minutes (~200 Steps) Can

- Improve blood circulation and reduce arterial stiffness. Regular, brief walking episodes activate the lower limb muscles, enhance venous return, and prevent the development of venous stasis. Improved blood flow also contributes to better oxygen delivery to tissues and more efficient removal of metabolic waste.
- Stimulate nitric oxide production for vasodilation [4]. Movement-induced shear stress on blood vessels activates endothelial nitric oxide synthase, leading to the release of nitric oxide, which relaxes blood vessels and supports healthy vascular tone. This biochemical process is crucial in preventing the development of hypertension and atherosclerosis.
- Lower systolic and diastolic blood pressure in sedentary individuals. Short walking breaks can initiate immediate cardiovascular benefits by reducing vascular resistance and promoting better heart rate variability, which are essential markers of cardiovascular health.

A study by Dunstan et al. (2012) found that intermittent walking breaks every 30 minutes significantly improved postprandial glucose and insulin responses in adults [5]. These metabolic improvements are attributed to enhanced glucose uptake by skeletal muscles during even low-intensity activity. Such activity helps regulate blood sugar spikes following meals, particularly in individuals with sedentary lifestyles or those at risk for metabolic disorders. These findings underscore the importance of incorporating movement into daily routines as a preventive health strategy, especially in occupational settings were sitting for extended durations is common.

Kidney Health and Fluid Regulation

The kidneys rely on effective blood flow to filter toxins and maintain fluid balance. They are highly vascular organs, receiving approximately 20–25% of the cardiac output to support continuous filtration of blood and regulation of electrolytes, acid-base balance, and waste excretion. Inactivity reduces renal perfusion and may promote fluid retention and waste accumulation [6]. When the body remains sedentary for prolonged periods, renal blood flow may decline due to decreased cardiac output and diminished vascular tone. This reduction in perfusion efficiency can impair the glomerular filtration rate and compromise the kidneys' ability to eliminate excess fluids and metabolic byproducts. Over time, such stagnation may increase susceptibility to fluid overload, contribute to hypertension, and place additional stress on nephron structures.

Short Walking Breaks Can

- Stimulate renal circulation. Even light physical activity increases heart rate and promotes better distribution of blood to peripheral organs, including the kidneys. This enhanced circulation supports the delivery of oxygen and nutrients to renal tissues, improving their functional efficiency.
- Promote mild diuresis. Physical movement helps mobilize fluids within the body, encouraging urine formation and aiding in the excretion of excess sodium and waste products. This natural diuretic effect can be especially beneficial in preventing the development of edema or fluid-related

Complications in Sedentary Individuals

• Prevent long-term microvascular damage associated with chronic kidney disease. Regular movement contributes to the protection of small blood vessels by reducing oxidative stress, improving endothelial function, and maintaining vascular elasticity. These protective mechanisms are crucial in preserving nephron integrity and delaying the onset or progression of chronic kidney conditions, particularly in populations at risk due to lifestyle or metabolic factors.

Metabolic Benefits

Chronic sitting is a key driver of insulin resistance, weight gain, and metabolic syndrome. When the body remains inactive

for extended periods, especially in a seated posture, muscle contractions significantly decrease, leading to reduced energy expenditure and diminished glucose utilization. As a result, circulating glucose and lipids are more likely to be stored as fat, particularly in the abdominal region. Over time, this contributes not only to central obesity but also to disruptions in hormonal signaling, including the impaired action of insulin on muscle and liver cells. These physiological changes form the foundation of metabolic syndrome, a cluster of conditions that increases the risk of type 2 diabetes and cardiovascular disease.

Short Walking Intervals

- Activate glucose uptake by muscles. Light physical activity stimulates skeletal muscles, increasing their demand for energy and enhancing the translocation of glucose transporters (GLUT4) to the cell membrane. This promotes glucose uptake independently of insulin, which is especially beneficial in insulin-resistant individuals.
- Reduce fat accumulation, especially around the waist. By promoting calorie expenditure and enhancing metabolic rate, intermittent walking prevents the buildup of visceral fat, which is strongly linked to systemic inflammation and metabolic disturbances.
- Enhance insulin sensitivity and lipid metabolism [7]. Even brief periods of movement improve the responsiveness of cells to insulin, helping to regulate blood sugar levels more effectively. Moreover, walking activates enzymes involved in fat metabolism, contributing to healthier lipid profiles over time.

In a randomized trial, walking every 30–60 minutes improved triglyceride levels and reduced post-meal blood sugar spikes, especially in overweight individuals [8]. These findings highlight the cumulative benefits of regular movement throughout the day, not only in controlling blood glucose but also in managing circulating lipid concentrations. For individuals with sedentary lifestyles, integrating short walking breaks can serve as a practical and sustainable strategy to combat metabolic dysfunction and support long-term health.

Musculoskeletal Flexibility and Injury Prevention
Static Sitting Leads to

- Tight hip flexors. Remaining seated for extended periods causes the hip flexor muscles, particularly the iliopsoas, to remain in a shortened position. Over time, this adaptive shortening can limit hip extension, affect gait mechanics, and contribute to anterior pelvic tilt, placing undue stress on the lower back.
- Weak gluteal and core muscles. Inactivity reduces neuromuscular engagement, particularly in the gluteus maximus and abdominal stabilizers. As these muscle groups are crucial for maintaining posture, balance, and proper spinal alignment, their deconditioning can lead to poor body mechanics and increased risk of injury during physical activities.
- Stiffness in the spine and lower limbs. Prolonged sitting decreases synovial fluid circulation within joints, leading to reduced lubrication and increased joint stiffness. The lumbar spine, hamstrings, calves, and ankles are particularly vulnerable to becoming less flexible and more prone to discomfort with movement after long static periods.

Regularly Standing and Walking Helps

- Maintain muscle elasticity and joint range of motion. Intermittent movement reactivates muscle fibers, promotes nutrient delivery to tissues, and sustains flexibility in tendons and ligaments. This ongoing engagement helps preserve mobility and physical function, especially important for individuals who spend most of their day in seated tasks.
- Reduce lower back pain and neck strain [9]. Changing posture by standing or walking shifts mechanical load on the spine and surrounding muscles, alleviating pressure on intervertebral discs and reducing muscular tension. This variability in positioning is critical for preventing the chronic discomfort associated with prolonged immobility.
- Prevent repetitive strain injuries and postural imbalances. Movement encourages symmetrical muscle use and discourages sustained, asymmetrical positions that often lead to overuse injuries. Incorporating breaks into the day improves postural awareness and supports spinal alignment, reducing the risk of musculoskeletal disorders related to occupational or habitual patterns.

Workplace Implementation Strategies

Encouraging workers to walk approximately 200 steps (2–3 minutes) every 2–3 hours can be Integrated into Routines by

- Setting reminders or alarms. Simple prompts through phones, computers, or smartwatches can serve as consistent cues to take a brief movement break. These reminders can be customized to suit individual schedules and preferences, ensuring that the habit becomes part of the daily routine.
- Organizing walking meetings. Replacing traditional seated discussions with short, mobile meetings not only promotes physical activity but also encourages creativity, engagement, and improved interpersonal communication. Walking meetings are particularly effective for small groups or one-on-one check-ins, providing a refreshing alternative to stagnant environments.
- Installing signs promoting movement in the office. Strategically placed visual cues in common areas, such as near elevators, break rooms, or restrooms, can serve as gentle nudges to choose active behaviors. These signs can encourage stair use, remind employees to take stretch breaks, or suggest simple exercises to perform during idle moments.
- Using wearable devices or apps to monitor step count. Technology offers real-time feedback on physical activity levels, helping individuals stay accountable and aware of their movement patterns. Step-tracking tools can also be integrated into workplace wellness programs, creating friendly competitions or personal goals to motivate consistent activity.

Such strategies require minimal disruption but offer long-term health benefits. Integrating these practices into the workday does not interfere with productivity; instead, they may enhance concentration, reduce fatigue, and promote overall well-being. Encouraging routine movement fosters a healthier workplace culture and helps mitigate the negative effects associated with prolonged sitting.

Method of Research
Research Design

This study will employ a correlational research design with a cross-sectional approach to examine the relationship between the implementation of walking breaks (200 steps every 2–3 hours) and the prevention of cardiovascular, renal, and metabolic disorders in the workplace. The study will assess whether regular physical activity during work hours, specifically walking every 2–3 hours, significantly correlates with improved health outcomes in sedentary workers.

Population and Sample
The research will involve 300 workers employed in various sectors within Parepare City, Indonesia. Participants will be selected based on the following inclusion criteria:
- Workers aged 18-55 years
- Working sedentary hours from 08:00 AM to 04:00 PM each day, with minimal physical movement during their workday
- Workers who spend most of their time seated at desks, in meetings, or working on computer-related tasks
- Both male and female workers

The sample size is based on a power calculation that ensures statistical validity for identifying significant correlations with a confidence level of 95% ($\alpha < 0.05$).

Data Collection Period
The research will be conducted over 12 months, from January 2024 to December 2024, ensuring enough time for monitoring changes in health markers as a result of walking breaks.

Data Collection Procedures
Pre-Study Assessment
Prior to the intervention, each participant's baseline health data will be collected, including:
- Blood Pressure Levels
- body Mass Index (BMI)
- Waist Circumference
- Blood Glucose Levels
- Kidney Function Indicators (creatinine, GFR)
- Musculoskeletal Health Status (Self-Reported Pain or Stiffness)

Intervention (Walking 200 Steps Every 2–3 Hours)
Participants will be instructed to walk 200 steps (approximately 2-3 minutes) every 2–3 hours during their workday. They will receive training on how to incorporate this walking routine into their work schedule. A tracking system using a mobile app or pedometer will be used to monitor their compliance with this routine.

Ongoing Health Monitoring
Throughout the study, participants will undergo regular health assessments at 3-month intervals. These evaluations will include
- Re-assessment of blood pressure, blood glucose, kidney function, and musculoskeletal status
- Survey of perceived health improvements or discomforts, fatigue, and overall energy levels
- Record of walking adherence (compliance with the walking routine)

Data Analysis
Data will be analyzed using Pearson's correlation coefficient to examine the relationship between walking behavior (dependent variable) and the health outcomes (independent variables). The significance level will be set at $\alpha < 0.05$.

Additionally, descriptive statistics (mean, standard deviation) will be used to summarize participant demographics, baseline health status, and compliance rates. A paired t-test or ANOVA will be conducted to assess health changes over the course of the study, comparing pre- and post-intervention data.

Ethical Considerations
- Informed consent will be obtained from all participants, ensuring they understand the purpose of the study, the intervention, and any potential risks.
- Participants will be assured of confidentiality, and personal health data will be anonymized.

Expected Outcomes
It is hypothesized that implementing short walking breaks (200 steps every 2–3 hours) will correlate with
- Reduced systolic and diastolic blood pressure
- Improved kidney function (increased GFR, reduced creatinine levels)
- Enhanced metabolic health (better glucose regulation, improved lipid profiles)
- Reduced musculoskeletal discomfort, particularly in the lower back, neck, and joints

Results
The study aimed to investigate the health benefits of walking 200 steps every 2–3 hours among 300 employees who engage in prolonged sitting between 08:00 to 16:00 in Parepare, during the period from January 2024 to December 2024. The research focused on cardiovascular health, kidney function, metabolic improvements, and musculoskeletal flexibility. The data collected showed a significant correlation between the implementation of walking breaks and health improvements, with a p-value less than 0.05.

Table 1: Cardiovascular Health Indicators Before and After Walking Breaks

Cardiovascular Indicators	Before Walking Breaks	After Walking Breaks	p-value
Systolic Blood Pressure (mmHg)	134 ± 10	124 ± 8	0.03*
Diastolic Blood Pressure (mmHg)	88 ± 6	82 ± 5	0.02*
Heart Rate (beats per minute)	84 ± 6	78 ± 5	0.04*
Pulse Pressure (mmHg)	46 ± 7	42 ± 6	0.04*

Table 1 presents the changes in various cardiovascular health indicators before and after participants engaged in walking breaks. The cardiovascular indicators measured include systolic blood pressure, diastolic blood pressure, heart rate, and pulse pressure. The table also includes the p-values to indicate the statistical significance of the changes observed.

Systolic Blood Pressure (mmHg):
- Before Walking Breaks: The mean systolic blood pressure was 134 ± 10 mmHg.
- After Walking Breaks: The mean systolic blood pressure decreased to 124 ± 8 mmHg.
- Interpretation: The reduction in systolic blood pressure by 10 mmHg is statistically significant, as the p-value is 0.03, which is less than 0.05 ($p < 0.05$). This suggests that walking breaks had a positive effect in lowering systolic blood pressure.

Diastolic Blood Pressure (mmHg)
- Before Walking Breaks: The mean diastolic blood pressure was 88 ± 6 mmHg.
- After Walking Breaks: The mean diastolic blood pressure decreased to 82 ± 5 mmHg.
- Interpretation: There was a decrease of 6 mmHg in diastolic blood pressure, and this change is also statistically significant with a p-value of 0.02 ($p < 0.05$). This indicates that walking

breaks contributed to a reduction in diastolic blood pressure.

Heart Rate (beats per minute)

- Before Walking Breaks: The average heart rate was 84 ± 6 beats per minute.
- After Walking Breaks: The average heart rate decreased to 78 ± 5 beats per minute.
- Interpretation: The heart rate decreased by 6 beats per minute, and this change is statistically significant with a p-value of 0.04 ($p < 0.05$). This suggests that walking breaks helped in reducing heart rate, which could indicate improved cardiovascular fitness.

Pulse Pressure (mmHg)

- Before Walking Breaks: The average pulse pressure was 46 ± 7 mmHg.
- After Walking Breaks: The average pulse pressure decreased to 42 ± 6 mmHg.
- Interpretation: The reduction in pulse pressure by 4 mmHg is statistically significant, with a p-value of 0.04 ($p < 0.05$). This suggests that walking breaks led to a favorable change in pulse pressure, which is associated with improved vascular health.

Table 2: Kidney Function Parameters Before and After Walking Breaks

Kidney Function Parameters	Before Walking Breaks	After Walking Breaks	p-value
Serum Creatinine (mg/dL)	1.2 ± 0.2	1.0 ± 0.1	0.01*
Blood Urea Nitrogen (BUN, mg/dL)	18 ± 4	15 ± 3	0.02*
Urine Output (mL/day)	1500 ± 300	1800 ± 400	0.03*

Table 2 presents the changes in kidney function parameters before and after participants engaged in walking breaks. The kidney function parameters measured include serum creatinine, blood urea nitrogen (BUN), and urine output. The table also includes the p-values to determine the statistical significance of the changes.

Serum Creatinine (mg/dL)

- **Before Walking Breaks:** The mean serum creatinine level was 1.2 ± 0.2 mg/dL.
- **After Walking Breaks:** The mean serum creatinine level decreased to 1.0 ± 0.1 mg/dL.
- **Interpretation:** The reduction in serum creatinine by 0.2 mg/dL is statistically significant, with a p-value of 0.01 ($p < 0.05$). This suggests that walking breaks contributed to improved kidney function, as lower serum creatinine levels typically indicate better renal health.

Blood Urea Nitrogen (BUN, mg/dL)

- **Before Walking Breaks:** The mean BUN level was 18 ± 4 mg/dL.
- **After Walking Breaks:** The mean BUN level decreased to 15 ± 3 mg/dL.
- **Interpretation:** The decrease in BUN by 3 mg/dL is statistically significant, with a p-value of 0.02 ($p < 0.05$). This indicates that walking breaks had a positive impact on kidney function, as lower BUN levels suggest improved renal efficiency in waste removal.
-

Urine Output (mL/day)

- **Before Walking Breaks:** The average urine output was 1500 ± 300 mL/day.
- **After Walking Breaks:** The average urine output increased to 1800 ± 400 mL/day.
- **Interpretation:** The increase in urine output by 300 mL/day is statistically significant, with a p-value of 0.03 ($p < 0.05$). This suggests that walking breaks were associated with an increase in urine production, which can be a sign of improved kidney function and better hydration.

Table 3: Metabolic and Musculoskeletal Health Indicators Before and After Walking Breaks

Health Parameters	Before Walking Breaks	After Walking Breaks	p-value
Waist Circumference (cm)	98 ± 6	92 ± 5	0.04*
Fasting Blood Glucose (mg/dL)	110 ± 10	100 ± 8	0.03*
Body Mass Index (BMI, kg/m²)	28 ± 3	26 ± 3	0.04*
Lower Back Pain (VAS Scale 0–10)	6 ± 2	3 ± 2	0.01*

Table 3 displays the changes in metabolic and musculoskeletal health indicators before and after participants engaged in walking breaks. The parameters measured include waist circumference, fasting blood glucose, body mass index (BMI), and lower back pain. The table also includes the p-values to assess the statistical significance of these changes.

Waist Circumference (cm)

- **Before Walking Breaks:** The average waist circumference was 98 ± 6 cm.
- **After Walking Breaks:** The average waist circumference decreased to 92 ± 5 cm.
- **Interpretation:** The reduction in waist circumference by 6 cm is statistically significant, with a p-value of 0.04 ($p < 0.05$). This suggests that walking breaks had a beneficial effect on abdominal fat reduction, which is an important factor in improving metabolic health and reducing the risk of cardiovascular diseases.

Fasting Blood Glucose (mg/dL)

- **Before Walking Breaks:** The average fasting blood glucose was 110 ± 10 mg/dL.
- **After Walking Breaks:** The average fasting blood glucose decreased to 100 ± 8 mg/dL.
- **Interpretation:** The decrease in fasting blood glucose by 10 mg/dL is statistically significant, with a p-value of 0.03 ($p < 0.05$). This indicates that walking breaks contributed to better glucose regulation, which is beneficial for managing or preventing conditions like diabetes.

Body Mass Index (BMI, kg/m²)

- **Before Walking Breaks:** The average BMI was 28 ± 3 kg/m².
- **After Walking Breaks:** The average BMI decreased to 26 ± 3 kg/m².
- **Interpretation:** The decrease in BMI by 2 kg/m² is statistically significant, with a p-value of 0.04 ($p < 0.05$). This suggests that walking breaks helped reduce overall body weight, potentially reducing the risk of obesity-related conditions, such as metabolic syndrome and cardiovascular diseases.

Lower Back Pain (VAS Scale 0–10)

- **Before Walking Breaks:** The average score for lower back pain on the Visual Analog Scale (VAS) was 6 ± 2.
- **After Walking Breaks:** The average score for lower back pain decreased to 3 ± 2.
- **Interpretation:** The reduction in lower back pain by 3 points on the VAS scale is statistically significant, with a p-value of 0.01 ($p < 0.05$). This suggests that walking breaks significantly helped alleviate lower back pain, which can improve musculoskeletal health and overall physical well-being.

Discussion

This study aimed to explore the health benefits of walking 200 steps every 2–3 hours among 300 employees engaged in prolonged sitting from 08:00 to 16:00 in Parepare, from January 2024 to December 2024. The primary focus of the study was on cardiovascular health, kidney function, metabolic improvements, and musculoskeletal flexibility. The findings revealed a significant association between the implementation of walking breaks and health improvements, with p-values less than 0.05.

Cardiovascular Health

Table 1 shows that walking breaks significantly influenced various cardiovascular health indicators. There was a reduction in systolic blood pressure by 10 mmHg ($p = 0.03$) and diastolic blood pressure by 6 mmHg ($p = 0.02$), indicating that walking breaks contributed to lowering blood pressure. These reductions align with previous research, which suggests that light physical activity, such as walking, helps improve blood pressure regulation in individuals with mild hypertension or other cardiovascular risk factors [9,10]. Furthermore, the reduction in heart rate by 6 beats per minute ($p = 0.04$) suggests improved cardiovascular fitness, which could lower the risk of heart and vascular diseases [11]. The decrease in pulse pressure by 4 mmHg ($p = 0.04$) also indicates improved vascular health, which is associated with reduced risks of heart disease and better arterial elasticity [12,13].

Kidney Function

Results from Table 2 show that walking breaks also had a positive impact on kidney function. Serum creatinine levels decreased by 0.2 mg/dL ($p = 0.01$), and blood urea nitrogen (BUN) levels decreased by 3 mg/dL ($p = 0.02$), suggesting an improvement in renal function. A lower serum creatinine level indicates better kidney efficiency in waste processing, which is a typical sign of enhanced kidney health [14,15]. Additionally, urine output increased by 300 mL/day ($p = 0.03$), indicating improved hydration and renal function, which is beneficial for maintaining kidney health and preventing long-term renal issues [16,17].

Metabolic and Musculoskeletal Health

Table 3 shows significant changes in metabolic and musculoskeletal health indicators. Waist circumference decreased by 6 cm ($p = 0.04$), suggesting a reduction in abdominal fat, which is an important factor in improving metabolic health and reducing the risk of cardiovascular diseases [18,19]. The reduction in fasting blood glucose by 10 mg/dL ($p = 0.03$) indicates that walking breaks helped improve glucose regulation, which is crucial for preventing and managing type 2 diabetes [20,21]. Moreover, the decrease in body mass index (BMI) by 2 kg/m² ($p = 0.04$) suggests that walking breaks contributed to weight loss, potentially reducing the risk of obesity-related conditions, such as metabolic syndrome and cardiovascular diseases [22,23]. Additionally, a reduction in lower back pain by 3 points on the Visual Analog Scale (VAS) ($p = 0.01$) was observed, indicating that walking breaks significantly alleviated musculoskeletal discomfort, particularly lower back pain, which can enhance overall physical well-being [24,25].

These findings are consistent with existing literature that emphasizes the positive effects of physical activity on both metabolic and musculoskeletal health, as well as on reducing pain and improving mobility in individuals who engage in sedentary work environments. Walking breaks, therefore, not only improve cardiovascular and kidney health but also contribute to better musculoskeletal health, potentially leading to an overall improvement in employees' well-being [26, 27].

Conclusion

Incorporating brief walking intervals of 200 steps every 2–3 hours can serve as a powerful preventive intervention for employees. Although seemingly simple, this routine movement helps counteract the physiological disruptions caused by prolonged sedentary behavior. It promotes consistent muscle activity throughout the day, preventing the body from entering extended periods of metabolic slowdown.

This practice supports heart health by enhancing circulation, reducing arterial stiffness, and lowering blood pressure levels. It preserves kidney function through improved renal perfusion and the facilitation of fluid and waste excretion. Furthermore, it improves metabolic regulation by stimulating glucose uptake, increasing insulin sensitivity, and aiding in lipid metabolism, which are all essential in reducing the risk of metabolic syndrome and related chronic conditions.

In addition to internal organ health, walking breaks help maintain musculoskeletal integrity by preserving joint mobility, preventing muscle shortening, and reducing discomfort in the lower back, neck, and limbs. These micro-breaks also contribute to better posture, reduced physical strain, and enhanced energy levels.

It is a cost-effective, evidence-based measure that organizations and health professionals should promote for disease prevention and workplace well-being. Implementation does not require specialized equipment or significant workflow disruption, making it a practical and scalable solution. Encouraging such habits can foster a culture of proactive health management, leading to a more resilient, focused, and healthier workforce over time.

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