

Steps That Count: The Association Between the Number and Intensity of Steps Accumulated and Fitness and Health Measures

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Background: Pedometer-based recommendations for accumulating steps/d largely focus on volume, with less emphasis on intensity and fitness/health outcomes. We aim to examine this relationship. **Methods:** A convenience sample (N = 70, 35 men, 32 ± 8yrs) wore a pedometer (4 days). The pedometer classified steps as “aerobic” (≥ 60 steps/minute, minimum duration of 1 minute) or “non-aerobic” (< 60 steps/minute and/or < 1 minute). Estimated maximal oxygen uptake (VO₂max), derived from a 12-minute submaximal step-test, and health outcomes: blood pressure (BP), body mass index (BMI), percentage body fat (%BF), and waist circumference (WC) were correlated with pedometer data. Participants were grouped according to number and intensity of steps: LOW (< 5000 steps/day), HIGH-LOW (≥ 5000 steps/day, no aerobic steps), HIGH-HIGH (≥ 5000 steps/day, including some aerobic steps). Analyses of covariance, adjusting for age, gender, and total steps/day were used to compare groups. **Results:** Average steps/day was 6520 ± 2306. Total steps/day and total time spent accumulating “aerobic” steps (minutes/day) were inversely associated with %BF, BMI, WC, and systolic BP (P < .05). After adjusting for gender and total steps/day, %BF was different between all 3 groups, VO₂max was different between the LOW and HIGH-HIGH groups, WC was lower in the HIGH-HIGH versus the other 2 groups (P < .03, respectively). **Conclusion:** Intensity seems an important factor to consider in steps/day cut-points.

Keywords: ambulatory, pedometer, steps/d, aerobic, intensity

The health benefits of regular physical activity (PA) have been unequivocally demonstrated across populations and in a wide variety of settings.¹⁻³ As a result, the American College of Sports Medicine (ACSM) guidelines recommend that adults accumulate at least 30 minutes of moderate-intensity physical activity (MPA), on at least 5 days per week.⁴ Walking is an accessible mode of activity and therefore may be easily translated into PA recommendations, especially for adoption by inactive adults,⁵⁻⁷ the benefits of which have been demonstrated by many studies.⁸⁻¹¹ Yet, despite the significant health benefits of walking, the overall prevalence of walking for health is only 8%–15% in adults.¹² Furthermore, studies on the extent to which walking contributes to meeting PA guidelines is largely limited, as the recommendations for accumulating steps per day (steps/d) generally do not consider intensity,^{13,14} which is a key factor in assessing the impact on health benefits.¹⁵

Studies have shown that 30 minutes of moderate-vigorous walking equates to between 3100–4000 steps,¹⁶⁻

¹⁸ even when considering factors such as stride length and BMI in their recommendations.^{19,20} The impact of intensity-based walking recommendations is therefore an emerging area of research and further information on volume and intensity of PA patterns will add to the current understanding of the dose-response related benefits of walking and provide the basis for current/future steps/d recommendations. We therefore aim to determine the relationship between the volume and intensity of steps/d and aerobic fitness and health status.

Methods

Participants

A convenience sample of 70 adults (35 men and 35 women) between the ages of 21–49 years completed the study. The participants were recruited through advertisements placed at a tertiary academic institution and at other organizations such as fitness centers and health assessment clubs, as well as via word of mouth.

Ethics approval for the study was obtained from the Human Research Ethics Committee of the Faculty of Health Sciences, University of Cape Town, Republic of South Africa. Before the study, the participants were provided with a Participant’s Information Sheet detailing purpose, aims, procedures, requirements, and potential risks of the study and thereafter signed an Informed Consent Form.

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Preparticipation Screening

The Physical Activity Readiness Questionnaire (PAR-Q)²¹ was administered to all before participation. This conforms to the recommendations for cardiovascular screening, staffing, and emergency policies at health/fitness facilities.²²

Measures

Anthropometry.

Anthropometric measures were completed (upon return of the pedometer and before the commencement of the aerobic fitness assessment) in an indoor setting. Participants, during their initial visit (during which information on the study was provided and the PAR-Q completed) were requested to abstain for eating/drinking within 4 hours of the subsequent visit, avoid exercising within 12 hours of the visit, void (urinate) completely before the visit, abstain from any alcoholic drinks within 48 hours of the visit, and avoid taking any diuretics before the visit, unless instructed by a physician.

Body height was measured in centimeters, using a height chart as the vertical distance from the floor to the vertex of the head. The participant stood barefoot with heels, buttocks, and head in contact with the wall and arms at their side. Waist circumference was measured (in centimeters) using a tape measure around the skin.

Body weight was measured using an electronic scale (Beurer PS 06), allowing only a single layer of clothing. The values were rounded to the nearest 100g. BMI was computed as weight (in kg)/height (in meters) squared.

The Futrex 6 100 (Futrex Inc., Gaithersburg, MD, USA) method of Near-Infrared Reactance (NIR) was used to measure %BF and is based on the principles of light absorption and reflection, where body fat (BF) absorbs the light and muscle reflects it.²³ The preprogrammed equation factors in the participant's age, body height, and gender and then calculates the individual's %BF.²³

Blood Pressure (BP).

BP was recorded (in mmHg) using a sphygmomanometer after the participant remained relaxed for 5 minutes. Two readings were taken, approximately 5 minutes apart. An average of the 2 readings was recorded. If the 2 readings obtained were different from each other (> 5 mmHg), a third reading was taken. The average of the 2 nearest readings was used.

Estimated Maximal Oxygen Uptake (VO₂max).

Aerobic fitness was derived from the heart rate response (recorded by a Suunto heart rate monitor), based on a 12-minute intermittent step test illustrated in Figure 1. This test comprised 4 incremental workloads for 2 minutes at a time on a stationary, 25cm high step, separated by a 1-minute rest period between each bout, at intensities regulated by an audible metronome (80, 96, 112, and 120 steps/min, respectively). The final rest period lasted 1 minute and the heart rate response to exercise was regressed to predict peak METS at age-predicted maximum heart rate. Thereafter, maximal oxygen uptake

(ml/kg/min) was estimated using the following equation: $44.891 - (\text{age} \times 0.262) - (\text{gender} \times 0.855) + (\text{peak METS} \times 0.994) + (\text{maximum reported MET hrs/wk of activity} \times 0.163)$.²⁴ This test has been shown to explain 76% of the variance in actual measured maximal oxygen consumption. The test was conducted after the participants had worn the pedometer for 4 consecutive days (minimum of 10 waking hours per day), so that the outcome of the test did not play any role in altering ambulatory PA during pedometer use.

\ insert figure 1 \

Pedometer

Participants were required to wear the Omron HJ 750 ITC pedometer, attached to the left or right hip, as conventionally worn in most studies.²⁵ Literature suggests that a minimum reliability of 0.80 can be achieved through an intraclass correlation of steps/d through pedometer use for at least 3 days, irrespective of the days of the week.²⁶⁻²⁸ Thus, a 4-consecutive-day protocol was decided upon to provide a reliable indication of accumulated steps/d.

The pedometer screen was covered to reduce the likelihood of participants observing their daily steps, which may have influenced habitual levels of PA and subsequently daily steps accumulation during the study. Participants were asked to wear the pedometer throughout the day and to follow their usual routine of daily activities and remove the pedometer only when bathing, showering, or swimming. Participants were also informed that their daily results would be made available to them at the end of the study and that there was no need for any resetting the pedometer as this pedometer automatically resets at 00:00 hrs.

Data Recording

The pedometer data were downloaded electronically by the researcher according to the Omron Health Management Manager software protocol.²⁹ One of the unique features of the pedometer is the ability to provide an hourly representation of steps/d. Furthermore, in addition to indicating total steps/d, the output illustrates steps accumulated as being "aerobic" or "non-aerobic" according to the Omron classification that integrates both intensity and duration. Steps classified as "aerobic" (≥ 60 steps/min, minimum duration of 1 minute) and "non-aerobic" (< 60 steps/min and/or < 1 -minute duration) within the total steps/d record is therefore provided. Consequently, total time spent accumulating "aerobic" steps in minutes/day (aerobic time) was determined. Information was obtained on the number of days that the pedometer was worn and whether over 4 consecutive days for at least 10 hours per day, as a minimum criterion set for this study.

Statistical Analyses

The data were analyzed using STATISTICA version 8 (StatSoft Inc., Tulsa, OK, USA) and statistical significance was set to $P < .05$. The relationship between average number of steps/d and BP, %BF, BMI, WC, and VO₂max was assessed using Pearson-Product-Moment Correlation analysis. To differentiate between total steps/d, and the intensity on health and fitness outcomes, participants were grouped according to the number and intensity of steps: LOW (< 5000 steps/d, irrespective of intensity), HIGH-LOW (≥ 5000 steps/d with no aerobic activity) and HIGH-HIGH (≥ 5000 steps/d with aerobic activity). The 5000 steps/d cut-off is based on current PA classifications that categorize those accumulating less than 5000 steps/d as sedentary.⁶ Analyses of covariance, adjusting for age, gender, and total steps/d, were used to compare groups, with Bonferonni post hoc analyses, to determine the between group effect of these categories for BP, %BF, BMI, waist circumference, and VO₂max.

Results

Participant Characteristics

Of the 78 participants that volunteered to participate in the study, 77 participants returned the pedometer and completed the fitness test. After downloading pedometer data, 7 of the participants (3 men and 5 women) were identified as not having worn the pedometer for 4 consecutive days or for a minimum of 10 hours per day and were excluded from the analysis. The final analysis sample therefore included 70 participants (35 male and 35 female, 32 ± 8 yrs). Table 1 illustrates the clinical and ambulatory characteristics of the study group.

\ insert table 1 \

The mean daily steps accumulated was 6520 ± 2306 for the total sample ($N = 70$). The intraindividual coefficient of variation (CoV) in steps/d (represented as a percentage) was 39.2 ± 17.3 . Forty-two participants accumulated at least some steps classified by the pedometer as “aerobic” (≥ 60 steps/min for 1 minute or more). The mean daily aerobic steps accumulated were $1,816 \pm 938$ per day and the average intensity and duration were 118 ± 9 steps/min and 16.2 ± 9.5 minutes, respectively.

Table 2 illustrates the correlation between health measures and total volume of steps (ie, both aerobic and nonaerobic combined), aerobic steps only, aerobic intensity, and aerobic time accumulated daily.

\ insert table 2 \

Total steps/d, aerobic intensity, and aerobic time were significantly negatively correlated to %BF ($P < .003$), BMI ($P < .03$), waist circumference ($P < .005$), and SBP ($P < .01$), respectively, for the overall group. Similarly, a positive correlation was found between total

steps/d and aerobic intensity and VO₂max ($P < .03$ and $P < .02$, respectively). DBP was not significantly correlated to any measure of steps.

In the groups accumulating ≥ 5000 steps/d (HIGH-HIGH and HIGH-LOW groups), statistically significant differences in the total steps/d were observed (7839 ± 1952 in HIGH-HIGH group and 6353 ± 949 in HIGH-LOW group, respectively, $P < .001$). Therefore, in the subsequent analyses of between group differences for fitness and health outcomes, adjustments were made for age and gender and with and without adjustments for total steps/d.

Table 3 illustrates the overall and between group effects of health measures, after adjusting for age and gender.

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There were significant differences in % BF between all 3 groups after adjusting for age and gender ($P < .001$), irrespective of whether results were adjusted for total steps/d. Body fat % was lowest in those in the HIGH-HIGH group, followed by the HIGH-LOW group, and then the LOW group. Similarly, waist circumference was significantly lower in the HIGH-HIGH group, compared with the other groups ($P < .001$). This effect remained even after adjusting for differences in total steps/d.

Estimated VO₂max was only significantly different between the LOW group and the HIGH-HIGH group ($P < .01$); however, after adjusting for total steps/d, these results were no longer significant. This indicates that VO₂max is not independent of total steps/d, despite differences in intensity. Therefore, the between-group differences for VO₂max, may relate more to the total volume than intensity of steps/d. Comparable results were found for blood pressure and BMI.

Discussion

The results of this pilot study supports the existing evidence linking steps/d to fitness and health outcomes. In addition, the study provides evidence that body composition may be influenced by not only total steps/d, but also by the intensity at which they are accumulated. Intensity of steps may, therefore, be a factor directly contributing to the attainment of better fitness and health outcomes, or indirectly by increasing the total volume of steps/d. Exercise prescription and/or steps/d recommendations may benefit from being framed within the context of intensity, thus corroborating recent accelerometer-based studies.^{30,31}

The mean steps/d of 6520 ± 2306 suggest that our sample group fell slightly below the lower end of the recommended 7000–13,000 steps/d for healthy, younger adults.⁶ Our data were consistent with the observation that individuals accumulating < 5000 steps/d are more likely to be classified as obese.³² Additional findings showed that the mean number of aerobic steps/d in the HIGH-HIGH group was 1816 ± 938 steps/d (accumulated over

16.2 ± 9.5 minutes/d) at an approximate average intensity of 118 ± 9 steps/min. Although slightly higher than the 96–107 steps/min⁶ and 100–110 steps/min¹⁸ ranges identified for moderate-intensity walking in recent studies under controlled settings, this (steps/minute rate) provides useful information on the intensity of PA accumulated by individuals under free-living conditions.

Participants accumulating 5000 steps/d or more, which included some sustained walking at a minimum pace of 60 steps/min, had lower %BF, waist circumferences, and a higher estimated VO₂ when compared with those who walked less than 5000 steps/d, or those who walked more than 5000 steps/d but at low intensities (< 60 steps/min) and/or short bouts (< 1 minute). The association between intensity of steps and health and fitness parameters persisted even after adjusting for differences in total steps per day. In a recent literature review, Choi et al³³ alluded to the viewpoint that there is a daily deficit of approximately 4000 steps/d, which must be gained from more rigorous activities. The result of the current study, which demonstrates the possible benefit of intensity-based walking, supports this viewpoint.

The intraindividual coefficient of variation (CoV, represented as a percentage) in steps/d was 39.2 ± 17.3. An intraindividual CoV of less than or equal to 10% has been recommended as an indication of adequate repeatability.^{34,35} However, Schonhofer et al reported an intraindividual CoV of steps/d of 17%–18% in patients with chronic obstructive pulmonary disease³⁶ and Tudor-Locke et al reported an intraindividual CoV of steps/d of 32.7% in adult participants.¹⁷ Tudor-Locke et al also reported that the individual with the lowest CoV (6.3%) took 1466 ± 92 steps/d and the individual with the highest CoV (87.9%) took 695 ± 610 steps/d.¹⁷ These studies^{17,34–36} support the contention that day-to-day walking behavior is not consistent, and the result obtained in this study further justifies this viewpoint.

Association Between Steps/d and Body Measures

Studies have shown that people meeting the 10,000 steps/d target are more frequently classified as normal weight, and those individuals with values less than 5,000 steps are more frequently classified as obese.³² Studies have also shown a distinct relationship between pedometer data and body composition variables in the expected direction.^{32,37–39} For example, Tudor-Locke et al,³² through an accelerometer-based study, measured time spent in various intensity categories and showed a decreasing gradient across all BMI categories. The mean % body fat of 17.9%, 23.5%, and 30.1% noted in the HIGH-HIGH, HIGH-LOW, and LOW groups, respectively, confirms the linear positive relationship between physical activity and % body fat.

Similarly, the results reported on waist circumference (mean waist circumference of 77.5 cm, 84.5 cm, and 87.2 cm noted in the HIGH-HIGH, HIGH-

LOW, and LOW groups, respectively) further demonstrates a significant association between physical activity and waist circumference and the benefit of the accumulation of volume and intensity of steps in maintaining a waist circumference within the accepted range as suggested by the National Institutes of Health.⁴⁰

A lower mean SBP observed in the HIGH-HIGH group when compared with the HIGH-LOW and LOW groups, respectively, demonstrates the value of increased steps/d and/or intensity; however, the mean values obtained in all of the 3 groups were within the accepted clinical range of 110–140 mmHg.⁴¹ Similarly, no clinical significance was noted for DBP between the groups as the mean values were within the 70–90 mmHg⁴¹ for all 3 groups. Chan et al³⁹ reported a comparable finding in 2003, where a low inverse correlation between DBP and steps/d and a stronger inverse correlation between SBP and steps/d that was nearly significant ($P = .0648$) was detected. The result obtained in this (Chan et al) study, however, only demonstrated the association between volume of steps/d and BP and did not consider intensity of steps accumulated. Totsika et al⁴² demonstrated a comparable effect in a 9-month diet and physical activity modification intervention in patients at risk for type 2 diabetes where systolic BP improved ($P \leq .006$) but diastolic BP did not change significantly ($P = .06$).

Association Between Steps/d and Estimated VO₂max

It is widely accepted that PA contributes to improved aerobic fitness and longevity.^{43,44} While such evidence points to the view that aerobic fitness is an important predictor of longevity to which volume and intensity of steps/d is typically a contributor, there is limited evidence on the association between steps/d and aerobic fitness. The results of this study show a positive relationship between estimated VO₂max and steps accumulated, with the HIGH-HIGH group attaining the highest estimated VO₂max and the LOW group, the lowest.

Steps Per Day Versus the 30-Minute Recommendation of MPA

The improved clinical ranges seen in the HIGH-HIGH group of our study supports current literature on the importance of volume and intensity of PA and points toward a similar direction as that documented by Wilde et al in establishing that the addition of intensity based steps/d contributed toward achieving the 10,000 steps/d recommendation.^{45,46} In relation to the ACSM guidelines of 30 minutes moderate-vigorous physical activity at least 5 times per week,⁵ Wilde et al reported that women increased their average physical activity from 7220 steps/d to 10,030 steps/d when they included a 30-minute, self-timed walk.¹⁶

A recent accelerometer-based study by Cook et al⁴⁷ in an adult population of rural Black South African women showed the health benefits of a high number of low intensity steps accumulated (mean > 9000 steps/d)

with reduced risk of obesity by 34% at 7500 steps/d, 52% at 10,000 steps/d, and 62% at 12,500 steps/d, when compared with achieving < 5000 steps/d. While the ambulatory levels seen here are very different from the current study that observed a mean value of 6520 steps/d, the pronounced risk reduction (more acceptable clinical and anthropometric ranges) in the 5000–10,000 steps/d categories in both studies remains a notable observation.

Categorization of Aerobic Steps

Omron has proprietary software that categorizes “aerobic” steps as ≥ 60 steps/min for a minimum duration of 1 minute, which is substantially different from those recommended by recent studies conducted. Tudor-Locke and colleagues⁶ determined that 96–107 steps/min represents a minimum threshold for moderate-intensity walking and Marshall and colleagues¹⁸ suggested a range of 100–110 steps/min. While the recommendations of these 2 studies are far greater than the cut-off used by the Omron pedometer, the Omron classification of “aerobic steps” has allowed for the differentiation of steps based on some level of intensity and duration. Nevertheless, by no means do we allude to 60 steps/min being an equivalent proxy for aerobic activity. Rather, this categorization allows us to extrapolate more refined intensity and duration-based data usually not available through pedometers. The subcategorization of steps according to this base-line level of intensity and duration is therefore a useful addition to pedometry, as previous studies on intensity of physical activity have been limited to accelerometry.^{29,31} Further development of this may be of value in determining an appropriate intensity-based target that can inform more personalized goal settings by providing a baseline level for moderate intensity PA that can be applied to pedometry.

Strengths of the Study

The research undertaken is the first pedometer-based study to our knowledge that differentiates walking according to a baseline level of intensity and duration. In a sample of people accumulating an average of approximately 6000 steps/d, this categorization has helped identify “steps that count” (ie, ≥ 1 minute of walking at a minimum pace of 60 steps/min) and thereafter extrapolate further information on intensity and volume specific to these bouts of PA. This is useful in establishing associations between “steps that count” and clinical and fitness measures. It must be noted, however, that in the subanalysis of the HIGH-HIGH group, the intensity of steps was 118 ± 9 steps/min accumulated for an average duration of 16.2 ± 9.5 minutes. This study therefore supports the recommendations made by Marshall and colleagues¹⁸ that concluded comparable but slightly lower step/minute rate findings for aerobic ambulation. The demonstration of this effect under free-living conditions provides a useful addition to current literature.

This is also among the first pedometer-based studies to be conducted in the Republic of South Africa within an

urban context and therefore provides useful information on physical activity patterns and a starting point to further pedometer-based research studies. The possibility of expanding and modifying the current study into a large-scale study is recommended and can be explored further.

Limitations

The relatively small sample size and the potential selection bias, inherent in any convenience sample, limit the external validity of the study. As the study is presented as a pilot study, no power calculation has been carried out. Thus the results cannot be generalized to the entire population. This necessitates the need for similar but larger studies to confirm present findings, and the outcomes of the study can be used to perform an appropriate power calculation for future studies of this type to be carried out in a similar context.

The use of NIR as a measure of %BF may be viewed as a limitation. Furthermore, most published %BF ranges have been based on empirically set limits, population percentiles, and *z*-scores and subject to potential limitations.⁴⁸ Percentage BF was however used as an additional measure to BMI and the results of both measures were analyzed and reported separately.

The categorization of aerobic steps as ≥ 60 steps/min by this pedometer is substantively lower than those recommended by recent studies.^{6,18} Furthermore, the pedometer does not reflect any moderate-high intensity steps as aerobic steps if sustained for anything less than 1 minute in duration. This (≥ 60 steps/min, 1 minute or more) classification does provide some level of differentiation in the type and duration of steps accumulated throughout the day and has provided an intensity and duration component to typical pedometer data.

This study highlights the association between the volume and intensity of steps/d and health and fitness measures. The findings of this study support the viewpoint that pedometer-determined ambulatory physical activity is of practical importance in establishing more precise, population-specific indices and demonstrates an association between specific health outcomes and both the number and intensity of steps/d.

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Step Test Protocol- (Virgin Life Care™)

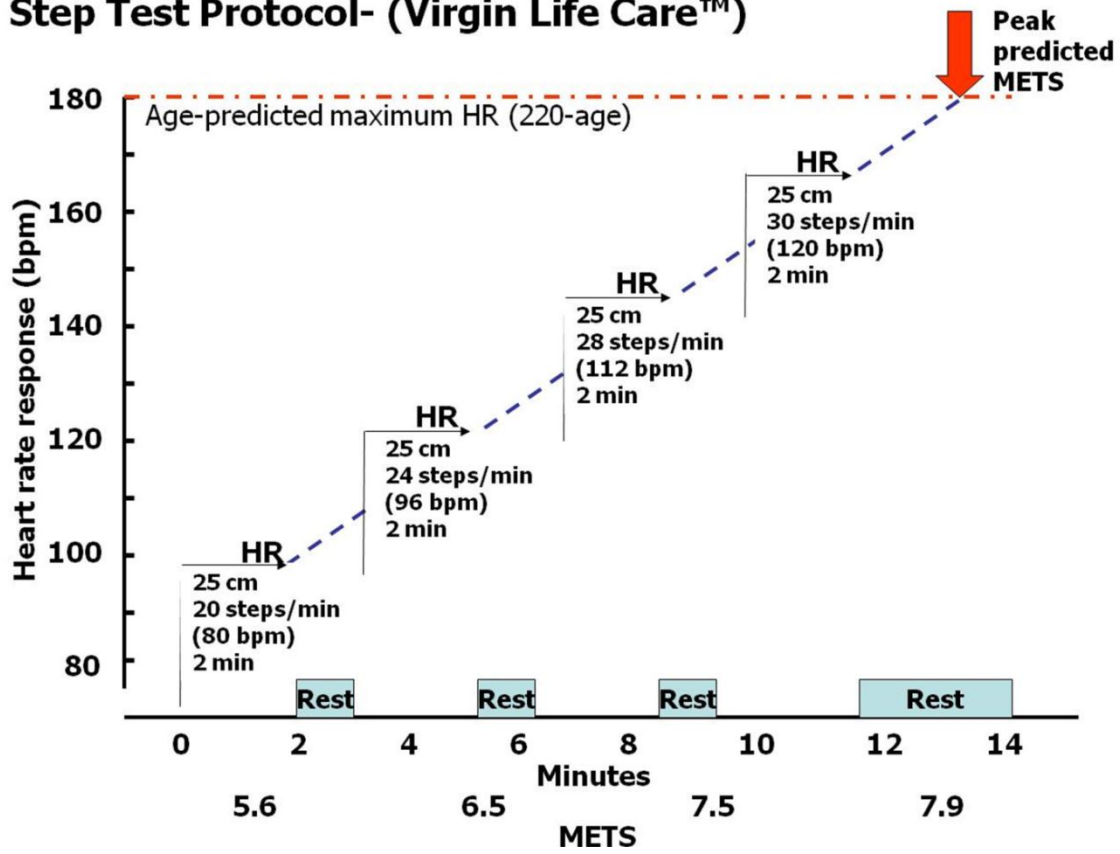


Figure 1 — Step test protocol: virgin life care.

Table 1 Fitness, Health, and Ambulatory Characteristics of Participants (N = 70)

Variable	Men	Women	Total
Age	33.1 ± 7.9	31.6 ± 7.7	32.3 ± 7.8
Body mass index (kg/m ²)	25.3 ± 3.2	23.9 ± 4.5	24.6 ± 3.9
% Body fat	20.9 ± 8.1	23.3 ± 9.6	22.1 ± 8.9
Waist circumference (cm)	86.7 ± 9.6	75.9 ± 9.8	81.3 ± 11.1**
Systolic blood pressure (mmHg)	125.8 ± 12.6	120.1 ± 7.3	122.9 ± 10.6*
Diastolic blood pressure (mmHg)	83.3 ± 8.8	81.7 ± 8.6	82.5 ± 8.7
Estimated VO ₂ max (ml/kg/min)	41.9 ± 7.6	35.8 ± 8.8	38.8 ± 8.7**
Pedometer steps /day	6424 ± 2208	6616 ± 2427	6520 ± 2306
Daily aerobic time in minutes (N = 42, participants who accumulated any aerobic steps)	14.4 ± 7.4	17.4 ± 10.7	16.2 ± 9.6

Note. Values are means ± standard deviation.

* Indicates statistical significance ($P < .05$); ** ($P < .003$) between men and women.

Table 2 Correlation (rho) Between Health Measures and Total Steps, Aerobic Steps, Intensity and Time per Day (N = 70)

Variable	Average total steps/day	Average aerobic steps/day	Average aerobic minutes/day	Average aerobic intensity (%)
% Body fat	-0.38**	-0.45**	-0.37**	-0.48**
Body mass index	-0.28*	-0.31*	-0.24*	-0.32*
Waist circumference	-0.41**	-0.38**	-0.31**	-0.44**
Systolic blood pressure	-0.25*	-0.31*	-0.31*	-0.28*
Diastolic blood pressure	-0.10	-0.15	-0.20	-0.16
VO ₂ max	0.27*	0.23	0.17	0.29*

Note. Values indicate rho values; asterisk indicates statistical significance (* $P < .05$, ** $P < .01$).

Table 3 Fitness, Health, and Ambulatory Characteristics of Participants by Group (Means Adjusted for Age and Gender, ± Standard Deviations)

Variable	Low (N = 18)	High-Low (N = 13)	High-High (N = 39)
% Body fat	30.1 ± 6.7 ^a	23.5 ± 6.8 ^b	17.9 ± 6.8 ^c
Body mass index (kg/m ²)	26.8 ± 3.5 ^a	24.4 ± 3.5 ^{ab}	23.6 ± 3.5 ^b
Waist circumference (cm)	87.2 ± 8.7 ^a	84.5 ± 8.9 ^a	77.5 ± 8.9 ^c
Systolic blood pressure (mmHg)	127.1 ± 10.2 ^a	125.7 ± 10.3 ^{ab}	120.1 ± 10.3 ^b
Diastolic blood pressure (mmHg)	82.8 ± 8.8	86.1 ± 8.9	81.2 ± 8.9
VO ₂ max (ml/kg/min)	35.4 ± 6.8 ^a	36.2 ± 7.0 ^{ab}	41.3 ± 7.0 ^b
Pedometer steps/day	3705 ± 1540 ^a	6176 ± 1540 ^b	7935 ± 1564 ^c

Note. Values represent mean ± standard deviation. % body fat ^avs^b, $P < .03$; % body fat and waist circumference, ^avs^c, $P < .002$.