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NÍVEL DE ATIVIDADE FÍSICA E RISCO DE QUEDAS EM DIABÉTICOS COM E SEM NEUROPATIA

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Resumo: Os objetivos deste estudo foram verificar as associações do comportamento ativo e sedentário com parâmetros da marcha indicativos de Risco de Queda, em pacientes com diabetes mellitus (DM) com e sem neuropatia diabética (ND). A amostra foi composta por 45 voluntários de ambos os sexos, com idade entre 40 e 72 anos, distribuídos igualmente entre os seguintes grupos: DM com DN (DM+ND), DM sem DN (DM) e controle não diabético (C). Um acelerômetro mediu o nível de atividade física (AF) e comportamento sedentário (CS) por oito dias consecutivos. A composição corporal foi medida por absorciometria de raios X de dupla energia (DXA). O risco de queda foi mensurado pelos parâmetros da marcha, bem como pela Escala de Equilíbrio de Berg (BBS). Houve maior tempo em minutos diários em AF moderada a vigorosa (AFMV) no grupo C (45,06), quando comparado aos grupos DM+ND (26,14) e DM (28,5). Os minutos diários em PA Leve (LPA) e SB foram, respectivamente: 343,90 e 431,90 para o grupo DM+ND; 320,59 e 498,08 para o grupo DM e 405,20 e 473,45 para o grupo C, sem diferença entre os grupos. Em relação à velocidade da marcha, o grupo C apresentou valor significativamente maior em comparação aos grupos DM+ND e DM, sem diferença entre eles. A cadência da marcha e o comprimento da passada também apresentaram maiores valores para o grupo C, em comparação aos grupos DM+ND e DM. O grupo C apresentou um tempo de duplo apoio menor que os grupos DM+ND e DM. Os escores da EEB foram piores para os grupos DM+ND e DM, quando comparados ao grupo C. Em conclusão, foi possível verificar as associações da presença de DM, independentemente da ND, juntamente com o baixo nível de AF, com reduzidos valores dos parâmetros espaço-temporais da marcha e com o aumento do Risco de Quedas, nessa população.

Palavras-chave: diabetes; neuropatia diabética; nível de atividade física; parâmetro de marcha; Risco de queda

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PHYSICAL ACTIVITY LEVEL AND DIABETICS' FALL RISK WITH AND WITHOUT NEUROPATHY

Abstract: This study's objectives were to verify the associations of active and sedentary behavior with gait parameters indicative of Fall Risk, in patients with diabetes mellitus (DM) with and without diabetic neuropathy (DN). The sample consisted of 45 volunteers of both sexes, aged between 40 and 72 years, distributed equally among the following groups: DM with DN (DM+ND), DM without DN (DM), and non-diabetic control (C). An accelerometer measured the physical activity (PA) level and sedentary behavior (SB) for eight consecutive days. Body composition was measured by Dual-energy X-ray Absorptiometry (DXA). Fall Risk was measured using gait parameters, as well as by the Berg Balance Scale (BBS). There was a longer time in daily minutes in moderate to vigorous PA (MVPA) by group C (45.06) when compared to the DM+ND (26.14) and DM (28.5) groups. The daily minutes in Light PA (LPA) and SB were, respectively: 343.90 and 431.90 for the DM+ND group, 320.59 and 498.08 for the DM group, and 405.20 and 473.45 for group C, with no difference between the groups. Regarding gait speed, group C presented a significantly higher value in comparison to the DM+ND and DM groups, with no difference between them. Gait cadence and stride length also presented higher values for group C in comparison to the DM+ND and DM groups. Group C presented a shorter double support time than the DM+ND and DM groups. The BBS scores were worse for the DM+ND and DM groups when compared to group C. In conclusion, it was possible to verify the associations of the presence of DM, regardless of DN, together with the low level of PA, to losses in the space-time parameters of gait and increased Fall Risk, in this population.

Key words: diabetes; diabetic neuropathy; physical activity level; gait parameter; fall risk.

Introduction

Diabetes *mellitus* (DM) is a heterogeneous group of metabolic disorders of a chronic nature that have hyperglycemia states resulting from failures in the secretion, action of the insulin hormone, or both in common[1]. Its incidence and prevalence are increasing, and in 2021 the global and Brazil estimates was 10.5% of the adult population (20-79 years), approximately. The global projection for 2045 predicts a 46% increase in the incidence of diabetes mellitus, resulting in a prevalence of 12.2%[2]. In Brazil's Southeast region, this prevalence is close to 8.2% of the population over 18 years of age[3]. In addition to the high prevalence, there is also an essential proportion of undiagnosed type 2 DM (DM2) patients, mainly due to the lack of symptoms in the first years of the disease.

Chronic hyperglycemia, resulting from DM, can lead to debilitating complications, both macrovascular and microvascular, such as acute myocardial infarction and neuropathic disorders [4–6].

Diabetic neuropathy (DN) significantly increases the risk of an ulcerated foot injury and, consequently, amputations[7]. Furthermore, the DN progression, concomitantly with neuropathic symptoms, negatively affects the cenesthesia, leading to changes in postural, sensory, and, consequently manifesting in gait and balance[8], considerably increasing the Fall Risk[9]. It is known that falls are the leading cause of traumatic injury in the elderly and may determine fractures, such as those of the hip, which substantially increase the risk of functional dependence and death in this public, even before the DN diagnosis [10–13].

On the other hand, to mitigate the complications resulting from the pathology, habitual physical activity (PA) and physical exercise are crucial pillars for efficient DM management, considerably reducing the risk of death from cardiovascular events[14,15]. Aerobic activity sessions should be 30 minutes or more per day and strength activities two to three times a week[16]. Conversely, regardless of PA, a high sedentary behavior (SB) presents substantial risks for all causes of death. It is encouraged to reduce the amount of time spent being sedentary, by breaking up bouts of sedentary behavior above 30 minutes[17]. This work's objective was to evaluate PA's level, the sand-time parameters of gait, and its relations with the Fall Risk in patients with and without DN.

Materials and Methods

Sample

This is an observational, cross-sectional study conducted between March and April

2017. The sample consisted of 45 adults and older people between 40 and 72 years old, of which 23 were women and 22 were men. Considering the age of the women in the study, the average age range was 59.21, which suggests that most (or all) of them would be in the menopause phase. All participants were recruited from the municipality of Viçosa, Minas Gerais, Brazil.

The volunteer's participation was initiated through the study's individual presentation and subsequent signing of the Free and Informed Consent Form (FICF). This study was approved by the Ethics Committee on Research with Human Beings of the Federal University of Viçosa (with Brazilian Portuguese initials UFV), under approval number CAAE: 59855516.0.0000.5153. All procedures followed the Declaration of Helsinki (2013).

Volunteers of both sexes were divided into three groups, with fifteen volunteers each, being: DM patients with diabetic neuropathy (DM+ND), DM patients without neuropathy (DM), and non-diabetic control (C). For the DM carrier groups (DM and DM+ND), being diagnosed with DM was an inclusion criterion. The Neuropathy disability score (NDS) was applied, a tool validated in Brazil[18] in all diabetic patients. Patients with DN were selected through medical records in the neurologist/clinical neurophysiologist's office, collaborating with the study, who performed the electroneuromyography of the patients to confirm the diagnosis, using a Nihon-Kohden electroneuromyograph, *Neuropack* S1 Model, MEB 9400K (Tokyo, Japan). Patients with DM without DN were selected from Viçosa's "State Center of Specialized Care" (with Brazilian Portuguese initials CEAE) and UFV and did not present symptoms attributable to DN, according to the NDS. Group C was composed of volunteers linked to UFV.

Any pathology that could determine the physical and psychological dependence for the execution of simple tasks was adopted as an exclusion criterion for all groups.

Level of physical activity (PA) and sedentary behavior (SB)

The level of PA and SB were measured by the tri-axial Actigraph accelerometer (model GT3X, Pensacola, FL, USA), and the ActiLife Software version 6.13.4 was used for data analysis. The equipment was worn in the hip, located near the anterosuperior iliac spine on the right side of the body for an uninterrupted period of 8 days, and was removed only for aquatic activities and night sleep. The volunteers received information about the accelerometer's proper use and were still encouraged to maintain their routine.

The equipment used was considered valid when worn for a minimum of 9 hours daily and four days, being three weekdays and one weekend[19,20]. The study defined a 60-second

epoch and normal filter.

Non-use time above 60 minutes of 0 counts was excluded. As the times of use varied, the PA level analyses were performed by the mean daily PA from moderate to vigorous. The individuals were classified daily from the levels of Light Physical Activity (LPA), Moderate to Vigorous Physical Activity (MVPA), and SB, using the criterion proposed by Freedson et al.[21].

Body and anthropometric composition Evaluation

The corresponding values of lean and fat mass were measured by body segment using the Dual-energy X-ray Absorptiometry (DXA) method, Lunar Prodigy Advance DXA System, version13.31 (GE Medical, model 8743, Madison, WI, USA). The volunteers were instructed not to eat large meals or drink water (two hours) before the procedure. During measurement, all patients had comfortable clothes and no metal accessories worn. All measurements were performed in the imaging section of UFV's Health Division, by the same radiology technician.

Body mass (BM) was measured by the Mercy® scale (model LC 200, Brazil, 2010), with a scale ranging from 1 to 200 kilograms and 50 grams of precision. Height was measured using the Welmy ® (model R110, Brazil, 2009) with a scale ranging from 0.8 to 2.00 meters with 1 millimeter of precision.

Gait analysis

For the analysis of three-dimensional kinematics of gait, an optoelectronic system (Optitrack) composed of 16 cameras positioned around the subjects (360Hz) (Visual 3D software, C-*motionInc*., Germantown, MD, USA) was used. Retroreflective markers were fixed on the pelvis (anterosuperior iliac spines and in the posterior superior iliac spine) in the lower limbs' calcaneus and second metatarsus. The subjects performed six walking attempts, three of which started with the right foot and three with the left foot. The participants were instructed to walk freely along an eight-meter way. Five stride cycles were analyzed in each attempt. From the retroreflective markers' three-dimensional coordinates, the pelvis and foot segments were defined, and the means were calculated for each variables subject: gait speed, stride length, double support time, and gait cadence. Gait analysis took place at UFV's Laboratory of Biomechanical Analysis (LBA) and was performed by a competent technician. The volunteer was instructed to wear an appropriate garment for physical activity and to perform the walk barefoot.

Fall Risk Analysis

The Berg Balance Scale (BBS) was used for Fall Risk analysis, validated, and adapted for Brazilian culture[22]. The procedure was conducted by a previously trained evaluator and took place after the gait and body composition analysis.

Glycated hemoglobin analysis (HbA1c)

The HbA1c analysis was the last stage of the study, carried out outside the UFV campus in a laboratory participating in the Quality Control Program of the Brazilian Society of Clinical Analysis (with Brazilian Portuguese initials SBAC). Immunoturbidimetry was the method used for measurement, certified by the *National Glycohemoglobin Standardization Program-USA* (NGSP). An experienced biochemist performed the procedure, and previous fasting was not required. 10 mL of venous blood were collected for analysis.

Statistical Analysis

Initially, the Shapiro-Wilk test was used to verify the normality of the distribution of errors and the Levene test for homogeneity of error variances. The data considered parametric were evaluated by variance analysis (ANOVA), and Duncan's test compared those that presented significant differences.

Regarding the non-parametric data, the Kruskal-Wallis test was used to verify the difference between the groups, followed by a Mann-Whitney test.

Correlations with the measurements obtained were performed using Spearman's correlation coefficient since parametric and non-parametric data were presented.

The Statistical analysis was performed in the SAS statistical program (Statistical Analysis System - SAS Institute Inc., North Carolina, USA, 1989) version 9.3. The significance level of $\alpha = 5\%$ was adopted to interpret the results of all analyses.

Results

The final sample consisted of 45 participants, aged 40 to 72, distributed in 3 groups of 15 volunteers. The number of subjects per gender, age group, anthropometric characteristics, and body composition of the sample is demonstrated by the mean and standard deviation in Table 1. Significant differences were found in the BM values and Body Mass Index (BMI) of the DM+ND and DM groups when comparing to group C. There was no difference in any of the parameters of body composition, except in the total muscle mass, which was lower in group C than the DM+ND group.

Table 1 – The sample's age group, anthropometric characteristics, and body composition presented in mean and standard deviation.

	DM+ND n=15	DM n=15	C n=15	*p*
N	15	15	15	-
Sex (M/F)	8/7	7/8	8/7	-
Age (years)	61(501)	59.80 (6,10)	61.06 (6,19)	0,.8615
BM (kg)	85.86[a] (14.84)	86.57[a] (18.06)	70.54[b] (11.62)	**0.0108**
Height (m)	1.67 (0.10)	1.61 (0.11)	1,61 (0.09)	0.1688
BMI (kg/m^2)	30.82[a] (4.90)	32.90[a] (4.15)	26.97[b] (3.03)	**0.0021**
Body fat (%)	34.62 (0.08)	36.78 (0,08)	34.76 (0,08)	0.9888
Total muscle mass (kg)	52.94[a] (7.66)	48.75[a] (10.92)	43.62[b] (9.69)	**0.0329**

Different letters on the same line are significantly distinct at 5% probability by Duncan's test (a > b > c). BM: body mass; BMI: body mass index; M: Male; F: Female; kg: kilogram; m: meters; kg/m^2= kilogram per square meter; DM+ND: diabetes patients with neuropathy; DM: diabetes patient without neuropathy; C: Non-diabetic control.

Table 2 shows HbA1c, NDS, and the BBS means. The findings indicate differences between the DM and group C groups regarding BBS. There was a difference in HbA1c between all groups. Regarding NDS, the difference between the DM+ND and DM groups was also demonstrated.

Table 2 – HbA1c values and neuropathic symptoms score between groups, expressed as mean and standard deviation.

	DM+ND n=15	DM n=15	C n=15	*p*
HbA1c* (%/SD)	9.24[a] (2.18)	7.82[b] (1.57)	5.56[c] (0.48)	**<0.0001**
NDS# (IQR)	6[a] (5-7)	1[b] (1-3.75)	-	**<0.0001**
BBS# (IQR)	51[b] (45.5-53)	54[b] (52-55)	55[a] (54.5-56)	**0.0030**

Different letters in the same line are significantly distinct at 5% probability (a > b > c). *: Duncan's test analysis; #: Mann-Whitney test analysis; SD: standard deviation; IQR: interquartile range (27-75); NDS: Neuropathy disability score; BBS: Berg Balance Scale; HbA1c: Glycated hemoglobin; DM+ND: diabetes patients with neuropathy; DM: diabetes patient without neuropathy; C: Non-diabetic control.

Table 3 shows the groups' means and kinematic variables' standard deviation. The results revealed differences in all gait parameters analyzed between the DM and DM+ND groups in relation to group C.

Table 3 – Gait parameters values between groups expressed in mean and standard deviation.

	DM+ND n=15	DM n=15	C n=15	*p*
Cadence (steps/minute)	103.30[b] (9.12)	96.05[b] (8.39)	111.68[a] (13.17)	**0.0012**
Stride length (cm)	109[b] (0.23)	109[b] (0.19)	129[a] (0.15)	**0.0088**
Gait speed (cm/s)	92[b] (0.23)	88[b] (0.19)	122[a] (0.26)	**0.0003**
Double support time (s)	0.44[a] (0.09)	0.46[a] (0.07)	0.37[b] (0.05)	**0.0018**

Different letters on the same line are significantly distinct at 5% probability by Duncan's test (a > b > c). cm: centimeters; s: seconds; DM+ND: diabetes patients with neuropathy; DM: diabetes patient without neuropathy; C: Non-diabetic control.

Table 4 shows the PA level stratified by intensities and SB. The values are described in minutes, using the mean values and standard deviation of the daily activity. DM and DM+ND groups presented a lower daily MVPA compared to group C. Three participants from the DM+ND group and two from the DM group were excluded because they did not use the accelerometer for minimum weekly days or hours per day.

Table 4 – Level of daily PA and SB in the different groups expressed in mean and standard deviation.

	DM+ND n=12	DM n=13	C n=15	*p*
SB (MIN/DAY)	431.90 (77.94)	498.08 (97.82)	473.45 (90.67)	0.3859
LPA(MIN/DAY)	343.90 (80.09)	320.59 (91.04)	405.20 (104.49)	0.600
MVPA(MIN/DAY)	26.14[b] (21.91)	28.51[b] (21.12)	45.06[a] (20.49)	**0.0408**

Different letters in the same row are significantly distinct at 5% probability by the Duncan Test (a > b > c). kg: kilogram; min: minutes; SB: sedentary behavior; PA: physical activity; LPA: light physical activity; MVPA: moderate to vigorous intensity physical activity. DM+ND: diabetes patients with neuropathy; DM: diabetes patient without neuropathy; C: Non-diabetic control.

Additionally, correlations were made between the variables analyzed in the two groups. Moderate to strong and significant correlations occurred in variables related to balance, gait, and PA in DM+ND (BBS x CAD r = 0,6/p = 0,0184; LPA x GS r = 0,73/p = 0,0071; MVPA x GS r = 0,75/p = 0,0049; MVPA x BMI r = -0,59/p = 0,0446) and DM (BBS x CP r = 0,6/p = 0,0277).

Discussion

The study's main findings suggest that changes in gait kinematic parameters increase patients' Fall Risk in with DM and emphasize the low level of daily PA in this same public, regardless of neuropathy.

Considering the participants' characteristics, significantly higher values of BMI and BM of the DM+ND and DM group were found compared to group C. Due to the nature of the pathology and the fat mass changes that occur, differences in body composition were already predicted, even if no statistically significant differences were presented in total fat[23].

The HbA1c results showed significant differences among all groups, in decreasing order: DM+ND, DM and C. Commonly HbA1c values tend to be higher in DN carriers, since hyperglycemia can lead to changes in genetic expressions of hematopoietic stem cells, as well as inflammatory, significantly impacting the development of this complication[24].

This study demonstrated DM groups' significantly lower MVPA prevalence in minutes compared to group C. In another study of our group with DM patients, with and without DN, using the pedometer - another type of motion sensor, it was found that the group with DM+ND was less active (4663 steps/day) compared to the DM group (7050 steps/day) and that both were insufficiently physically active. It is interesting to note that, regardless of the type of motion sensor used, the predominance of physical inactivity and the non-achievement of the different recommendations have been presented as customary for patients with DM. The present study also showed a moderate and inverse correlation between MVPA and BMI in the DM+ND group (r: -0,59; p: 0,0446), converging in this perspective beyond the impact of DM itself.

Usually, patients with DM are more afraid to perform PA for fear of injuries and even lack knowledge about the practice's benefits[25]. Furthermore, complications resulting from the disease itself present clinical and psychological barriers to this practice. Here it is possible to highlight that DN may eventually result in pain or even ulceration, demotivating PA adherence[26]. Although an insufficient level of PA was verified, based on the Guidelines of the Brazilian Diabetes Society[1], no significant differences were verified between the DM and DM+ND groups associated with MVPA.

Regarding SB, there were no differences in relation to the daily time between the groups. Some studies also measured this variable based on accelerometry and found weekly values above 500 minutes[26,27]. Despite the differences in absolute values, the studies mentioned above presented high daily SB values and the present study that showed 7 to 8 hours of SB during waking hours, regardless of the group evaluated. Such high levels of this behavior being related to lack of information and the fear of performing physical activities is not ruled out[25].

The present study did not find a statistically significant difference in LPA between the groups. The LPA has been highlighted as a contributing factor for behavioral change towards an active lifestyle and being encouraged as a time mitigation tool in SB, and consequently of the associated risks[28,29]. LPA should be stimulated through habits, as it reduces SB in the DM groups, being an important strategy, given that evidence has been accumulated regarding the benefits of its increase[30].

Considering the BBS, there was a significant difference in DM+ND and DM in relation

to C. Corroborating our findings, the study by Vaz et al.[31] with DM2 patients, with and without DN, and non-diabetic control group, evaluated the balance using the same instrument, presenting similar results, verifying that the control group differed from patients with DM2 regarding the scores, with no difference between DM and DM+ND. However, when comparing the scores individually, it is possible to find that 27% of the participants in the DM+ND group are classified as below the cutoff point, followed by 7% of the DM group and none of the Group C. Thus, although there are no statistically significant differences between the groups with DM, there is the clinical relevance in the prevalence of the DM+ND group with higher fall risk suggested by the test.

Regarding kinematic analyses, significant differences and deteriorated results were observed in all parameters analyzed by the DM+ND and DM groups in relation to group C. Considering the step rate per minute, the DM+ND and DM groups presented significantly lower values compared to group C. In the present study, a moderate correlation was found between the BBS score and gait cadence in the DM+ND group, corroborating with Brodie et al.[32] who conducted an experiment with healthy elderly fallers and non-fallers, finding a correlation between lower values in Time Up and Go and lower gait cadence, and similarly suggested an increased Fall Risk. It is reported in the literature that the reduction of gait cadence, as well as other changes in the space-time parameters, is a cognitive adaptation performed by the elderly most fragile, in the expectation of staying protected when facing Fall Risk.

Regarding the stride length values between the groups, significant differences were found between patients with DM, with or without DN, in relation to group C. Brach et al.[33] demonstrated shorter gait length and width in individuals with diabetes, and this indication is sustained through possible dysfunctions in the vestibular, somatic and autonomic systems, not only DN[34]. Considering the previous assumptions that DN is not the only dysfunction that is related to balance in DM, the fact that there is no difference between groups with DM in the present study is not surprising.

Concerning the gait double support time, significantly higher values were found in the DM+ND and DM groups when compared to group C. In a study carried by Manor et al.[35], with groups stratification similar to the present study, significantly longer time in the double support and slower gait speed in the DM+ND group were found, corroborating our findings. Proprioceptive impairment of the lower limbs, in addition to possible changes in brain volume, may have a negative impact on this difference[36,37].

Differences were found in the DM+ND and DM groups in relation to group C when

comparing gait speed values. These results support Fregonesi et al.[38] that analyzed the gait speed between patients with DM+ND and healthy control group, verifying significantly higher speed values in the control group, attributing this difference to chronic complications that lead to decreased muscle strength and gait changes. Thus, the present study was in accordance with the study's findings mentioned above, since lower gait velocity values were also evidenced by group DM+ND in relation to group C, attributing the alterations to DM complications[39]. Camargo et al.[40] compared healthy and DN patients and analyzed the most comfortable and maximum gait velocities. They found significantly lower speed values of the DN group when compared to the control group, in both situations, converging with our results. However, both studies cited are limited by the non-inclusion of a DM group without DN, as done in the present study.

This decreased velocity can also be attributed to motor-sensory dysfunction in both groups with DM in the present study, since there are indications about the accelerated aging process on the part of patients with DM, who alter balance functions, independent of the diagnosis of DN[41].

Additionally, the present study found strong correlations between gait speed, LPA and MVPA in the DM+ND group. These findings indicate a possible trend of increased PA level and improvement of this gait parameter and may consequently attenuate daily activities' Fall Risk. Evidence has suggested that the reduction of daily physical activity is intimately associated with the precariousness of the various gait space-time parameters, while these are important indicators for Fall Risk prevention and may be appropriate for clinical use, given the ease of measurement[42].

A study by Verghese et al.[43] conducted with 597 healthy elderly in England found that each 10cm/s decrease in gait speed, caused a 7% Fall Risk increase, and this variable is of great use both in research and in the clinic, and can objectively predict the Fall Risk. From this finding, we can consider that our volunteers with DM, regardless of DN, have approximately 21% more chance of falling when compared to the control group.

The importance of prescribed and regular physical exercise in people with DM is highlighted. There is evidence to suggest that aerobic training, four hours per week on a treadmill, may be able to prevent the onset of DN in the long term[44]. Furthermore, considering that poor glycemic control may be crucial for the development of DN, physical exercises have proven to be effective strategies for glycemic control, regardless of the modality (aerobic, resistance or combined)[45]. Furthermore, it is suggested that physical exercises focused on

balance, lower limb strength and gait contribute significantly to the balance of elderly people with DM, this being a parameter closely related to the risk of falls[46].

The present study's limitations were related to sample recruitment difficulties, with the resulting reduced number of subjects. A higher number of evaluated individuals could give greater robustness in the statistical treatment.

As positive aspects, the use of objective and endorsed instruments can be mentioned for the variables evaluated such as DXA for body composition, accelerometer for analysis of the PA level and SB and electroneuromyography for the classification of DN carriers. We can also mention the addition of a non-neuropathic diabetic group facilitating the neuropathy and diabetes impact analyses in addition to the use of questionnaires and tests validated for the Brazilian population.

Further studies are needed to evaluate the impact of DM, regardless of DN, on balance and gait change, and the relationship between habitual PA and the two aforementioned parameters.

Conclusions

The DM presence in the study's sample, regardless of DN, jointly with the low level of PA, demonstrates a negative association with the gait parameters evaluated here, significantly increasing the Fall Risk.

The highest Fall Risk was verified through the BBS by both groups with DM in relation to the non-diabetic control group, suggesting that this risk is increased not only in patients with DN. Although they did not present statistically significant differences, patients with DM+ND presented lower individual scores, indicating that 27% of the samples with DN presented a high Fall Risk by the instrument, compared to only 7% of patients with DM without DM. These values may demonstrate a possible clinical difference in the Fall Risk.

Furthermore, correlations of total body fat, muscle mass and PA level with Fall Risk were found, suggesting further investigations in the latter.

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Conflicts of Interest

None.

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