Reliability and Intensity of the Six-Minute Walk Test in Healthy Elderly Subjects

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ABSTRACT

KERVIO, G., F. CARRE, and N. S. VILLE. Reliability and Intensity of the Six-Minute Walk Test in Healthy Elderly Subjects. *Med. Sci. Sports Exerc.*, Vol. 35, No. 1, pp. 169–174, 2003. **Purpose:** The 6-min walk test (6-MWT) is an easy and validated field test, generally used in patients to assess their physical capacity. We think that the 6-MWT could also be conducted in the same perspective in healthy subjects, aged 60–70 yr. However, little is known about the effect of the familiarization on the 6-MWT performance and the relative intensity of this test. The aims of this study were therefore to bring precision to the 6-MWT reliability and intensity in this population. **Methods:** Over 3 d, 12 subjects performed two maximal exercise tests on treadmill and five 6-MWT (two in the morning and three in the afternoon) with a portable metabolic measurement system (Cosmed K4, Rome, Italy). The distance, walking speed, oxygen uptake ($\dot{V}O_2$), and heart rate (HR) values were measured during the 6-MWT. **Results:** Distance, walking speed, and $\dot{V}O_2$ were only lower during the first two 6-MWT (respectively, $P < 0.001$, $P < 0.001$, and $P < 0.05$). HR was reliable from the first 6-MWT and was higher during the tests performed in the afternoon ($P < 0.001$). The intensity of the 6-MWT corresponded to 79.6 ± 4.5% of the $\dot{V}O_{2max}$, 85.8 ± 2.5% of the HR_{max}, and 78.0 ± 6.3% of the $HR_{reserve}$. Moreover, it was higher than the ventilatory threshold in each subject ($P < 0.01$). **Conclusion:** In healthy elderly subjects, the 6-MWT represents a submaximal exercise, but at almost 80% of the $\dot{V}O_{2max}$. To be exploitable, two familiarization attempts are required to limit the learning effect. Finally, the 6-MWT time of day must be taken into account when assessing HR. **Key Words:** FIELD TEST, FAMILIARIZATION, ASSESSMENT OF PHYSICAL CAPACITY, PORTABLE METABOLIC MEASUREMENT SYSTEM, CARDIORESPIRATORY PARAMETERS

The cardiovascular, respiratory, and muscular benefits of physical training in healthy elderly subjects have been largely underscored (11,20). Maximal oxygen uptake ($\dot{V}O_{2max}$) is usually used before and after physical training to evaluate the physical capacity. The regular use of this test to assess the subjects' progress may incite motivation to maintain a physical activity. However, this well-validated test (25) is still complex, requiring specially trained staff, and cumbersome and expensive equipment (19,24,29). Therefore, other more simple and inexpensive test is required in complement of the maximal exercise one.

The 6-min walk test (6-MWT) is a validated, simple, safe, and low-cost field test, often used in chronic heart failure (CHF) and chronic obstructive pulmonary disease (COPD) patients to regularly assess their functional exercise capacity and the effects of a rehabilitation program (8,16,21). Indeed, a premeasured level hallway, stopwatch, and specific instructions are all that are necessary for such a test (9). Moreover, the 6-MWT requires one only to walk and can be performed easily by young and old people. Different parameters in patients such as the 6-MWT familiarization (8,16,22) can, however, influence the performance obtained.

Because there are few field tests applicable to healthy subjects aged more than 60 yr, we think that the 6-MWT could be used in the same perspective in subjects without physical activity contra-indications. The aims of the present study were therefore to assess the distance and cardiorespiratory parameters during the 6-MWT in healthy subjects aged 60–70 yr to study (i) the test reliability on successive days and on the same day, and (ii) the test relative intensity.

METHODS

Subjects. Twelve subjects aged 60–70 yr were recruited. They had a medical examination and completed a health status questionnaire. Medication, smoking habits, and physical activities (27) were also noted. Their anthropometric values are indicated in Table 1. The classical inclusionary factors for the healthy elderly subset (10) were used: no current smoking, free from drugs, chronic disease, history of stroke, and body mass index lower than 35. None of the subjects had neurologic and orthopedic conditions that could influence successful completion of the exercise tests, and exhibited any significant anxiety or difficulty in understanding the test protocols. All were active but not involved in any regular physical training. The study was approved by the institutional committee on human research, and written informed consent was obtained from all subjects.

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TABLE 1. Characteristics of the studied subjects (N = 12).

Variable	Mean ± SE
Sex (M/F)	6/6
Age (yr)	64.7 ± 1.4
Weight (kg)	68.4 ± 2.6
Height (cm)	160.8 ± 2.2
BMI ($kg \cdot m^{-2}$)	26.4 ± 0.7

M, male; F, female; BMI, body mass index.

Study design. Individuals performed two maximal exercise tests and five 6-MWT on 3 d (1–2 d apart) according to the following manner: day 1 in the morning: 6-MWT and maximal exercise test, and in the afternoon: 6-MWT; day 2 in the morning: 6-MWT, and in the afternoon: 6-MWT; day 3 in the morning: maximal exercise test, and in the afternoon: 6-MWT. During all tests, they carried the Cosmed K4 (Rome, Italy), portable metabolic measurement system, to record the cardiorespiratory parameters.

Metabolic parameters. The Cosmed K4 is a well-validated portable metabolic measurement system (12,17) composed of a soft mask to sample exhaled air, a sensor system to measure ventilation, and O_2 and carbon dioxide (CO_2) analyzers. The total weight carried by the subject is about 800 g. The radio transmission range in an open field using a small 30-cm-long receiving antenna is about 800 m. The respiratory flow was measured by a turbine fixed to the face mask, and expired gas concentrations were measured with a polarographic electrode for the O_2 fraction and with an infrared electrode for the CO_2 fraction. These gas analyzers were thermostated and compensated for barometric pressure and environmental humidity variations. The Cosmed K4 system was calibrated before each test according to the manufacturer's recommended procedures (operator's manual of K4 system). Heart rate (HR) was simultaneously recorded with a polar portable system (Polar Electro OY, Kempele, Finland). The sampling of the parameters studied ($\dot{V}O_2$ and HR) was carried out at 30-s intervals. Furthermore, the apparatus includes a communication interface to download all recorded parameters onto a personal computer. Data was collected and analyzed using the software "K4 for Windows."

Maximal exercise test. Each subject underwent two maximal cardiorespiratory exercise tests on treadmill (Marquette Electronics, Milwaukee, WI). The first was used as a familiarization and exclusion test, eliminating from our study the participants presenting an exercise contra-indication. A conventional exercise protocol namely the "chronotropic assessment exercise protocol," well tolerated in elderly healthy subjects, was used (23). It started at 1.6 $km \cdot h^{-1}$ and increased (speed 0.8 $km \cdot h^{-1}$ and slope 1%) every 2 min. Blood pressure was measured manually in the left arm at each end stage by using a quartz transducer. A 12-lead electrocardiogram (Cardio System Marquette Hellige, Milwaukee, WI) was continuously monitored. The exercise test was stopped when at least three classical criteria of $\dot{V}O_{2max}$ were reached (11). Because of a possible influence of the familiarization test, only the results of the second exercise test were analyzed.

$\dot{V}O_{2max}$ and HR_{max} were defined as the mean $\dot{V}O_2$ and HR values obtained during the last minute of exercise. $HR_{reserve}$ was calculated ($HR_{reserve} = HR_{max} - HR_{resting}$) (18). Ventilatory threshold was determined in a blind manner by three technicians using the Beaver et al. method (3). If not conclusive, the Wasserman method was used (28).

The 6-min walk test. The medically supervised 6-MWT was performed in an 18-m-long hospital corridor free from all obstacles. Subjects were asked to walk back and forth at a regular pace, covering as great a distance as possible during the allotted time (16). Resting stops were allowed. Standardized encouragement was given every 30 s (4). The time remaining was called every 2 min (4). The supervisor stopped the subject when the 6 min had elapsed. So as not to influence their walking speed, subjects were unaccompanied. Medical staff and subjects were blind to all previous test results.

The total distance covered in meters was measured and the walking speed in $m \cdot s^{-1}$ lap by lap was calculated. To better characterize the metabolic evolution during the 6-MWT, $\dot{V}O_2$ and HR were noted every 30 s. The reliability and intensity of the 6-MWT were assessed using the mean $\dot{V}O_2$ and HR values recorded during the last minute of the walking test. Before and after each test, dyspnea was assessed on a 10-cm visual analog scale with "not breathless at all" at one end of the scale and "as breathless as you could ever imagine" at the other (7).

Conducting five 6-MWT in a strictly standardized procedure permitted us to assess the test familiarization and reliability over several days. Both 6-MWT performed on the second day of the study (one in the morning and the other in the afternoon) have been used to assess the test daily reliability. The fifth 6-MWT, conducted on the same day as the maximal exercise test, served as a reference to evaluate its relative intensity (i.e., in comparison with individual $\dot{V}O_{2max}$, HR_{max}, and $HR_{reserve}$) and to assess the variations in speed and metabolic parameters within the test.

Statistical analysis. All data is expressed as mean ± SE. The reliability of the parameters obtained from the 6-MWT was assessed using several complementary methods (2): a Friedman test, a Bland and Altman graphic representation (5) between the first two and the last two 6-MWT, the coefficient of variation (CV), and standard deviation (SD) calculation (15). During the fifth 6-MWT, the walking speed and the metabolic parameters ($\dot{V}O_2$ and HR) were evaluated, respectively, lap by lap and 30 s by 30 s using a Friedman test. Then, a Wilcoxon signed rank test was used for the pairwise analysis. It was also used to compare the 6-MWT intensity with the ventilatory threshold. In their recent study, some authors (10,14,26) have proposed a regression equation based on sex, age, height, and weight to predict the distance covered during the 6-MWT. A Wilcoxon signed rank test was used to compare the predicted 6-MWT distances using the different equations (10,14,26) and the real 6-MWT distance performed by our participants. A Bland and Altman graphic representation (5) was then performed between the predicted 6-MWT distance, using the Troosters et al. equation (26), and the

TABLE 2. Values (mean ± SE) of the parameters recorded during each 6-min walk test (6-MWT).

	First 6-MWT	Second 6-MWT	Third 6-MWT	Fourth 6-MWT	Fifth 6-MWT
Distance (m)	524.8 ± 19.0***	545.0 ± 21.2***	564.4 ± 20.1	563.4 ± 18.8	570.1 ± 22.7
Speed ($m{\cdot}s^{-1}$)	1.47 ± 0.05***	1.51 ± 0.06***	1.57 ± 0.06	1.58 ± 0.06	1.59 ± 0.06
$\dot{V}O_2$ ($mL{\cdot}kg^{-1}{\cdot}min^{-1}$)	22.0 ± 1.2#	21.9 ± 1.4#	23.2 ± 1.7	23.1 ± 1.2	23.8 ± 1.8
% of the $\dot{V}O_{2max}$	73.2 ± 4.0#	73.4 ± 3.3#	77.4 ± 4.5	77.1 ± 3.0	79.6 ± 4.5
HR ($beats{\cdot}min^{-1}$)	123.9 ± 4.8†††	127.4 ± 5.0	121.8 ± 4.1†††	128.2 ± 4.1	130.3 ± 4.4
% of the HR_{max}	80.0 ± 3.0†††	83.9 ± 2.7	80.4 ± 3.0†††	84.8 ± 2.6	85.8 ± 2.5
Dyspnea	3.5 ± 0.9	5.0 ± 0.8	4.5 ± 0.8	4.8 ± 0.7	4.5 ± 0.7

$\dot{V}O_2$, oxygen uptake; HR, heart rate.
*** $P < 0.001$, comparison between all the 6-MWT.
# $P < 0.05$, compared with the fifth 6-MWT.
††† $P < 0.001$ between morning and afternoon.

real distance to measure the agreement between the two measurements. Finally, a linear multiple regression analysis based on age, anthropometric values (weight, height), and on the 6-MWT distance, $\dot{V}O_2$, and HR was used to predict $\dot{V}O_{2max}$ of our subjects. For all analysis, a $P < 0.05$ level was accepted as significant.

RESULTS

Maximal exercise test. No adverse events were noted during the treadmill tests. The mean $\dot{V}O_{2max}$ and HR_{max} values were, respectively, 30.1 ± 1.0 $mL{\cdot}kg^{-1}{\cdot}min^{-1}$ and 152.0 ± 4.0 $beats{\cdot}min^{-1}$. The mean ventilatory threshold value corresponded to 65.4 ± 2.9% of the $\dot{V}O_{2max}$.

The 6-min walk test. None of the 6-MWT was interrupted. The mean distance increased by 45.3 m over the five trials. The distance performed and consequently the walking speed were significantly lower during the first two 6-MWT ($P < 0.001$, Table 2 and Fig. 1). During the last 6-MWT, subjects walked 570.1 ± 22.7 m. Moreover, the mean CV for the distance was lower than 6%. These values clearly reduced after the first two 6-MWT, as did the SD (Table 3). The distance was not significantly different between morning and afternoon (Table 2). Concerning the walking speed, a significant change occurred throughout the last 6-MWT ($P < 0.001$). Indeed, the mean pace reached 1.64 ± 0.06 $m{\cdot}s^{-1}$ during the first three laps and only 1.58 ± 0.07 $m{\cdot}s^{-1}$ during the others (Table 4). On the other hand, the predicted 6-MWT distances by using the equations of Enright and Sherill (10) and Gibbons et al. (14) were, respectively, significantly lower ($P < 0.01$) and higher ($P < 0.01$) than the real distance walked by our subjects during the 6-MWT. On the contrary, no significant difference was noted between the Troosters et al. (26) predicted and the real distances. Figure 2 shows the measurement of the agreement between these two values.

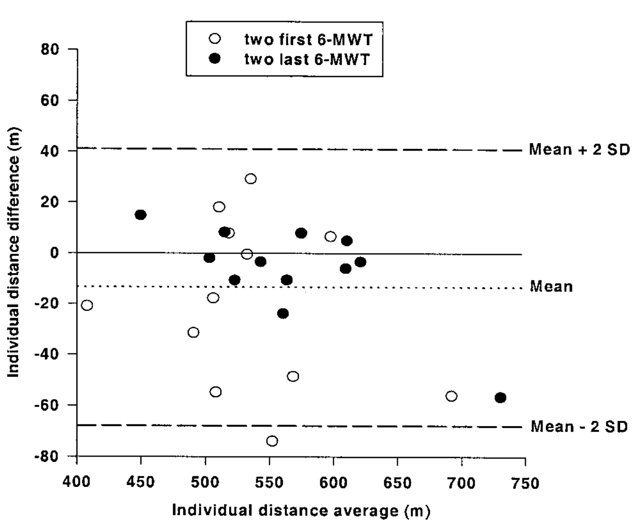

FIGURE 1—The calculated bias between the two first 6-min walk tests (6-MWT) (i.e., between the first and second 6-MWT) and between the two last 6-MWT (i.e., between the fourth and fifth 6-MWT).

$\dot{V}O_2$ recorded during the 6-MWT was significantly lower in the first two 6-MWT than in the last one ($P < 0.05$, Table 2). The mean CV and SD for $\dot{V}O_2$, respectively, ranged from 7.1 to 8.7% and from 1.5 to 2.0 $mL{\cdot}kg^{-1}{\cdot}min^{-1}$ (Table 3). No significant difference was observed between morning and afternoon (Table 2). Otherwise, HR was significantly lower during the 6-MWT performed in the morning than in the afternoon (test 3 vs test 4, $P < 0.001$, Table 2). The mean CV and SD, respectively, reached 4.0% and 5.0 $beats{\cdot}min^{-1}$ (Table 3). On the other hand, no HR difference was noted between tests 1 and 3 performed in the morning and tests 2, 4, and 5 performed in the afternoon (Table 2). Concerning the metabolic analysis within the last 6-MWT, $\dot{V}O_2$ and HR did not change significantly from each 30-s recording to the other, after, respectively, 2 and 2:30 min of exercise. Nevertheless, a slight drift in HR is observed until the end of the test (Table 4).

The 6-MWT intensity corresponded to 79.6 ± 4.5% of the $\dot{V}O_{2max}$, 85.8 ± 2.5% of the HR_{max}, and 78.0 ± 6.3% of the $HR_{reserve}$. The 6-MWT $\dot{V}O_2$ was significantly higher than the ventilatory threshold in each subject (23.8 ± 1.8 vs 19.5 ± 0.9 $mL{\cdot}kg^{-1}{\cdot}min^{-1}$, $P < 0.01$).

TABLE 3. Comparison of the parameters recorded during the five 6-min walk test (6-MWT): coefficients of variation (CV) and standard deviations (SD) between the first and second 6-MWT (T1–T2), the second and third 6-MWT (T2–T3), the third and fourth 6-MWT (T3–T4), and the fourth and fifth 6-MWT (T4–T5).

	T1–T2	T2–T3	T3–T4	T4–T5
Distance				
CV (%)	5.0	3.3	1.7	2.4
SD (m)	26.6	18.3	10.0	13.5
$\dot{V}O_2$				
CV (%)	7.1	7.4	7.0	8.7
SD ($mL{\cdot}kg^{-1}{\cdot}min^{-1}$)	1.5	1.6	1.6	2.0
HR				
CV (%)	7.6	5.3	4.0	3.3
SD ($beats{\cdot}min^{-1}$)	9.6	6.6	5.0	4.2

$\dot{V}O_2$, oxygen uptake; HR, heart rate.

TABLE 4. Values (mean ± SE) of the walking speed and metabolic parameters recorded, respectively, lap by lap and 30 s by 30 s during the fifth 6-min walk test (6-MWT), * $P < 0.05$ and ** $P < 0.01$ compared with the following lap or 30-s recording.

Lap by Lap	Walking Speed ($m \cdot s^{-1}$)	30-s Recordings	$\dot{V}O_2$ ($mL \cdot kg^{-1} \cdot min^{-1}$)	HR ($beats \cdot min^{-1}$)
1	1.63 ± 0.07*	1	9.5 ± 0.5**	106.7 ± 3.1**
2	1.65 ± 0.06*	2	16.1 ± 0.8**	115.9 ± 3.4**
3	1.61 ± 0.07	3	21.4 ± 1.4**	122.6 ± 3.6*
4	1.60 ± 0.08	4	23.5 ± 1.6	125.1 ± 4.1*
5	1.59 ± 0.07	5	23.5 ± 1.1	127.1 ± 4.3
6	1.57 ± 0.07	6	23.4 ± 1.4	127.3 ± 4.2
7	1.59 ± 0.07	7	23.6 ± 1.4	127.2 ± 4.3
8	1.55 ± 0.07	8	23.6 ± 1.5	127.9 ± 4.3
9	1.54 ± 0.06	9	23.7 ± 1.7	128.7 ± 4.4
10	1.56 ± 0.07	10	23.4 ± 1.8	129.1 ± 4.3
11	1.56 ± 0.07	11	23.5 ± 1.7	129.9 ± 4.3
12	1.55 ± 0.06	12	23.7 ± 1.6	130.6 ± 4.4

$\dot{V}O_2$, oxygen uptake; HR, heart rate.

A significant correlation has been obtained between $\dot{V}O_{2max}$ and both anthropometric values and 6-MWT parameters ($r = 0.97$, $r^2 = 0.94$, $P < 0.01$, SEE $= 177.6$ $mL \cdot min^{-1}$): $\dot{V}O_{2max} = 2830.6 - (45.2 \times age) + (4.70 \times weight) + (12.3 \times height) + (1.75 \times distance) + (0.309 \times \dot{V}O_2) - (12.4 \times HR)$, with $\dot{V}O_{2max}$ and $\dot{V}O_2$ ($mL \cdot min^{-1}$), age (yr), weight (kg), height (cm), distance (m), and HR ($beats \cdot min^{-1}$). Figure 3 illustrates the relationship between the predicted and the real $\dot{V}O_{2max}$.

Mean dyspnea value measured after each 6-MWT was set between 3.5 and 5, indicating a moderated dyspnea (Table 2).

DISCUSSION

This 6-MWT study is original and interesting in that it focuses on the reliability, on a day-to-day and between morning to afternoon basis, of the distance, and cardiorespiratory parameters measured in healthy subjects aged 60–70 yr. The main results indicate a good reliability of the 6-MWT only from the third test, concerning the distance, walking speed, $\dot{V}O_2$, and % of the $\dot{V}O_{2max}$. Otherwise, HR and % of the HR_{max} are lower during the tests performed in

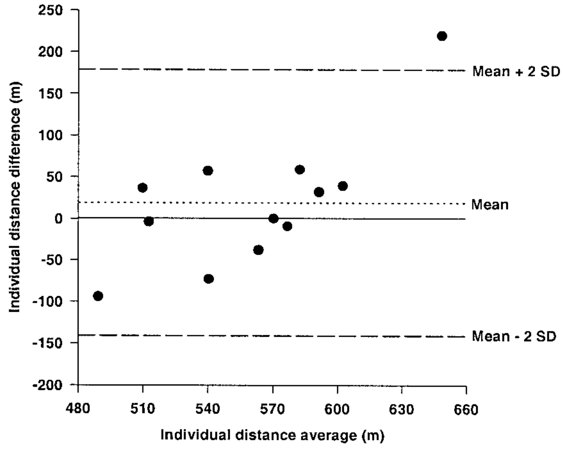

FIGURE 2—Measurement of the concordance between the Troosters et al. (26) predicted 6-MWT distance and the real distance performed by our participants during the 6-min walk test, expressing the individual differences in distance versus the individual means in distance.

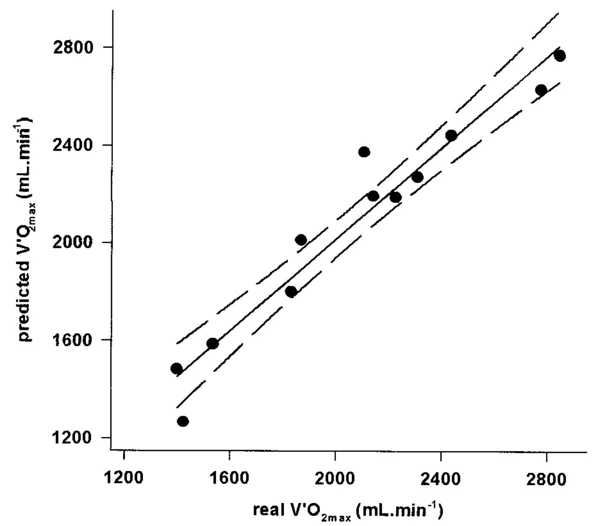

FIGURE 3—Predicted maximal oxygen uptake ($\dot{V}O_{2max}$) against real $\dot{V}O_{2max}$. The line of identity (—) and the 95% confidence intervals (- - -) are plotted.

the morning. In this population, the 6-MWT represents a submaximal exercise. Nevertheless, its intensity is always greater than the individual ventilatory threshold.

The use of CV and SD in addition to classical statistical analysis has been recommended to study a method's reliability (2). In this work, CV and SD for the distance decrease more than half between the first two and last two 6-MWT. This confirms that a familiarization to the 6-MWT is required in healthy elderly subjects. After two 6-MWT, the distance performed appears reproducible day to day and between morning and afternoon. Figure 1 shows that only in one subject the distance attained between the last two 6-MWT seems less reproducible. It can be explained by the fact that in the fifth test, the subject has a tendency to run. Moreover, this underscores that to obtain a good reliability, the instructions for undertaking the 6-MWT must be well explained and respected. Recently, Gibbons et al. (14) have also been interested in the reliability of the 6-MWT. In their study, a wide age range of healthy subjects performed four 6-MWT on the same day. However, no data or precisions were given as to the time of day the tests were conducted, and recordings of cardiorespiratory parameters were not made. These authors noted a "learning effect" for the distance. Indeed, between their first and fourth tests, the distance increased by about 30 m, whereas the average difference between the last two 6-MWT was only 11 m. Thus, this study and our results underscore the necessity of a familiarization to the 6-MWT to limit the skill effect and to obtain the best distance performed. Moreover, our data complete that of Gibbons et al. (14), as they show that at least two familiarization tests are required. Otherwise, it can be noted that in CHF and COPD patients, respectively, the distances walked appear reliable after one and two attempts (8,16,22). The dyspnea and/or fatigue perceptions or the psychological factors could explain this slight divergence obtained in our data from healthy subjects.

The distances covered in our study can be compared to both the predicted values (10,14,26) and the real distances already assessed in other healthy populations (10,14,19,26). In our subjects, the best prediction was obtained with the Troosters et al. (26) formula. However, as the confidence interval of the difference was around 50 m, the agreement between the predicted and real distances is limited. In addition and similarly when using the Enright and Sherill (10) formula, most of the distances predicted were lower than those measured. Conversely, the use of the Gibbons et al. (14) equation overestimated the distances performed by our subjects. Concerning the real 6-MWT distance, discrepancies also exist in the literature as it does in our study compared with others (10,14,19,26). Several hypotheses can be suggested to explain all these discrepancies. Gender is a well-established factor of the 6-MWT distance variation (10,14,26). In our study, given that the proportion between men and women is similar to the other works (almost 50%-50%), the gender factor cannot be thought to explain the divergence. Height and age have been recently reported as the essential determinants of the 6-MWT distance (10,14,26). A taller height is associated with a longer stride and a more efficient walk (10). The relatively smaller height and higher age of our subjects compared with those of other populations might result in the lower distance walked (14,19,26). Moreover, in our study, some factors concerning the 6-MWT protocol, such as the regular walking pace and the familiarization, could also explain the discrepancy with all studies (10,14,19,26). Finally, the length of the corridor could also influence the performance. Indeed, too many laps could imply a loss of energy and thus decrease the distance walked. Nevertheless, it is important to note that our subjects continued to walk at each turn. In two studies, the corridor was longer than ours (10,26), whereas it was similar in two others (14,19). Thus, this discussion underscores that the discrepancy between all 6-MWT distances published is multifactorial.

To the best of our knowledge, this study is the first to analyze the gas exchanges during the 6-MWT in healthy people. It obviously produces more relevant physiological data. The increase in $\dot{V}O_2$ during the first two 6-MWT can be explained by a higher energy requirement for a higher distance walked. After the familiarization period, $\dot{V}O_2$ is reliable, with satisfactory CV and SD. Indeed, as the portable system's measurement error is about 5% (12,17), the mean CV and SD for the $\dot{V}O_2$ appears to be low. Otherwise, concerning the 6-MWT relative intensity, Troosters et al. (26) using the predicted HR_{max}, have proposed that the 6-MWT represents a submaximal exercise in healthy subjects. In our study, the gas exchanges analysis showed that the 6-MWT intensity was significantly higher than the ventilatory threshold. Thus, our result confirmed that the 6-MWT is a submaximal test of quite a high level of intensity (80% of the $\dot{V}O_{2max}$), which could be in favor of a preliminary medical and particularly cardiovascular screening in this population.

When the 6-MWT were performed at the same time of day, HR shows a good reliability, with weak CV and SD values (tests 4 and 5, Table 3). Conversely, several external and internal factors can influence the daily variations of the exercise adaptation in healthy subjects. Thus, the higher HR values observed during the 6-MWT performed in the afternoon than in the morning can be partially explained by the diurnal fluctuations in adrenergic activity and body temperature (1,13). Our results show that the 6-MWT must be performed always at the same time of day (i.e., either in the morning or in the afternoon) to assess the evolution of cardiac parameters during a physical capacity follow-up.

Our study indicates that during the fifth 6-MWT, subjects stabilized their walking pace from the third lap. According to the reference values for the walking speed determined recently by Bohannon (6), they walked between their comfortable and maximum pace. Moreover, during this time-limited self-controlled test (22), our subjects selected a comfortable ventilatory rate, as shown by moderate dyspnea scores. They also attained a steady state for the $\dot{V}O_2$ values, with a weak drift for the HR values.

Some potential limitations of our study should be considered. First, we studied a relatively small sample size of population composed of both men and women. Therefore, our results require confirmation in a larger population of each gender. Second, the use of an 18-m corridor, which induces numerous laps (14,26), could lead to an underestimation of the distance walked during the 6-MWT and to an overestimation of the familiarization period. To verify this hypothesis, it would be interesting to conduct the familiarization period using the same sample of population on different corridor lengths or on a continuous track. However, we show that the $\dot{V}O_2$ reliability needs also a familiarization period, and, as suggested by others (14), the influence of the 6-MWT repetition seems to be much greater than the influence of the corridor length. Moreover, in our opinion, the main point is to perform the 6-MWT in well-standardized conditions to compare groups of subjects or to assess the effects of a physical training. Finally, given the weak number of subjects included in this study, the equation proposed to predict $\dot{V}O_{2max}$ must be used with precaution. Furthermore, it needs to be validated in a greater sample of healthy elderly subjects.

In conclusion, two familiarization 6-MWT are required to obtain a good reliability in healthy subjects aged 60–70 yr. The 6-MWT daily schedule depends upon studied parameters. Indeed, the time of day must be taken into account when assessing HR. The 6-MWT is well tolerated in this population. Nevertheless, it is performed above the ventilatory threshold. After familiarization, its high reliability makes it interesting for assessing functional capacity in healthy subjects having a regular physical activity.

Preliminary results of this work have been presented in an oral communication at the third congress of muscular physiology (Clermont-Ferrand, 2001).

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