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ORIGINAL ARTICLE

Sedentary behavior, physical activity, and walking speed in hospitalized patients with acute myocardial infarction in a Brazilian public hospital

Comportamento sedentário, atividade física e velocidade da marcha em pacientes internados com infarto agudo do miocárdio em um hospital público Brasileiro

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Abstract

Introduction: The benefits of physical activity for cardiovascular disease prevention are well evidenced in the literature, however a high percentage of individuals in adulthood do not perform the physical activity levels recommended by World Health Organization. *Objective:* This study aimed to assess the previous physical activity levels and sedentary behavior in stable patients admitted to the ICU with a diagnosis of acute myocardial infarction. *Methods:* This cross-sectional study was conducted in the cardiological ICU of a high-complexity hospital. Sedentary behavior and physical activity were assessed using Sedentary Behavior Questionnaire (SBQ) and the International Physical Activity Questionnaire (IPAQ). The Walking Speed Test (WST) was used to assess functional capacity. *Results:* A high percentage of participants (45%) did not meet the physical activity recommendations. Dyslipidemia was the only risk factor associated with physical activity ($p=0.025$). The mean time of sedentary behavioir was 37.24 h/w (CI95% 31.17; 43.17) assessed by IPAC, and 52.17 h/w (CI95% 42.93; 61.41) assessed by SBQ. There was a positive correlation between sedentary behavior

assessed by SBQ and IPAC (rs = 0.39; p = 0.01). The WST mean was 1.38 ± 0.36 m/s. *Conclusion:* A high proportion of patients did not meet the recommendations for physical activity before acute myocardial infarction. Physical activity had an association with dyslipidemia. Sedentary behavior accessed by IPAC and by SBQ had a positive correlation. SWT was safe, easy to apply in ICU, and suitable for this population.
Keywords: Exercise; Sedentary Behavior; Myocardial Infarction; Intensive Care Units; Walking Speed.

Resumo

Introdução: Os benefícios da atividade física para a prevenção de doenças cardiovasculares são bem documentados na literatura; no entanto, uma alta porcentagem de indivíduos adultos não atinge os níveis de atividade física recomendados pela Organização Mundial da Saúde. *Objetivo:* Este estudo teve como objetivo avaliar os níveis prévios de atividade física e o comportamento sedentário em pacientes estáveis internados na UTI com diagnóstico de infarto agudo do miocárdio. *Métodos:* Este estudo transversal foi conduzido na UTI cardiológica de um hospital de alta complexidade. O comportamento sedentário e a atividade física foram avaliados utilizando o Questionário de Comportamento Sedentário (SBQ) e o Questionário Internacional de Atividade Física (IPAQ). O Teste de Velocidade da Marcha (TVM) foi utilizado para avaliar a capacidade funcional. *Resultados:* Uma alta porcentagem dos participantes (45%) não atingiu as recomendações de atividade física. A dislipidemia foi o único fator de risco associado à atividade física (p=0,025). O tempo médio de comportamento sedentário foi de 37,24 h/semana (IC95% 31,17; 43,17) avaliado pelo IPAC e de 52,17 h/semana (IC95% 42,93; 61,41) avaliado pelo SBQ. Houve correlação positiva entre o comportamento sedentário avaliado pelo SBQ e pelo IPAC (rs = 0,39; p = 0,01). A velocidade média de caminhada foi de 1,38 ± 0,36 m/s. *Conclusão:* Uma alta proporção de pacientes não atingiu as recomendações de atividade física antes do infarto agudo do miocárdio. A atividade física apresentou associação com dislipidemia. O comportamento sedentário avaliado pelo IPAC e pelo SBQ apresentou correlação positiva. O TVM mostrou-se seguro, fácil de aplicar na UTI e adequado para essa população.
Palavras-chave: Exercício Físico; Comportamento Sedentário; Infarto do Miocárdio; Unidades de Terapia Intensiva; Velocidade de Caminhada.

Introduction

Ischemic heart diseases have been the leading cause of death worldwide in the last decades [1], and they have become the main cause of disability-adjusted life years (DALYs) in adults aged 50 years old [2].

The classic known risk factors for ischemic heart diseases are arterial hypertension, dyslipidemia, obesity, a sedentary lifestyle, diabetes mellitus, smoking and family history [3].

Sedentary behavior (SB) has been defined as “any waking behavior characterized by an energy expenditure of 1.5 METS or lower while sitting, reclining, or lying” [4]. Recent data from the United States reported that adults spend 9.5 hours a day in

SB, which was equivalent to 59,7% of their waking hours [5]. Physical activity (PA) is defined as body movement associated with energy expenditure involving various activities of low, moderate, or vigorous intensity [6]. The benefits of PA are well known, including the prevention of CVD. Despite this, it is estimated that globally about 27.5% of individuals in adulthood do not perform the PA recommended by WHO [7], with little change in this scenario in the last decade [7].

The time spent in SB has been associated with CVD, diabetes, obesity, metabolic syndrome [8], carotid atherosclerosis [9], and venous thrombosis [10], beyond being a risk factor for general mortality [11, 12]. Evidence showed that SB has detrimental dose-response associations with metabolic risk even in those who meet the PA guidelines [13,14]. Thus, SB should be assessed, and its reduction has been recommended in the recent guidelines [4].

Physical functional performance has a high predictive value for mortality. A recent systematic review with meta-analysis evidenced that patients with heart failure presenting poor physical functional performance showed an increased risk of hospitalization and mortality, which reinforces the importance of this evaluation [15]. There is a range of clinical tests used to analyze functional performance, and the walking speed tests (WST) are easy-to-apply, low-cost, and have been validated and used in various populations [15-18]. In addition, walking speed has been mentioned by some researchers as a "sixth vital sign", a functional "vital sign", which has been associated with outcomes such as functional status, discharge location, and the need for rehabilitation [19,20].

However, there is a lack of studies that have used walking speed tests in intensive care units (ICU) after AMI, and it is relevant to investigate the safety of this use.

The objective of this study was to assess the previous PA levels and SB in stable patients admitted to the ICU with a diagnosis of AMI.

Methods

This is a cross-sectional observational study carried out in a high-complexity hospital in the city of Salvador (BA), Brazil, from August 2021 to January 2022. The study was approved by the Research Ethics Committee of the Hospital Geral Roberto Santos - BA, approval number 4.938.946, CAAE 46931721.2.0000.5028. All participants were volunteers and signed the Informed Consent.

Participants

The sample consisted of individuals hospitalized in the cardiological ICU of the HGRS during the collection period. Inclusion criteria were patients diagnosed with AMI according to the Fourth Universal Definition of AMI[21]; age ≥18 years; with stable hemodynamic markers and allowed to walk by the multidisciplinary team. The exclusion criteria were individuals who had a consciousness level that did not allow them to understand the commands to perform the WST (Glasgow scale ≤14), use of vasoactive and inotropic drugs in an infusion pump, wheelchair users, lower limb amputees, and any other factor that could make walking impossible.

Protocol and data collection

Data collection was carried out by 6 physiotherapists from the cardiologic sector, who were duly trained in advance to apply the questionnaires and the WST.

Eligible patients for the study were selected through a daily active search by researchers at the shift change of the cardiovascular ICU physiotherapy team. Questionnaires were performed on admission and WST was performed on the first day of ambulation in the unit after being authorized by the medical team.

First, a structured questionnaire was applied to collect sociodemographic and clinical data, which was complemented by a detailed analysis of the medical records. Data on SB and PA were obtained by applying the International Physical Activity Questionnaire (IPAQ) [7, 22], version 8, and the Sedentary Behavior Questionnaire (SBQ) for adults, in an adapted and validated version in Portuguese [23,24]. Then, to evaluate the functional capacity, the WST was performed [20].

The sociodemographic variables were included: age; sex; place of residence classified into rural and urban; self-reported race/skin color; marital status: single, married, divorced, separated, and widowed; education level, which was categorized as: no scholarly education, elementary school (complete/incomplete), high school (complete/incomplete), college (complete/incomplete); profession/occupation, defined as retired, formal worker, informal sector, retired and others; monthly income, described in multiples of Brazilian minimum wages.

The clinic variables, collected from the charts, were smoking, including time and number of cigarettes smoked, family history of AMI; obesity defined by the body mass index (BMI), in kilograms per square meter (kg/m2), classified as low weight, normal weight, overweight and obesity; ejection fraction (EF); systemic arterial hypertension (SAH); diabetes mellitus (DM); TIMI severity score; and need for ventilation invasive and non-invasive mechanics during the ICU stay.

Sedentary Behavior Questionnaire for Adults (SBQ)

The SBQ questionnaire includes 9 kinds of behaviors categorized into four domains, which describe SB in different contexts: watching television, playing on a computer/video game, sitting while listening to music, talking on the phone, doing paperwork or office work, reading, playing a musical instrument, doing arts and crafts, and driving/riding in a car, bus, or train). These 9 items are asked two times separately considering weekdays and weekend days. For calculating the total scores, hours/day for each item were summed separately for weekday and weekend days. For weekly estimates, weekday hours were multiplied by five, and weekend hours were multiplied by two and both were summed for obtaining the total amount of weekly hours on SB [23].

International Physical Activity Questionnaire (IPAQ)

To classify the PA levels, we used the short version of the IPAQ, in the version translated and validated in Brazil [6]. The IPAQ was used by the researcher at the bedside. Its short version has 8 questions to assess the weekly time spent in PA or inactivity reported by the individual, in addition to PA intensity in different dimensions [6]. The research participants were classified by the PA level according to the IPAQ, considering four strata: 1) Very Active: ≥30 minutes/session of vigorous activity ≥5 days/week; and/or ≥20 minutes/session of vigorous activity ≥3 days/week in addition to a ≥30 minutes/ session of moderate activities or walking ≥5 days/week; 2) Active: ≥20 minutes/session of vigorous activity ≥3 days/week; and/or ≥30 minutes/session of moderate activities or walking ≥5 days/week; and/or ≥150 minutes/week of any of the added activities (vigorous + moderate + walk); 3) Irregularly Active: <150 and ≥10 minutes/week of any of the added activities (vigorous + moderate + walk); and 4) Sedentary: <10 minutes/week of any of the added activities. For comparison between groups and statistical analysis, the subjects were classified into two groups: inactive (encompassing sedentary and irregularly active subjects) and active (including active and very active participants).

The IPAQ sedentary behavior (SB-IPAQ) was quantified by asking questions about sedentary behavior on weekdays and at the weekend, with the total sitting time being calculated as the sum of the minutes seated during the weekdays multiplied by five and the minutes seated at the weekend multiplied by two and divided by seven. For comparison between groups, they are categorized as < 6 hours/day or ≥ 6 hours/day [10].

Walking Speed Test (WST)

The WST was carried out in an open and flat 10 m corridor with visual markings on the initial and final 2 meters (acceleration and deceleration), timing only the inner 6 meters. Participants were instructed to walk at their usual speed 3 times with a short time interval between measurements. The best score was used for time accounting. The calculation was performed by dividing 6 by the time spent walking in seconds, with the measurement expressed in m/s [17]. Participants were divided into two groups according to the WST result: slow speed < 0.8 m/s and normal speed ≥ 0.8 m/s, since gait speed less than 0.8 m/s has been defined as slow gait, and this limit has been used as a cut-off point in other publications [25].

Statistical analysis

For the statistical analysis, the *Statistical Package for Social Sciences* software (IBM SPSS Statistics 22, IBM, Armonk, NY, US) was used. Absolute and relative frequencies were presented for categorical data. Initially, we used the Kolmogorov-Smirnov test to evaluate the normality of the variables.

Fisher’s exact test and Chi-square test were used for comparison between groups with categorical variables. The t-test for independent samples was used to assess the differences between the groups with quantitative variables. The Spearman’s and Pearson’s correlation tests were used to analyze the correlations. The significance level adopted was 5%.

Results

Forty individuals were included in the study, with a mean age of 61.15 ± 10.3 years, ranging from 39 to 89 years old. Some of the sociodemographic characteristics that predominate in the sample were male sex (67.5%), brown race/skin color (45.0%), and elementary education level (47.5%). In addition, most of them were married (75.0%), retired (45.0%), had a personal income equal to or lower than three minimum wage (87.5%), and living in urban domiciles (70%). There were no differences between active and inactive individuals regarding sociodemographic characteristics. Table 1 shows the details of the sample sociodemographic profile and the results of the statistical analysis of these characteristics’ distribution between active and inactive individuals.

Table 1 - *Association between sociodemographic characteristics and physical activity (n=40)*

Variables	Total	Active	Inactive	p
Age (years), mean ± sd [CI 95%]	61.15 + 10.30 [57.86; 64.44]	60.09 + 10,8 [55.30; 64.87]	62.44 + 9,79 [57.57; 67.31]	0.282[a]
Sex, n (%)				
Female	13 (32.5%)	8 (20.0%)	5 (12.5%)	0.737[b]
Male	27 (67.5%)	14 (35.0%)	13 (32.5%)	
Race/skin color, n (%)				
Black	12 (30.0%)	5 (12.5%)	7 (17.5%)	
Brown	18 (45.0%)	12 (30.0%)	6 (15.0%)	0.363[b]
White	10 (25.0%)	5 (12.5%)	5 (12.5%)	
Educational level, n (%)				
None	5 (12.5%)	3 (7.5%)	2 (5%)	
Elementary School (complete/incomplete)	19 (47.5%)	9 (22.5%)	10 (25.0%)	0.855[b]
High school (complete/ incomplete)	13 (32.5%)	8 (20.0%)	5 (12.5%)	
College (complete/ incomplete)	3 (7.5%)	2 (5.0%)	1 (2.5%)	

Occupation, n (%)				
Retired	18 (45%)	9 (22.5%)	9 (22.5%)	
Formal employment	10 (25%)	5 (12.5%)	5 (12.5%)	0.912[b]
Informal sector	9 (22.5%)	6 (15.0%)	3 (7.5%)	
Other	3 (7.5%)	2 (5.0%)	1 (2.5%)	
Marital status, n (%)				
Single	5 (12.5%)	4 (10.0%)	1 (2.5%)	
Married	30 (75%)	17 (42.5%)	13 (32.5%)	0.211[b]
Divorced/separated/ widowed	5 (12.5%)	1 (2.5%)	4 (10.0%)	
Personal income (minimum wage), n (%)				
≤ 3	35 (87.5%)	19 (47.5%)	16 (40.0%)	0,598 [b]
> 3	5 (12.5%)	3 (7.5%)	2 (5.0%)	
Domicile, n (%)				
Urban	28 (70%)	18 (45.0%)	10 (25.0%)	0.093 [b]
Rural	12 (30%)	4 (10.0%)	8 (20.0%)	

Legend: SD: standard deviation; CI: confidence interval; [a]t test for independent samples; [b]Fisher's exact test; *p≤0,05

Regarding the risk factors for coronary artery disease, hypertension (87.5%) was the most prevalent, followed by diabetes mellitus (42.5%) and dyslipidemia (25%). Dyslipidemia was the only risk factor that showed association with physical activity, and more individuals presenting dyslipidemia were physically inactive than active (p=0.025). The clinical characteristics of the patients and the results of statistical tests assessing these variables' association with physical activity are in Table 2.

Fifty-five percent of patients had a diagnosis of acute myocardial infarction with ST-segment elevation, and the average TIMI score was 3.65 ± 2.02. The statistical analysis also did not show any association between physical activity and TIMI score (Table 2).

The average ICU length of stay was 7.69 + 5.91 days, and the mean hospital length of stay was 9.0 + 8.3 days. The variables ICU and hospital length of stay did not present any association with physical activity (Table 2), nor correlation with the variables age, ejection fraction, walking speed, and total sitting time assessed by IPAC or SBQ (Table 4). However, as expected, it was observed a very strong positive correlation between ICU and hospital length of stay (rs=0,98; p=0,08). Table 4 presents the correlation tests. No patient required orotracheal intubation (OTI) or non-invasive ventilation during hospitalization.

According to the IPAQ assessment, 45% of the sample were sedentary or insufficiently active at any level. Table 3 presents the distribution of participants in the five levels of IPAQ physical activity classification.

The mean time of SB of the total sample was 5.55±2.82 h/d (CI 95% 4.47; 6.15) or 37.24±18.53 h/w (IC 95% 31.17; 43.17) when assessed by IPAQ, and 7.45±4.12 [6.13; 8.77] h/d or 52.17±28.89 h/w (CI 95% 42.93; 61.41) when assessed by SBQ (Table 3). In both analyses, per day and per week, there was an overlap of confidence intervals, showing that there was no difference between the two tests. Moreover, there was a positive correlation with moderate strength between the Total Sitting Time assessed by SBQ and IPAQ, rs=0.39; p=0.01 (Table 4). The detailed results of the SB evaluation are in Table 3 and the correlation tests are in Table 4.

The WST that assessed functional capacity had a mean of 1.38±0.36 m/s (CI 95% 1,26; 1,49) (table 3), with only 2 patients (5%) in the sample presenting results lower than 0.8 m/s. The walking speed test did not present any correlation with age, ejection fraction, length of stay in both, ICU and hospital, and sedentary behavior assessed by IPAQ and SBQ (Table 4). No adverse effects were observed during the test.

Table 2 - *Association between clinic characteristics and physical activity (n=40)*

Variables	Total	Active	Inactive	p
Nutritional status, n (%)				
Eutrophic	17 (42.5%)	10 (25.0%)	7 (17.5%)	0.372[b]
Overweight	16 (40.0%)	10 (25.0%)	6 (15.0%)	
Obesity	7 (17.5%)	2 (5.0%)	5 (12.5%)	
Hypertension, n (%)				
Yes	35 (87.5%)	18 (45.0%)	17 (42.5%)	0.355[c]
No	5 (12.5%)	4 (10.0%)	1 (2.5%)	
Diabetes mellitus, n (%)				
Yes	17 (42.5%)	9 (22.5%)	8 (20.0%)	0.051[c]
No	23 (57.5%)	13 (32.5%)	10 (25.0%)	
Dyslipidemia, n (%)				
Yes	10 (25.0%)	2 (5.0%)	8 (20.0%)	0.025[b]*
No	30 (75.0%)	20 (50.0%)	10 (25.0%)	
Smoking status, n (%)				
Yes	4 (10.0%)	2 (5.0%)	2 (5.0%)	0.897[b]
No	22 (55.0%)	13 (32.5%)	9 (22.5%)	
No, but in the past	14 (35.0%)	7 (17.5%)	7 (17.5%)	
TIMI Score, n (%)				
≤3	24 (60.0%)	14 (35.0%)	10 (25.0%)	0.748[b]
>3	16 (40.0%)	8 (20.0%)	8 (20.0%)	
ICU length of stay (days), mean ± sd [CI 95%]	7.69 ± 5.91 [4.41; 7.99]	6.18 ± 4.95 [3.98;8.37]	7.0 ± 7.15 [3.44;10.5]	0.17[a]
Hospital length of stay (days), mean ± sd [CI 95%]	9.0 ± 8.3 [4.99; 10.11]	7.23 ± 6.75 [4.23;10.2]	7.94 ± 9.48 [3.22;12.6]	0.32[a]
Ejection fraction (%), mean ± sd [CI 95%]	53.12 ± 16,59 [46.82;.59.44]	52.33 ± 16.6[43.7;60.8]	54.25 ± 17.2 [43.3;65.1]	0.70[a]

Legend: TIMI: thrombolysis in myocardial infarction score; ICU: intensive care unit; SD: standard deviation; CI: confidence interval; [a]: t-test for independent samples; [b]: Fisher's exact test; [c]: Chi-square test *p≤0,05

Table 3 - *Physical activity, sedentary behavior, and walking speed in hospitalized patients with acute myocardial infarction (= 40)*

Variables	Total
Physical activity level (IPAC), n (%)	
Very active	3 (7.5%)
Active	19 (47.5%)
Irregularly active A	16 (40.0%)
Sedentary	2 (5.0%)
Sedentary behavior (IPAC)	
Sitting time on the weekend (min) mean ± sd [CI 95%]	**752 ± 418.9 [563.4; 815.6]**
Sitting time on a weekday (min) mean ± sd [CI 95]	**1582.7 ± 848.1 [1286.5; 1803.5]**
Average total sitting time (h/d), mean ± sd [CI 95%]	**5.55 ± 2.82 [4.47; 6.15]**
Average total sitting time (h/w), mean ± sd [CI 95%]	**37.24 ± 18.53 [IC 95% 31.17; 43.17]**
<6 hours/day	**26 (65.0%)**
≥6 hours/day	**14 (35.0%)**
Sedentary behavior (SBQ, h/d), mean ± sd [CI 95%]	**7.45 ± 4.12 [6.13; 8.77]**
Sedentary behavior (SBQ, h/w), mean ± sd [CI 95%]	**52.17 ± 28.89 [42.93; 61.41]**
Walking speed (m/s), mean ± sd [CI 95%]	**1.38 ± 0,36 [1,26; 1,49]**

Legend: IPAQ: International Physical Activity Questionnaire; sd: standard deviation; CI: confidence interval; SBQ: Sedentary Behavior Questionnaire; h/d: hours per day; h/w: hours per week; m/s: meter per second.

Table 4 - *Results of the correlation tests*

	Age	ICU LOS	Hospital LOS	Ejection Fraction	TST (IPAC)	WST
ICU LOS	-0.12 (0.44)					
Hospital LOS	-0.16 (0.30)	0.98 (0.0008)*				
Ejection Fraction	0.28¹ (0.13)	-0.23 (0.22)	-0.19 (0.31)	-		
TST (IPAC)	-0.03 (0.82)	0.11 (0.47)	0.12 (0.45)	0.27 (0.15)		
WST	-0.18¹ (0.26)	-0.01 (0.93)	0.02 (0.90)	0.93¹ (0.22)	0.14 (0.35)	
TST (SBQ)	-0.18¹ (0.22)	0.07 (0.66)	0.08 (0.59)	0.22¹ (0.24)	0.39 (0.01)*	0.18 (0.25)

Legend: ICU LOS: intensive care unit length of stay; Hospital LOS: Hospital length of stay; IPAC: International Physical Activity Questionnaire; TST: Total sitting time; WST: Walking speed test; Correlations performed with Pearson's tests (r)¹ and the others with the Spearman test (rs); *Statistical significance p≤ 0.05

Discussion

The principal results in this sample of stable in-ICU patients with AMI showed that most individuals were considered active before AMI by the IPAC assessment. However, a high percentage of this population (45%) still did not meet WHO's minimum physical activity recommendations. Moreover, an association between PA and dyslipidemia was observed but not with other risk factors.

As secondary results, a positive correlation was found between SB accessed by IPAQ and SBQ. It was the first study using SBQ to assess previous SB in patients post AMI. So, this correlation suggests that SBQ is suitable to be used in studies with similar populations. In addition, the results showed that the WST was safe, feasible, easy, and suitable to apply in ICU to patients after AMI, with stable hemodynamic markers, presenting 15 in Glasgow score, and being able to understand the commands and walk.

The prevalence of insufficient physical activity in adults was globally estimated [7] at 27·5%; therefore, it was too lower than the prevalence found in the present study in individuals who had AMI (45%). A high prevalence of individuals classified as non-active prior to AMI has also been described in other studies, 56.3% [26], 37% [27], and 56.7% [28]. These results deserve attention since the benefits of PA in the prevention and treatment of coronary artery disease have been described [29] and the negative association between PA and the risk of coronary heart disease is well known [30, 31].

There were more inactive than active individuals with dyslipidemia in the sample, and an association between PA and dyslipidemia was found in analyses of the results. It is not possible to establish a cause-effect relation due to the design of this study; however, it is still important to identify this association to highlight the need for strategies to increase PA for primary and secondary prevention actions. Indeed, dyslipidemia is one of the main modifiable risk factors for myocardial infarction [32], and PA has been described as an important component of lifestyle change to improve dyslipidemia [33,34].

PA was associated with lower severity of acute coronary disease and reduced in-hospital mortality rates in a Greek study that included 2172 patients with a diagnosis of acute coronary syndrome [27], however, that study did not analyze the association between PA and TIMI scores. Another study that used TIMI scores to assess the AMI severity did not find any association between this variable and PA. Similarly, our results showed no association between PA and TIMI scores. In addition, it is important to note that the more severe patients were excluded from this study due to exclusion criteria, and the present sample comprised only patients with a Glasgow score above 14, which had clinical conditions to perform the WST. Consequently, the higher homogeneity in the severity of the sample probably reduced the possibility of any association between severity and PA.

The short form of IPAQ has been validated across several countries, including Brazil [7], and has been widely used in studies performed with hospitalized patients after acute coronary syndrome [26-28] and with in-house patients waiting for elective cardiac surgery [35]. SBQ was more recently validated [23] and had little use to access SB in patients with cardiovascular disease [36]. While the IPAQ assesses the time in SB in general and is particularly useful for population surveillance, and surveys that require brevity, the SBQ assesses the time spent in 9 specific sedentary behaviors [23] helping to identify specific actions to reduce sedentary times, although not all the SBQ's items may be relevant to all populations and studies. So, measures of sedentary behaviors may need to be tailored for each situation [23], and it is relevant to have different tools for that.

To the best of our knowledge, this is the first study that applied SBQ to assess the previous sedentary behavior of in-ICU patients, after AMI. The average total sitting time per day and per week assessed by IPAQ and SBQ had no difference considering the overlap of the confidence intervals. SBQ was easy-to-apply and presented a moderate positive correlation with IPAQ, suggesting that it is a suitable tool to be used with hospitalized populations with AMI to assess previous SB.

A recent review that included data from 62 countries about self-reported SB mentioned that although low-income countries provide little data on SB, high-income countries spend almost twice as much time on SB. The authors attribute this result to the more sedentary works performed in more industrialized countries [37]. The participants of the current sample were mostly retired, but most reported previous jobs in professions with high energy expenditure, such as farmers, porters, and fishermen, among others. Therefore, the sample profile could at least partially explain the lower percentage of patients who reported more than 6 hours per day of SB (35%) compared with another study conducted In Denmark (55.4%) [12]. In addition, younger age, male sex, being unmarried, higher education level, being employed, a higher BMI, and higher physical activity levels have been independently associated with higher levels of total SB [36] which also might explain the lower percentage of SB reported in this study, since most of them were older, male, with a low level of education, and retired.

There were no correlations between SB and ICU or hospital length of stay, and we did not find other studies about this issue, which deserves to be more studied.

In older adults, it has been reported that the time spent in moderate to vigorous PA was positively associated with physical functionality, independently of SB, on the other hand, older adults who spent less time in SB were more likely to have an improvement in general functional fitness [38]. Similarly, a recent publication showed that individuals who remain for 7 hours or more in SB were more likely to develop mobility disorders [39]. Another study showed no agreement between tertiles of sitting and physical inactivity categories assessed by IPAQ, concluding that SB should be explicitly measured instead of being defined by lack of PA [40].

An observational cohort with longitudinal follow-up of individuals 1 year after AMI reported that slow walking speed one month after AMI discharge was present in half of older adults recovering from AMI hospitalization and was associated with nearly twice the mortality or hospital readmission over the subsequent year [25]. The cut-point to consider slow walking speed has been defined as less than 0.8 m/s [16, 25]. When analyzing the walking speed of the patients in the present study, only 2 patients had values lower than 0.8 m/s, which might be understood due to the exclusion criteria of this study, which excluded the more severe patients.

A recent study showed that a walking speed of 0.93 m/s was required for independence in basic activities of daily life, such as bathing and dressing, 1.10 m/s for walking several hundred meters, and 1.20 m/s for moderate activities, such as household work, and 1.30 m/s for vigorous activities, such as sports [41]. However, the present results did not show an association between PA and walking speed, nor a correlation between SB and this variable, probably due to the small sample and the lower severity of patients since only two had low walking speed. In addition, it is probable that patients' walking speed after AMI was lower than before AMI, which could explain the lack of association between the walking speed after AMI and PA before AMI. We did not find another study that had performed the WST with in-ICU patients after AMI. However, this test was safe, easy to apply in ICU, and suitable for patients after AMI, with stable hemodynamic markers, scoring 15 in Glasgow, able to understand the commands and walk. This is relevant since a growing number of hospitals have adopted protocols for preparation and support for physical activity following hospital discharge after coronary artery bypass graft surgery [42], and these results indicate that the walking speed could be incorporated in the assessment of these patients before discharge, contributing to better planning of in-hospital and post-discharge rehabilitation.

This study's strengths include being low-cost and easily reproducible in clinical practice. However, its main limitation was the small sample size. Additionally, the relative homogeneity of patients in terms of severity may have prevented some statistical comparisons to assess associations between variables but contributed to the study's external validity, allowing a good characterization of the population profile to which these results apply. Although self-administered questionnaires can be a source of bias, validated questionnaires were used, which contributes to reducing this risk.

Conclusion

The results showed that a high proportion of in-ICU patients with AMI had not been following the minimal recommendations for PA practice before AMI. Moreover, an association between PA and dyslipidemia was observed, but not with other risk factors. As secondary outcomes, it was found a positive correlation between SB accessed by IPAQ and by SBQ, suggesting that both tests are feasible for this population. In addition, the results showed that SWT was safe, easy to apply in ICU, and suitable for in-ICU patients after AMI, with stable hemodynamic conditions and able to walk, which can contribute to its inclusion in clinical practice. Due to the relevance of this issue, more studies are needed with higher samples and different designs.

Ethical Approval

The study received approval from the Research Ethics Committee of the Hospital Geral Roberto Santos, Salvador (BA), Brazil (CAAE 46931721.2.0000.5028 and approval n°4.938.946).

Conflicts of interest

None.

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Authors' Contributions

Conception and design of the research: França DLG, Oliva PN, Silva GAS, Barbalho-Moulim MC; Data collection: França DLG, Oliva PN, Silva GAS, Barbalho-Moulim MC; Data analysis and interpretation: França DLG, Oliva PN, Barbalho-Moulim MC, Paro FM, Guimarães RF; Manuscript writing: França DLG, Oliva PN, Paro FM, Barbalho-Moulim MC; Critical revision of the manuscript for important intellectual content: França DLG, Oliva PN, Paro FM, Barbalho-Moulim MC, Silva GAS, Guimarães RF.

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