

Rate of perceived exertion and cardiovascular response of community dwelling older adults to six-minute walk test

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Abstract

Objectives: This study was designed to determine the rate of perceived exertion, cardiovascular responses of community dwelling older adults to six minutes' walk (6MWT) and possible gender difference.

Methods: One hundred and three apparently healthy community dwelling older adults, aged 60 years and above participated in the study. Rate of perceived exertion (RPE) and cardiovascular responses (blood pressure, peripheral capillary oxygen saturation (SPO₂) and pulse rate) were measured pre and post 6MWT.

Results: There was a significant increase ($p = 0.01$) in RPE among all participants after the 6MWT. There was no significant difference ($p > 0.05$) in all the cardiovascular parameters pre and post 6MWT but with a significant difference in SPO₂ between male and female participants.

Conclusion: Among older adults, rate of perceived exertion after a 6MWT was sort of hard with possible influence on the Systolic Blood Pressure following 6MWT. Female participants showed higher oxygen saturation than males.

Key words: Rate of perceived exertion, Ageing, Cardiovascular response, six-minutes walk test

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Taux d'effort perçu et de réponse cardiovasculaire des personnes âgées vivant dans la communauté à un test de marche de six minutes

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Résumé

Objectif de l'étude : Cette étude a été conçue pour déterminer le taux d'effort perçu, les réponses cardiovasculaires des personnes âgées vivant dans la communauté à six minutes de marche (6MWT) et la différence possible entre les sexes.

Méthode de l'étude : Cent trois personnes âgées apparemment en bonne santé, âgées de 60 ans et plus, vivant dans la communauté, ont participé à l'étude. Le taux d'effort perçu (TEP) et les réponses cardiovasculaires (pression artérielle, saturation capillaire périphérique en oxygène (SPO₂) et pouls) ont été mesurés avant et après 6MWT.

Résultat de l'étude : Il y a eu une augmentation significative ($p = 0,01$) du RPE parmi tous les participants après le 6MWT. Il n'y avait pas de différence significative ($p > 0,05$) dans tous les paramètres cardiovasculaires avant et après 6MWT mais avec une différence significative de SPO₂ entre les participants masculins et féminins.

Conclusion : Chez les adultes plus âgés, le taux d'effort perçu après un 6MWT était assez difficile avec une influence possible sur la pression artérielle systolique après 6MWT. Les participantes ont montré une saturation en oxygène plus élevée que les hommes.

Mots-clés : Taux d'effort perçu, vieillissement, réponse cardiovasculaire, test de marche de six minutes

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INTRODUCTION

At a global level, especially in the developed world, the population of the people older than 65 years is growing at a faster rate compared to that of people below (1). The responsible factor is more connected with increase in life expectancy and decline in number of children being given birth to in a year (1). However, as people age, they experience changes or decline in health status which means that as age-related changes set in, the elderly become challenged health-wise and coping will become the only tool to move on with life (2).

Cardiovascular response which is the reaction by the body to a specific influence subject to individual factors such as advancing age, heredity, gender and level of physical fitness (3). Studies have shown that advancing age is potentially the most contributor to the various causes of decline in the metabolic function (4). Ageing results in a decrease of muscle power and exercise capacity (5). Therefore, the elderly often functions at the limit of their capacity to perform the activities of daily living (ADL) (6).

In older people, physical activity is a key component of independent functioning and quality of life (QoL) and it contributes to the prevention of diseases, disability, and falls (7,8). There are several modalities available for the objective evaluation of exercise capacity such as six-minute walk test, stair climbing, shuttle-walk test and a cardiopulmonary exercise test (9,10).

Six-minute walk test (6MWT) is a sub maximal exercise test which measures the distance an individual covers in 6 minutes and it assesses the functional capacity of the individual. It has a high reliability in healthy older adults and since most activities of daily living are performed at submaximal levels of exertion, the 6MWT is more reflective of activities of daily living (ADL) than the other forms of walk tests (11,12). The effort expended during these submaximal levels of exertion is objectively evaluated using the Borg's scale, Rating of Perceived Exertion (RPE).

Rating perceived exertion involves self-evaluation of physical effort which is drawn from perceptual, psychological and physiological factors (13). The bodily sensations, feedback, and the actual performance of a specific physical activity inform the expression of RPE (14). During aging process, blood flow to the brain reduces, which leads to decrease in cognitive and physical functions, hence, influencing RPE in older adults (15).

A decline in cardiovascular function with

increasing age has been established (4), making it imperative to evaluate the change in cardiovascular response of older adults to submaximal exercise (6MWT), necessary to carry out ADL. Hence, this study is aimed at evaluating the cardiovascular responses of community dwelling older adult to a 6MWT.

MATERIALS AND METHODS

Ethical Consideration: Prior to the commencement of this study, ethical approval was sought and obtained from the Health Research and Ethics Committee of the Lagos University Teaching Hospital, Idi-Araba Lagos, Nigeria. Permission was also sought from the community leaders/clergy at the sites of data collection. Informed consent was also sought from the subject prior to the commencement of the study. All procedures were explained to the participants verbally and an information sheet which contained detailed information of what the study was all about was given to all participants.

Participants

This cross-sectional analytical survey involved 103 apparently healthy community dwelling older adults (aged 60 to 91). They were recruited from churches and mosques in Lagos state, Nigeria. The study included older persons who were ambulant either independently or with an aid and a score of >18 on the Mini Mental State Examination Questionnaire (MMSE). Older adults with history of unstable angina, myocardial infarction, resting heart rate of greater than 120bpm, systolic blood pressure greater than 180mmHg, Diastolic blood pressure greater than 100mmHg and history of any form of cardiovascular disease were excluded from the study.

Procedure for Data Collection

Pre- Test Assessment: Participants that met the inclusion criteria and gave their consent were assessed for cognition using the MMSE questionnaire. Rate of perceived exertion was assessed using Borg's rating scale of perceived exertion (16). This was followed by assessing the metabolic function (systolic and diastolic blood pressure were measure using an analogue sphygmomanometer and a stethoscope, the pulse rate and respiratory rate were assessed while oxygen saturation (SpO₂) was measured using a pulse oximeter). Following these baseline measurements, the participants were asked to perform the six-minute walk test.

The six minutes' walk test: The six-minute walk

test was performed indoors and outdoors when the weather condition was favourable enough, along a long, flat, straight, enclosed corridor with a hard surface that was seldom travelled. The walking course was 30 meters in length. A 100-ft hallway was, therefore, required. The length of the corridor was marked at every 3 meters. The turnaround point was marked with an orange traffic cone. The starting line, which marked the beginning and end of each 60-m lap, was marked on the floor using brightly coloured tape (17). The test was then carried out following the American Thoracic Society Guideline for six-minutes walk test (12).

Post- Test Measurement: Immediately after the six-minute walk test, participants were re-assessed based only on the Borg's scale of perceived exertion and all the cardiovascular responses measured at baseline (systolic and diastolic blood pressures, pulse rate, respiratory rate and SpO₂).

Statistical Analysis

Data was analysed using Statistical Package for the Social Sciences (SPSS) windows version 22.0. Descriptive statistics of measures of central tendency (mean, median, and mode) and measure of variability (standard deviation) were used to summarize the data obtained. Paired t-test was used to determine the changes in the rate of perceived exertion and cardiovascular responses before and after the six-minute walk test while independent t-test was used to compare the data of the male and female participants. Spearman's rank correlation coefficient was used to determine the relationship between the rate of perceived exertion score and all the cardiovascular responses assessed after the 6MWT. The level of significance for all the inferential statistics was $p < 0.05$.

RESULTS

The participants include 76 (74%) females and 27 (26%) males. The mean age of female participants was 68.70 ± 7.24 year and mean age of male participants was 67.96 ± 7.25 years. Using paired t-test, table 1 shows the comparison of rate of perceived exertion and cardiovascular response of the participants pre- and post-six-minute walk test. It was observed that there was significant difference in the RPE pre and post 6MWT.

Spearman rank correlation test was used to determine the relationship between rate of perceived exertion and cardiovascular responses of the participants. There was significant positive

relationship between RPE and SBP after 6MWT ($r_s = 0.19, p = 0.04$) (Table 2).

Independent t-test was used to compare the data of the male and female participants' pre and post 6MWT and it was observed that pre 6MWT, there was a significant difference in the PR while after 6MWT, a significant difference was observed in the oxygen consumption (SPO₂). (Table 3).

DISCUSSION

Six-minutes walk test, a submaximal exercise, is a useful tool for the evaluation of the exercise capacity in older adults. Understanding the immediate response to this level of exercise is of utmost importance to exercise prescription for older adults. As expected, it was observed in this study that there was a substantial increase in the rate of perceived exertion after the six-minute walk test but there was no significant increase in the cardiovascular response. Shamay *et al* (18) while studying effect of walkway length, turning direction and distance covered during the six-minute walk test among 25 ambulant stroke survivor (>50 years) observed a increase RPE post exercise.

Furthermore, this study showed that there was no significant difference in cardiovascular responses of participants before and after the six- minute walk test. This is not unexpected because with aging there is a reduced cardiac response to stress and exercise (19). Even in diseases state, Fonseca *et al*, (20) found no significant difference in cardiovascular parameters among elderly population with COPD before and after two 6MWT with 30 mins rest in between. However, this disagrees with findings of Chugh *et al*, (21) where a significant difference was found between the pre and post 6MWT heart rate among young smokers.

There was a significant relationship between rate of perceived exertion and systolic blood pressure after 6MWT. This implies that even-though there is a reduction in exercise response among the elderly, the increase in rate of perceived exertion could account for the observed marginal though not significant increase in systolic blood pressure, hence the weak relationship. Among younger population, who do not experience a delay in response to exercise, there was an observed moderate to strong relationship between rate of perceived exertion and systolic blood pressure as reported by Rodriguez *et al* (22).

Higher oxygen saturation rate was observed after the 6MWT among the female

participants. This is inline with reported normative values even after considering age and body mass indices (23,24). This may be due to hormone-related differences. These hormones may have a direct or an indirect effect on the respiratory centers (25). Progesterone hormone which has been shown to be higher in women throughout all phases of the menstrual cycle has been shown to stimulate breathing via central and peripheral chemoreceptors (26). Furthermore, a possible indirect effect of sex on SpO₂ could be related to increase work of breathing (WOB) as this has also been shown to be higher in women compared to men (23).

CONCLUSIONS

Based on the outcomes of this study it was concluded that among community dwelling older adults, rate of perceived exertion after a 6MWT was sort of hard with possible influence on the Systolic Blood Pressure. Also, female community dwelling older adults have more tendency for higher oxygen saturation than males following 6MWT.

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Conflicts of interest: Authors declare no conflicts of interest and no external financial support. This study has not been submitted or published in any form in other journals.

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Table 1: Rate of perceived exertion and cardiovascular response of the participants pre- and post-six- minute walk test

Variable	Mean \pm SD Pre	Mean \pm SD Post	t-value	p-value
SBP(mmHg)	137.93 \pm 18.29	138.45 \pm 18.57	-0.54	0.58
DBP(mmHg)	80.61 \pm 11.12	80.04 \pm 11.50	0.62	0.53
PR (bpm)	76.11 \pm 12.87	76.47 \pm 12.25	-0.65	0.51
SPO ₂ (%)	96.90 \pm 4.76	97.76 \pm 1.63	-1.97	0.05
RPE	2.71 \pm 1.42	3.79 \pm 1.65	-10.73	0.01*

*Level of significance letter < 0.05

Key: SBP: Systolic Blood Pressure DBP: Diastolic Blood Pressure
 PR: Pulse Rate SPO₂: Oxygen Saturation
 RPE: Rate of Perceived Exertion mmHg: millimeters of Mercury
 t-test: Paired t-test SD: Standard Deviation

Table 2: Relationship between rate of perceived exertion (RPE) and cardiovascular responses

Variable	r _s	p-value
Pre 6MWT		
RPE vs. SBP	0.18	0.63
RPE vs. DBP	-0.54	0.58
RPE vs. SpO ₂	0.10	0.30
RPE vs. PR	-0.32	0.75
Post 6MWT		
RPE vs. SBP	0.19	0.04*
RPE vs. DBP	0.00	1.00
RPE vs. SpO ₂	0.03	0.76
RPE vs. PR	0.04	0.67

*Level of significance letter < 0.05

Key: SBP: Systolic Blood Pressure
 DBP: Diastolic Blood Pressure
 PR: Pulse Rate
 SPO₂: Oxygen Saturation
 RPE: Rate of Perceived Exertion
 r_s: Spearman's Correlation Coefficient

Table 3: Comparison of perceived exertion rate of male and female participants

Variable	Mean Male	\pm SD	Mean Female	\pm SD	t-value	p-value
Pre 6MWT						
RPE	0.88 \pm 0.93		1.15 \pm 1.12		1.11	0.27
SBP(mmHg)	140.00 \pm 19.44		137.19 \pm 17.96		0.68	0.49
DBP(mmHg)	81.62 \pm 10.55		80.25 \pm 11.36		-0.55	0.58
PR (bpm)	71.51 \pm 14.92		77.75 \pm 11.74		2.20	0.03*
SPO ₂ (%)	96.44 \pm 6.87		97.06 \pm 3.79		0.58	0.56
Post 6MWT						
RPE	1.62 \pm 1.17		2.09 \pm 1.51		1.43	0.15
SBP(mmHg)	139.40 \pm 18.13		138.11 \pm 18.83		-0.30	0.75
DBP(mmHg)	80.66 \pm 13.40		79.82 \pm 10.84		-0.32	0.74
PR (bpm)	73.51 \pm 12.95		77.52 \pm 11.90		1.46	0.14
SPO ₂ (%)	97.22 \pm 2.51		97.96 \pm 1.13		2.04	0.04*

*Level of significance letter < 0.05

Key: SBP: Systolic Blood Pressure DBP: Diastolic Blood Pressure
 PR: Pulse Rate SPO₂: Oxygen Saturation
 RPE: Rate of Perceived Exertion mmHg: millimeters of Mercury
 t-test: Independent t-test SD: Standard Deviation