

Analysis of Functional Capacity and Postural Balance in Former Cutters Cane

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Abstract

Background: Large-scale cane cultivation can promote health impacts of workers, resulting from weight bearing and repetitive movements. Musculoskeletal conditions can alter balance and increase risk of falls. **Aim of Work:** The objective of this study is to identify clinical characteristics and to correlate balance with functional capacity in ex-cane cutters. **Methods:** This was a descriptive exploratory study, 42 former workers of the cane cut, with mean age of 49 (± 13) years, who were submitted to balance evaluation through the Berg Balance Scale (BSE) and the functional capacity was evaluated by the Incremental Shuttle Walk Test (ISWT). To investigate respiratory symptoms, the Medical Research Council questionnaire was used. **Results:** The individuals reached a mean of 52 points in BSE, considered low to moderate risk for falls and the average distance traveled of 446.2 (± 188.5) meters, corresponding to 52.9% (± 23.1) of the normal distance. Weak and negative correlations were found between changes in balance and exposure time ($r^2 -0.16$). **Conclusion:** It is concluded that excessive physical effort contributes to changes in the balance and, consequently, diminish functional capacity.

Keywords

Walking, Postural Balance, Accidental Falls, Workers

1. Introduction

Over the decades, sugarcane has been commercially cultivated in Brazil and factors such as the search for renewable energy sources and competitiveness in the agro-industrial system have been attracting investments in this biomass [1] [2]. In this sugar and ethanol production chain, workers' participation can be highlighted, from the planting and harvesting of sugarcane to production at the mills [3]. The payment system is based on the weight of individually cut cane,

which encourages employees to strive to achieve the goals, in search of better remuneration [4].

Large-scale sugarcane production can have harmful impacts on the health of rural workers. Due to occupational injuries caused by the loading of heavy loads, inadequate postures, repetitive movements, long working hours and insufficient rest breaks [5] [6]. The pathological processes, most frequently developed are those of the musculoskeletal system and connective tissue, followed by diseases of the respiratory system [7]. These diseases can lead to changes in body balance, increasing the reduction of functional mobility [7] [8]. The human body consists of components that, in the presence of functional losses, hamper the performance and execution of motor response, responsible for the maintenance of posture and balance control, leading to risk of fall [9].

Body balance is defined as the ability of the human being to maintain orthostatic posture or to perform body acceleration and rotation movements without imbalances or falls [10]. In order to perform this task, the integrity of the entrance exam, proprioceptive and vision systems is required [11]. The presence of chronic respiratory diseases may also contribute to balance deficits, since the biomechanics of the thoracic cavity do not function in a dissociated way, being part of a global body mechanics, any respiratory imbalance will have repercussions on the global organization [12].

The health impacts of these workers who are in the active phase are extensively investigated; however, the repercussions after the interruption of this work activity and the sequels, are still little known [5] [6]. Within this context, the objective of this study is to identify clinical characteristics and to correlate the body balance with the functional capacity of exercises in former sugar cane workers.

2. Methods

This is a cross-sectional, descriptive exploratory study carried out in the municipality of Amélia Rodrigues-Ba, in 2016. The study population consisted of former sugarcane workers from a biofuel plant. Sampling was defined by convenience, given the peculiarities of the reality found, and composed of 42 eligible individuals who lived in hamlets of distressed entry in the rural area of the municipality, a fact that made access difficult to control and organized workers. In this way, the subjects of the research were approached in their homes and through the disclosure of a “sound car”.

Workers were included that exercised the activity of the cane cut until 2014, year in which the plant ended its activities, both sexes, older than 18 years old. Being excluded volunteers who had diagnosed neurological diseases, vestibular impairment and who presented difficulties of communication and comprehension to answer the questions and/or perform the requested tasks.

The evaluations were duly authorized by the participants themselves. The information was treated confidentially and the project was submitted to the ethics committee of the Faculty of Technology and Sciences, being approved in all its

stages and released for its effectiveness (CAEE 58832316.7.0000.5032). In addition to signing a Term of Free and Informed Consent, being informed about the objectives of the research and its repercussions. For the present research, interviews were conducted using a semi-structured questionnaire containing information about the profile of the interviewees (sex, age, race, time of exposure to risk factors, cane cut and stop activity). The demographic questionnaire was structured based on the social phenomena commonly studied in this population.

The Incremental Shuttle Walk Test (ISWT) was used to evaluate exercise capacity. The test consists of the individual moving around a circuit of 10 m, according to the speed dictated by sound signals. The initial walking speed was 0.5 m/s and received increments of 0.17 m/s every minute, with 12 levels in total. If it reached the cone before the expected time were directed to carry out stationary gear, until the next auditory signal. It was interrupted when the required speed was not maintained or if it failed to complete the lap in the time allowed, the second time. Previously it was calculated from the expected normal distance [13].

In order to evaluate body balance, the Berg Balance Scale (BSE) was used, a predictor of risk factors for loss of independence and falls. The instrument evaluates the balance in 14 items common to daily life, the maximum score being 56. The points were assigned according to the maintained time in which a position, in the distance reached in front of the body by the upper limb and in time to complete the task. The lower the score reached, the higher the risk of falling. The individuals who scored between 53 - 46 points were considered low to moderate risk for falls, and scores below 46 points indicated a high risk for falls [14] [15]. For this study, there is no need for a control group, since the instruments used for evaluation (ISWT and BSE) present normality values already established by the literature.

The investigation of the presence of respiratory symptoms was done through the questionnaire of the Medical Resource Council - Great Britain [16], being applied by the researchers themselves, due to the low level of schooling of the individuals. The main advantage of the questionnaire is the standardization of information and the possibility of graduating the frequency of the referred symptoms. The presence of symptoms (cough, phlegm, dyspnea, wheezing) and smoking were investigated.

The study was analyzed and the graphs were made using the software Satan 12[®], and the tables in Excel for Windows 2013 for demonstration of the results. In the analysis of this study a descriptive of the means, standard deviation and percentage value of some sociodemographic variables, the distance covered in the ISWT and the BSE score were made. The correlation between the distance covered in the ISWT and the balance by BSE was analyzed by means of a scatter plot. The comparison between the categories of the BSE variable and the explanatory variables of the study were analyzed by Pearson's chi-square test, with a significance level of 5%. In addition, Pearson's correlation coefficient was calcu-

lated between the balance and socio-demographic variables, distance covered in the ISWT, time of labor activity and consumption of alcoholic beverage.

3. Results

The total sample of the study consisted of 42 former sugar cane cutters of both sexes, aged 18 years or older. Regarding the sociodemographic characteristics of the sample analyzed, the majority were male (55%) and white race (61.9%). Mean age 49 (± 13) years, of which 26.2% is less than 40 years old, 57.1% is aged between 40 - 60 years and 16.7% have more than 60 years. As for the clinical characteristics 35.7% reported making use of alcoholic beverage, which 26.2% socially and 9.5% daily. The presence of respiratory diseases was verified in 19.1% of the population studied, of which 54.8% were symptomatic. Most of the individuals were non-smokers (79%).

The mean age of BSE was 52 (range, 34 - 56), with a compromised balance, and mean body mass index (BMI) was 26 kg/m² (± 4), identified as overweight. Regarding the evaluation of the functional capacity of exercises, the subjects presented a distance walked with a mean of 446.2 (± 188.5) meters, corresponding to 52.9% (± 23.1) of the expected normal distance.

Table 1 shows the results of the comparison between the sociodemographic and clinical characteristics of the former workers of the sugarcane cut with the risk of falling. It was found that adult individuals presented a high risk of falling ($p = 0.02$). Those subjects who did not consume alcoholic beverages were evidenced with low/moderate risk of falls, those who consumed alcohol ($p = 0.05$) and had symptoms for respiratory diseases such as cough, sputum, wheezing and/or dyspnea ($p = 0.01$) showed a high risk of falls.

In the Pearson correlation coefficient, there was a moderate and significant correlation between the distance covered in the ISWT and the BSE scores (r^2 0.42) (**Graph 1/Table 2**). There was also a weak and negative correlation between BSE scores and age (r^2 -0.38), alcohol consumption (r^2 -0.25), exposure time (r^2 -0.16) and no exposure (r^2 -0.15) to the risk factors of sugarcane cutting. And the body mass index showed a positive and weak correlation (r^2 0.22) with the results of BSE (**Table 2**).

4. Discussion

This study investigated the correlation between exercise capacity and body balance of ex-cane cutters and identified a moderate correlation between fall risk parameters and distance traveled. That is, the individuals who walked a shorter distance in the ISWT, presented a lower BSE score, characterizing an increased risk of falls. It has recently been described in the literature that the distance covered in the ISWT showed a consistent correlation ($r^2 = 0.61$) with the balance assessed by BSE in a sample of 64 individuals aged 40 - 84 years. Corroborating with the results found in the present study [17].

Table 1. Comparison of sociodemographic and clinical characteristics of the former workers of sugarcane cutting according to the risk of fall.

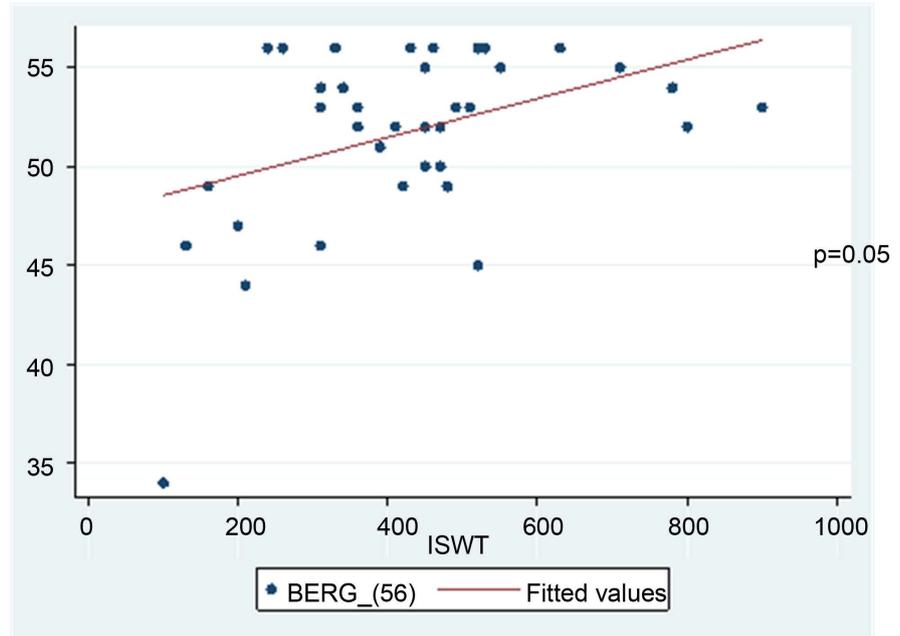
Distribution Variables	Berg Balance Scale (BSE)			p-value
	No risk of fall (n = 18)	Low/Moderate Risk of Fall (n = 20)	High Fall Risk (n = 3)	
Age Group (%)				0.02*
Adult	95	55	67	
Old man	5	45	33	
Sexes (%)				0.48
Female	63	45	67	
Male	37	55	33	
Exposure time (%)				0.45
<10 years	68	45	67	
10 - 20 years	21	25	0.0	
>20 years	11	30	33	
Exposure stop time (%)				0.10
Until 2 years	32	30	33	
>2 years	68	70	67	
Smoker (%)				0.57
No	74	80	100	
Yes	26	20	0.0	
Frequency of Alcohol Use (%)				0.01*
No	63	70	33	
Social	26	30	0.0	
Daily	11	0.0	67	
Respiratory symptoms (%)				0.05*
No	63	35	0.0	
Yes	37	65	100	

*p-value: level of significance of 5%; Pearson's chi-square test.

Table 2. Correlation between balance and functional capacity of exercise and sociodemographic and clinical data of ex-cane cutters.

Berg Balance Scale	r ²
ISWT (m)	0.42
Age(years)	-0.38
Sex	-0.02
BMI (kg/m ²)	0.22
Alcohol consumption	-0.25
Exposure time (year)	-0.16
Time without exposure (year)	-0.15

ISWT: Incremental Shuttle Walk Test; BMI: body mass index; r²: Pearson correlation coefficient; *p < 0.0.



Graph 1. Correlation between the Berg Balance Scale score and the distance traveled in the Incremental Shuttle Walk Test by former cane cutters.

The balance is the result of the harmonic interaction of various vestibular, visual, somatosensory and musculoskeletal systems [8] [9]. In the present study, the age group that presented a high risk of falls were adults (67%). This finding was not expected, since the literature shows that aging promotes morphological, functional and biochemical changes that progressively modify the organism. As people age, they increase the chances of developing diseases, including those that cause changes in body balance and increased risk of falls [18] [19] [20]. However, it is worth mentioning that the adults in this sample had a shorter time of interruption of the cane cutting activity, which may have influenced the permanence of musculoskeletal alterations and possibly explain the reduction of balance. Studies indicate that occupational diseases, such as the musculoskeletal system and connective tissue, are the ones that most promote absenteeism in the rural work environment [7] [21].

In the present study, subjects who did not consume alcohol indicated a low/moderate risk of falls, and those who reported daily consumption had a high risk of falling ($p = 0.01$). This result can be explained by alcohol, if it is a psychotropic drug that acts on the central nervous system (CNS) and in the long term may result in neuronal loss in regions of the cerebral cortex, hypothalamus and cerebellum, organs responsible for functions that [22] [23].

Regarding the results of the correlation between the time of exposure to sugarcane cutting risk factors and their repercussions on the balance, a weak and negative correlation was observed ($r^2 = 0.16$). Although the sample had an exposure time of 14 (± 13) years, this result may have occurred because the characteristic of rural work in sugarcane plantations is seasonal. Thus, it may possibly

allow recovery in the off-season. Collaborating with these findings, recent studies evaluated the presence of respiratory and cardiovascular symptoms in a group of sugarcane cutters in an active working phase, where it was verified that there was remission or improvement of some symptoms during the off-season [24].

As for the presence of respiratory symptoms (cough, sputum, wheezing and/or dyspnea), individuals who presented at least one of these symptoms had a change in balance, showing a high risk of falls ($p = 0.05$). Researches aimed at analyzing the repercussions of respiratory diseases in the muscular system contribute to explain this result. Since pulmonary involvement, with consequent air-flow limitation and dyspnea, is also characterized by extrapulmonary impairment, among them, skeletal muscle dysfunction, which in turn is related to a decrease in the functional capacity of exercise [25] [26].

This study found a moderate and significant correlation of the ISWT, which evaluates functional exercise capacity, with the BSE score (r^2 0.42). Confirming this result, other authors who evaluated populations of adults and the elderly found a similar correlation [18] [19]. In this study, it was not possible to observe strong correlation, the permanence of changes in balance and functional capacity caused by the time of exposure to the deleterious factors of the work. However, it could be verified that functional capacity is related to balance in adults and the elderly.

The reduced number of participants and the scarcity of studies on functional repercussions in former sugarcane cutters limited more specific comparisons with this study. The identification of the causes of imbalances and the early diagnosis are essential for prevention and intervention, thus enabling an effective rehabilitation planning, reflecting the improvement of the quality of life, reducing the risk of falls and possible fractures.

5. Conclusion

This study allowed the evaluation of the impact of deleterious factors on the health of former workers, who were exposed in the sugarcane cutting activity. The results outlined here demonstrate that excessive physical effort and unhealthy working conditions are factors that can contribute to the onset of deficit in the body balance, perpetuation of these alterations and consequently decrease of the functional capacity of exercises in this class of workers. Obtaining data on the sequelae left by the execution of the manual cane harvesting activity suggests investments in public health, actions that minimize these deleterious health effects, as well as the implementation of mechanized cutting during the harvest phase.

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