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EFFECTIVENESS OF INCLINE TREADMILL WALKING VS LEVEL TREADMILL WALKING IN OBESE INDIVIDUALS

Sports Science

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ABSTRACT

Obesity is a major global health concern associated with an increased risk of cardiovascular disease, diabetes, and hypertension. Improving cardiovascular fitness plays a key role in its management, and low-impact aerobic exercises such as treadmill walking are practical and accessible for obese individuals. This study aimed to compare the cardiovascular response between incline treadmill walking and level treadmill walking in obese individuals. Twenty-five participants aged 25 to 40 years with sedentary lifestyles were included after appropriate screening using ECG, echocardiography, and the Global Physical Activity Questionnaire (GPAQ). Each participant performed two exercise sessions consisting of level treadmill walking at 5 km/h for 30 minutes and incline treadmill walking at a 4% gradient with the same speed and duration. Heart rate and calorie expenditure were recorded using an Apple Watch, and the rate of perceived exertion was assessed using the Borg scale. Incline walking resulted in a significantly higher average heart rate of 138.67 bpm compared to 118.67 bpm during level walking, and calorie expenditure was also higher at 180.38 kcal compared to 131.75 kcal, with statistical significance set at $p < 0.001$. Despite these differences, perceived exertion remained similar between both conditions. Incline treadmill walking is therefore more effective in improving cardiovascular response and energy expenditure without increasing perceived exertion, making it a useful exercise strategy for obese individuals.

KEYWORDS

Obesity, Incline Walking, Treadmill, Heart Rate, Calorie Expenditure

INTRODUCTION:

Obesity is a major global health concern associated with increased risk of cardiovascular disease, diabetes, and hypertension (1). Improving cardiovascular fitness through aerobic exercise is essential in its management (2).

Treadmill walking is a commonly recommended low-impact exercise for obese individuals due to its safety , accessibility and effectiveness (3). Increasing exercise intensity is necessary for greater cardiovascular benefit; however, increasing speed may not always be feasible due to joint stress. Incline walking provides an effective alternative by increasing workload without increasing speed, thereby enhancing energy expenditure and cardiovascular response (3).

Heart rate is a reliable indicator of exercise intensity and is strongly correlated with oxygen consumption and caloric expenditure during submaximal exercise (5,6). However, limited studies have directly compared incline and level treadmill walking in obese individuals. This study aims to evaluate the effectiveness of incline walking in improving cardiovascular response and energy expenditure.

Aim and Objectives:

The aim of this study was to compare the cardiovascular response and energy expenditure between incline treadmill walking and level treadmill walking in obese individuals.

The objectives of the study were to evaluate the differences in average heart rate between incline and level treadmill walking, to compare calorie expenditure between the two exercise conditions, and to assess whether there is any difference in perceived exertion between incline and level walking.

Materials and methods:

This study was conducted as a comparative experimental study among obese individuals with sedentary lifestyles. A total of twenty-five participants aged between 25 and 40 years were included in the study. Ethical clearance was obtained prior to the study, and informed consent was taken from all participants.

Participants were screened using electrocardiography (ECG), echocardiography, and the Global Physical Activity Questionnaire (GPAQ) to ensure their suitability for exercise testing.

Inclusion Criteria :- Participants aged between 25 and 40 years with a sedentary lifestyle and classified as obese based on body mass index (BMI between 30 and 35) were included in the study.

Exclusion Criteria :- Participants with known cardiovascular disease, respiratory disorders, musculoskeletal limitations affecting walking, or any contraindication to exercise were excluded from the study. Individuals on medications affecting heart rate or exercise tolerance were also excluded.

Data Collection:

Each participant underwent two exercise sessions on separate days under controlled conditions. Participants were instructed to maintain similar dietary intake and physical activity levels on the day prior to each session to minimize variability. On the first day, participants performed level treadmill walking at a speed of 5 km per hour for a duration of 30 minutes. On the second day, the same protocol was repeated with a 4% incline.

Heart rate and calorie expenditure were continuously monitored using a wearable device (Apple Watch). The rate of perceived exertion was recorded immediately after each session using the Borg scale. All measurements were documented and compiled for analysis.

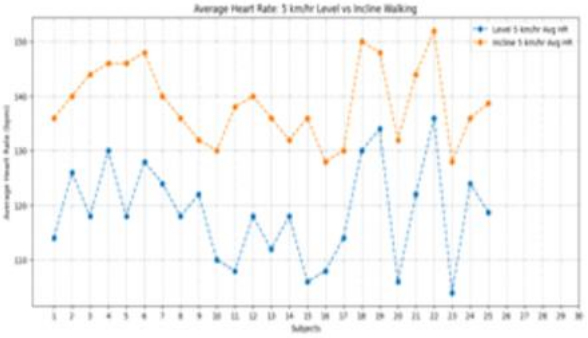
RESULTS

Demographic Data:

Table showing the demographic data of the participants

Parameter	Mean ± SD	Min	Max
Age (years)	30.54 ± 2.38	26	35
Height (m)	1.68 ± 0.07	1.55	1.80
Weight (kg)	89.42 ± 5.58	75	98
BMI(kg/m2)	31.54 ± 1.32	30.10	34.85

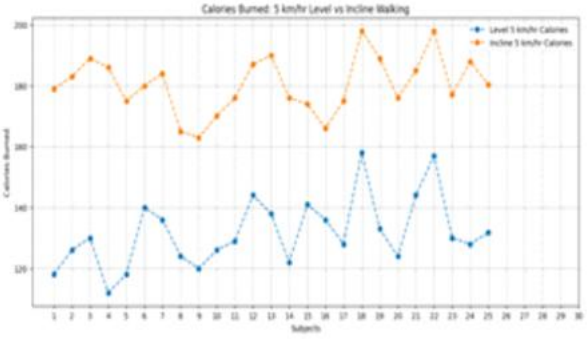
The study demonstrated a significant difference in cardiovascular response between incline and level treadmill walking. The average heart rate during incline walking was higher at 138.67 beats per minute compared to 118.67 beats per minute during level walking, with statistical significance ($p < 0.001$). The effect size for heart rate was large (Cohen's $d = 3.5$), indicating a substantial difference between the two conditions.



Graph shows average Heart rate in Level vs Incline walking

Similarly, calorie expenditure was significantly greater during incline walking, with an average of 180.38 kilocalories compared to 131.75 kilocalories during level walking ($p < 0.001$). The effect size for calorie expenditure was also large (Cohen's $d = 4.8$), further supporting the strength of the observed difference.

Graph shows average calories burned in Level vs



Despite these physiological differences, the rate of perceived exertion remained comparable between both conditions, indicating that participants did not perceive incline walking as more strenuous. These large effect sizes indicate strong clinical significance of the findings.

DISCUSSION :

The present study demonstrates that incline treadmill walking produces a significantly greater cardiovascular response and energy expenditure compared to level walking in obese individuals. The higher heart rate and calorie expenditure observed during incline walking reflect the increased mechanical and metabolic demand associated with walking against gravity. Studies published through the American College of Sports Medicine have shown that increasing treadmill grade significantly elevates oxygen consumption and cardiovascular workload, supporting the findings of the present study (3).

Heart rate is a reliable indicator of exercise intensity and is strongly correlated with oxygen consumption and energy expenditure. Achten et al. reported that heart rate monitoring is an effective method for assessing exercise intensity, while Keytel et al. demonstrated its utility in predicting energy expenditure during submaximal exercise. Similarly, Hiilloskorpi et al. observed that energy expenditure increases proportionally with increasing workload (5–7).

Despite the increased physiological demand, perceived exertion remained comparable between both conditions. Swain et al. reported that variations in exercise intensity may not always produce proportional changes in perceived exertion, which is consistent with the findings of the present study (8). This suggests that incline walking improves exercise efficiency without increasing subjective fatigue.

The large effect sizes observed further highlight the clinical significance of incline walking as an effective strategy for improving cardiovascular workload and energy expenditure. These findings support its use as a practical and efficient exercise modality in obese individuals.

CONCLUSION:

Incline treadmill walking is more effective than level treadmill walking in improving cardiovascular response and calorie expenditure while maintaining a similar level of perceived exertion. It can therefore be recommended as a safe, efficient, and practical exercise modality for obese individuals to enhance cardiovascular fitness.

Limitations:

The study was conducted on a relatively small sample size, which may limit the generalizability of the findings. The short duration of the study did not allow for assessment of long-term adaptations to incline walking. Measurements were obtained using a wearable device, which may have inherent limitations in accuracy. Additionally, environmental factors and individual variability in physiological responses were not controlled, which could influence the results.

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