

PHYSIOLOGICAL AND PSYCHOLOGICAL DIFFERENCES BETWEEN 20% GRADE INCLINE WALKING AND LEVEL GRADE JOGGING AT ISOCALORIC INTENSITY

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Abstract

Although the benefits of physical activity are well established, many adults do not meet the recommended weekly aerobic physical activity guidelines. Internal barriers such as enjoyment and affective response may challenge engagement and adherence of exercise. While walking and jogging are common modes of exercise, incline walking has recently gained popularity. **Purpose:** To compare physiological and psychological differences between high incline walking at 20% grade (HIW) and level grade jogging (LGJ) at isocaloric intensities. **Methods:** Physically inactive and sedentary participants (descriptive data) 18-59 years of age will complete the study. Participants (n=30) will complete HIW and LGJ on a treadmill for 20 minutes on two separate occasions and will be matched at isocaloric intensities through indirect calorimetry. During every two minutes of exercise, rating of perceived exertion (RPE), “how long can you comfortably maintain for?” (HCM), and the Feeling Scale (FS) will be measured. Breath by breath gas exchange analysis and heart rate (HR) will also be measured throughout exercise. Immediately after exercise, participants will complete the Physical Activity Enjoyment Scale (PACES) and a 0-100 likelihood scale. Fat and carbohydrate oxidation will be calculated using the Frayn equation using indirect calorimetry.

Introduction

Recommended Physical Activity Guidelines:

- 150-300 minutes of moderate intensity aerobic PA per week or 75-150 minutes of vigorous-intensity aerobic PA per week, or an equivalent combination of both (*World Health Organization, 2020, p.8; Piercy et al., 2018*)

Physical Inactivity

- 27.5% of the global adult population did not meet recommended PA levels (*World Health Organization, 2020, p. 8*)
- <52% of American adults met aerobic physical activity guidelines in 2020 (*Abildso et al., 2023*)
- In the United States, about \$117 billion in yearly health care costs are associated with physical inactivity (*Carlson et al., 2015*)

Effects of Physical Inactivity

- Significant modifiable risk factor for chronic diseases and mental health illnesses such as stroke, type 2 diabetes, coronary heart disease, breast cancer, depression, and dementia (*Santos et al., 2022*)
- Globally, if the trend of physical inactivity continues, it is estimated that additional cases of preventable NCDs and mental health issues will increase up to 499.2 million during the years of 2020-2030 (*Santos et al., 2022*)

Benefits of Physical Activity

- Reduce risk for cardiovascular disease, hypertension, dyslipidemia, coronary heart disease, and heart failure (*Alpsoy, 2020; Ruvio & Alcantara, 2011; Kelley & Kelley, 2006; Wang & Xu, 2017; Winzer et al., 2018; Kraus et al., 2019; Sattelmair et al., 2011*)
- Provide noninvasive therapy for mental health by improving depression and anxiety (*Gujral et al., 2017; Josefsson et al., 2013; Morris et al., 2018; McDowell et al., 2019; Tavares et al., 2021*)

Barriers of Physical Activity

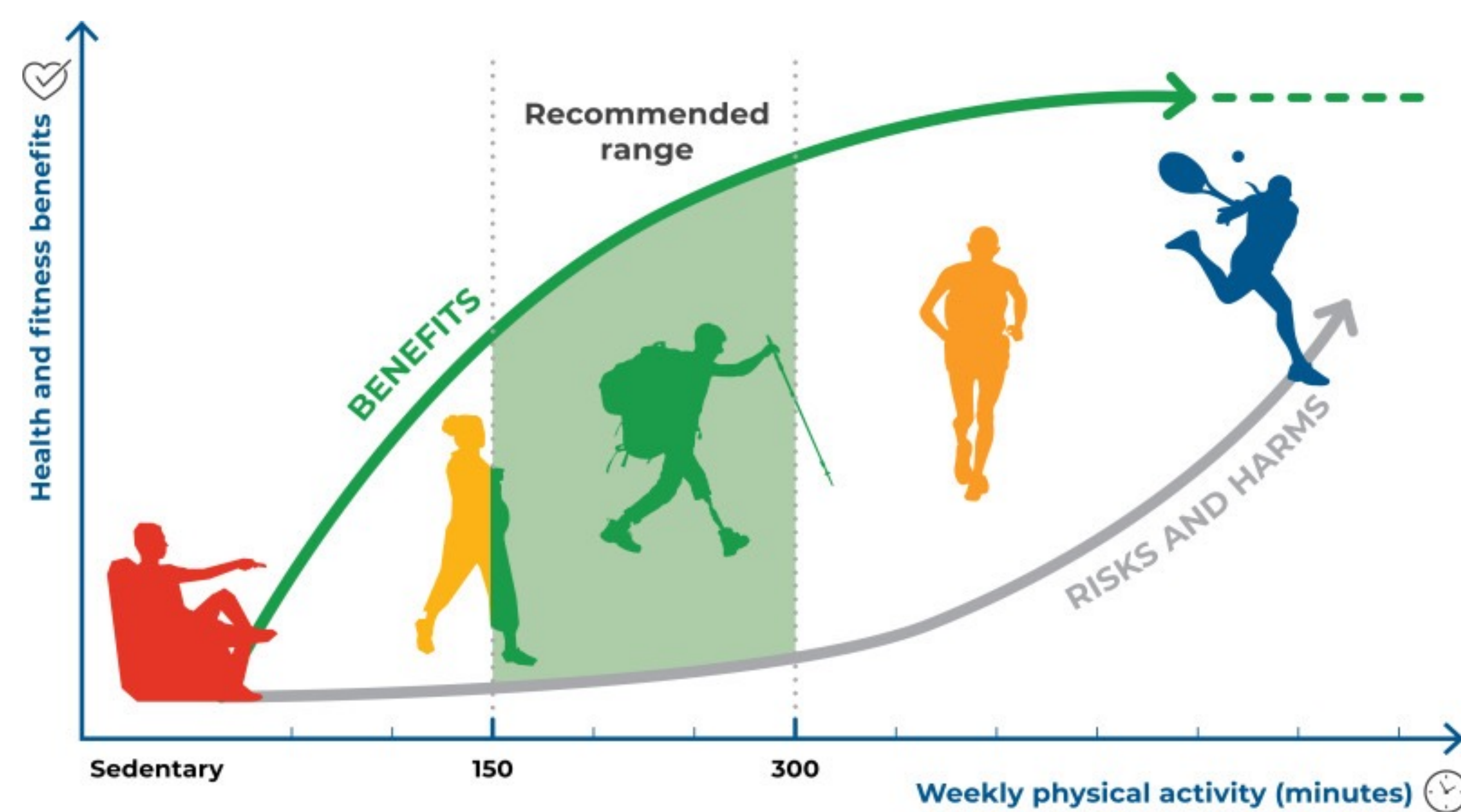
- Lack of enjoyment
 - Perception of enjoyment on a specific type of exercise or PA is considered a strong predictor for adherence (*Lewis et al., 2016; Waaso et al., 2022*)
- Lack of affective response
 - Positive affective response to exercise is associated with increased motivation and assists in sustaining long term motivation of exercise (*Kwan & Bryan, 2011*)

Treadmill Popularity

- 2019 HRSA Health Club Consumer Report reported treadmills to be the most popular piece of exercise equipment
 - 43% of members use them regularly
 - Of that group, 51% prefer walking, while 28% prefer running or jogging
- Recently, walking at an incline has increased in popularity, leading to a rise in the production of high incline treadmills

Purpose

Compare physiological (fat and carbohydrate utilization) and psychological (enjoyment, affective response, rating of perceived exertion) differences between 20% incline walking and level grade jogging at isocaloric intensity



Methods

Participants

- 30 participants, 18-59 years of age who get less than 150 minutes of moderate aerobic PA a week or 75 minutes of vigorous-intensity aerobic PA a week or an equivalent combination of both, consistently within the past six months

Session 1

- Participants will formally consent, complete the PAR-Q+, IPAQ, exercise questionnaire, and anthropometric measurements will be taken.
- All participants will undergo body composition analysis using air displacement plethysmography (BodPod)

Session 2

- Level grade jogging will take place
- Breath by breath gas exchange analysis will be analyzed using the ParvoMedics metabolic cart to measure VO₂ and Fat/Carbohydrate utilization
- ~5 minute familiarization session to establish a jogging speed that will be below lactate threshold on the Trackmaster Treadmill
 - Borg's RPE of 10-11
 - RER 0.83-0.92
 - Comfortably maintained for 40 minutes
- Once speed is established, participants will rest for ~5 minutes and jog for 20 mins at established speed
 - Every 2 mins, RPE and Maintain Scale will be asked
 - Minutes 2,10,20 Feelings scale will be asked
- Immediately post exercise, participants will be asked to complete the PACES and 0-100 likelihood scale

Session 3

- Participants will undergo 20% incline walking a minimum of 24 hours after completing session two
- ~5 familiarization session and speed will be adjusted to have the participants meet:
 - RER of 0.83-0.92
 - RPE of 10-11
 - Sustained for 40 minutes
 - Match the Relative Oxygen Consumption (VO₂) (mL/kg*min) ±3 from session
- Once speed is established, participants will rest for ~5 minutes and walk for 20 mins at established speed
 - Every 2 mins, RPE and Maintain Scale will be asked
 - Minutes 2,10,20 Feelings scale will be asked
- Immediately post exercise, participants will be asked to complete the PACES and 0-100 likelihood scale

Borg's Rating of Perceived Exertion

- RPE is a 15-grade scale of whole-body perceived exertion, ranging from 6-20
- A rating of 6 indicates “no exertion at all” and a rating of 20 indicates “maximal exertion.”

Feeling Scale

- Represents an individual's feelings of pleasure or displeasure to exercise at that moment (affective response)
- Consists of a 11-point bipolar scale that ranges from +5 (very good) to -5 (very bad) (*Rejeski et al., 1987*)

Physical Activity Enjoyment Scale

- The PACES (Physical Activity Enjoyment Scale) consists of a 7-point Likert scale with 18 items (11 negatively worded items and 7 positively worded items)
- Scored between 18 and 126, with higher scores indicating a more positive feeling or enjoyment of exercise

Substrate Utilization Calculation

- Fat and carbohydrate oxidation rates (g/min) will be calculated using stoichiometric equations by Frayn (*Frayn, 1983*)
- VO₂ and VCO₂ (L/min-1) values will be measured during each 20 minute bout
- CHO (g/min) = 4.55*(VCO₂ L/min) – 3.21*(VO₂ L/min)
- FAT (g/min) = 1.67*(VO₂ L/min) – 1.67*(VCO₂ L/min)

Statistical Analysis

- A repeated measure T-test will be used to compare average fat oxidation (g/min), average carbohydrate oxidation (g/min), average respiratory exchange ratio, average heart rate, average PACES, FS, and average preferred scale to determine any differences between LGJ and HIW
- A repeated measures T-test will be used to compare RPE and “how long can you maintain” at minutes 2-, 10- and 20-minute averages between walking at a LGJ and HIW
- A repeated measures T-test will also be used to determine if VO₂ is isocaloric between LGJ and HIW. Significance will be set at a *p* < 0.05

Citations

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