



RESEARCH ARTICLE

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ASSOCIATION BETWEEN ANTHROPOMETRICAL INDICATORS AND LIFESTYLE HABITS OF PEOPLE WITH DIABETES MELLITUS AND NEUROPATHIC SYMPTOMS

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ABSTRACT

The study has the purpose of analyzing the association of anthropometrical indicators and lifestyle habits on people with diabetes mellitus and neuropathic symptoms. It is an analytic, quantitative and transversal study, accomplished on a Primary Health Care Unit of a city from Ceará, Brazil, of March to December 2018, with 152 people. The data was gathered via instrument with the following data: clinical-epidemiological, anthropometrical, lifestyle habits, diabetes' diagnosis time, feeling of pain on the feet and legs and protective sensibility on the sole of the feet. Accordingly to the Neuropathic Symptoms Score (NSE), 67.1% of the participants presented pain or discomfort on the feet and legs, especially, the tingling (36.1%), was reported on the feet (25.1%) or legs (29.1%) singly. There was a similar prevalence between soft and moderate neuropathic symptoms. In accordance with the Visual Analogue Scale of pain, 63.16% mentioned a pain with a medium level of four. In relation to the lifestyle habits and scores of neuropathic symptoms, there was a significant correlation only on sedentary people ($p=0,013$). There were higher scores of altered NSE on alcoholics, ex-alcoholics and sedentary people. Most of the participants with altered NSE showed a change regarding the waist circumference ($p=0,024$). Higher scores of neuropathic symptoms occurred among the ones complaining about pain on lower members, sedentary and with altered waist circumference.

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INTRODUCTION

Diabetes Mellitus (DM) is a chronic condition resulting of hyperglycemia, caused by inefficiency at the production or action of insulin, and it is highly connected to the emergence of both chronic complications, microvascular (neuropathies, retinopathies and nephropathies) and macrovascular (Myocardial infarction and cerebrovascular accident)(Sales-Peres, 2016). The DM is the third most prevalent non transmissible chronic disease on the world after cardiovascular and neoplasia diseases. It represents a serious problem of public health for being connected to the increase of morbidity and mortality of people with diabetes (Liu et al., 2015). The number of people with diabetes mellitus in the world is estimated on 382 million, with a forecast of 592 million on

2035 (Guariguata et al., 2014). In Brazil, around 9.2 million Brazilians have the diagnosis of DM (Iser et al., 2015). The urbanization phenomenon associated with populational aging, hypercaloric diets, sedentarism and obesity are the major responsible for the increase of DM. The sedentarism is characterized by the absence of physical activities, where, most of the day is destined to tasks that do not generate energy expenditure in relation to rest, contributing to the increase of obese individuals. The obesity is one of the most important, and that, on people with DM, has relation to the appearance of complications, such as neuropathies (Boulton and Malik, 2010; Hruby and Hu, 2015). The diabetic neuropathy is a neurological alteration that may change autonomic, motor and sensorial functions of people with DM and produce damage to the individual at physical and emotional aspects through neuropathic symptoms (pain, burning, numbness and tingling),

which may be evaluated using the Diabetic Neuropathy Examination Scores (DNS) and are characterized as predisposing for the development of diabetic foot, a symptom responsible for the majority of the non-traumatic amputations (Nascimento *et al.*, 2015). The neuropathy is the most prevalent complication of diabetes, affecting 30% to 50% of the patients and it is related the lifestyle habits, sedentarism and obesity (Bruschi *et al.*, 2017). Studies accomplished in Brazil and Egypt highlighted, respectively that, 31.9% and 56.7% of the participants with diabetes analyzed by the DNS, had a peripheral diabetic neuropathy (Santos *et al.*, 2015; Kamel *et al.*, 2015). In face of these associations of risk factors and complications that may unleash or aggravate the DM patient's condition, one justifies the current study's accomplishment which aims to amplify such findings, relating them to the anthropometric indicators and the individual's lifestyle habits. The study has the purpose of analyzing the association of anthropometric indicators and the lifestyle habits of people with diabetes and neuropathic symptoms.

METHODS

Analytic, quantitative and transversal study accomplished inside a Primary Health Care Unit (APS) in the city of Maciço de Baturité, Ceará, Brazil, between march to December 2018. The study's target-population was made up by 229 people with DM, that were cared for on the APS mentioned above. The sample was calculated from the finite population formula with the following parameters: $N=229$; study's confidence level of 95% ($Z_{\alpha} = 1.96$); sampling error of 5%; calculated final sample of 142 participants. During the data gathering, 152 participants met the inclusion conditions, and therefore, were part of the sample. The inclusion conditions were: people with the diagnosis of DM confirmed at their health records, male and female, with age equal or above 18 years old and with the capability of hearing and verbally respond the formulated questions. People with bilateral amputation of lower members were excluded. The data was gathered from Monday to Friday at the APS'S opening hours using physical exams, structured interviews and the patients' record reading. An instrument with the clinical-epidemiological data was used, such as gender, age, education level, occupation, body weight, height, waist circumference (WC), neck circumference (NC), body/mass index (BMI), tobacco use, alcoholism, practice of physical exercise (minimum of three times a week), time with DM, feeling of pain in the feet and legs and protective sensibility on the sole of the feet. For the BMI evaluation purpose, one followed the WHO recommendation: below normal ($BMI < 18.5$), normal ($18.5 < BMI < 25.0$), overweight ($BMI \geq 25$) and obesity ($BMI \geq 30$) (Malachias *et al.*, 2016). To evaluate the waist circumference, the following conditions were used: higher or equal to 102 cm and 88 cm were considered elevated, for men and women respectively. The values considered normal were below 102 cm for men and 88 cm for women (Malachias *et al.*, 2016). Regarding the neck circumference (NC), on male, values ≥ 39 cm were inserted at the altered zone, meanwhile values inferior to that, were labeled a non-altered NC; in relation to women, values ≥ 35 cm were inserted at the altered zone and, the ones inferior to that, labeled as non-altered (Preis *et al.*, 2010). The pain was investigated via the Diabetic Neuropathy Examination Scores (DNS), characterizing the location, time of the day where the patient feels most pain and strategies that diminishes that pain, followed by the calculus of DNS and Wong-Baker Faces Pain Rating Scale, as well as the numeric scale of pain. The

graduation of DNS varies between 0 to 9 points, where: 0 to 2 means normal symptomatology, 3 to 4 means low symptomatology, 5 to 6, moderate symptomatology and 7 to 9, serious symptomatology. Monofilament tests were accomplished to evaluate the sole of the feet's sensibility with Semmes-Weinstein monofilament test (orange) and vibrating sensibility with diapason 128 Hz, accordingly to the norms of the Brazilian Diabetes Society. The data was labeled on a database using Excel, version 2016 and analyzed with the program EpiInfo™ version 7.2.1.0. To compare the numerical variables, one used the nonparametric test of Mann Whitney and Kruskal-Wallis. To analyze the categorical variables, one used the Chi-square test of Pearson. The adopted significance level was of 5% ($p \leq 0.05$). The research was approved by the Committee of Ethics on Research from the University of International Integration of Afro-Brazilian Lusophony, under report number 2.932.293/2018, also followed the recommendations of the Resolution nº 466/12, from the National Health Council. Moreover, all participants from the study signed a Term of Consent.

RESULTS

152 patients with the following data were analyzed: Average age of 62.4 ± 12.4 , with female predominance (73.68%) and elderlies (60.53%). Regarding education level, the majority (39.4%) had nine years of study. In relation to their job occupation. It was identified that 60.53% had no job occupation (housewives, retired or pensioners and unemployed). About the lifestyle habits, 44.7% of the participants were smokers, 31.5% were alcoholics and 62.5%, sedentary. In accordance with the DNS, 67.1% of the participants showed pain or discomfort at their feet and legs, specially, the complaint of tingling (36.1%), was reported at the feet (25.1%) or legs (29.1%), singly. Most of them sit or lay down (34.8%) to ease the pain. Despite that, the majority (34.8%) did not felt frightened in relation to these pains. The DNS was applied on all patients, therefore, obtaining the conclusions described on chart 02. One perceives a similar prevalence between low and moderate neuropathic symptoms (NS), with 20.39% and 21.71%, respectively, and less with serious NS (19.7%) The DNS average was 3.6 ± 3.06 . At the Visual Analogue Scale evaluation of pain, 63.16% mentioned having pain with an average level of four at the numeric scale (Chart 02). On chart 03, the comparison between anthropometric variables and the DNS highlighted that the higher values of this score are related to people with an altered waist circumference (average=3.81), altered neck circumference (average=3.62) and with altered BMI (average=3.74), however, there was no statistically significant relation ($p > 0.05$). Regarding the variables related to lifestyle habits and DNS, it was possible to obtain a significant correlation only o sedentary people (average of 4.08/ $p=0.013$). Most of the participants with altered DNS also showed a variation regarding their waist circumference ($p=0.024$). Despite the variations of verified proportions, there was no statistically significant association between DNS and variations of lifestyle habits under study (Chart 04). One verified higher percentages of altered DNS on working alcoholics, ex-alcoholics (66.67%) and on sedentary people (67.37%). There was a high association between non-smokers and altered DNS, however, there was no significant association among any variable of lifestyle habits and DNS. Despite the p value found, it is not possible to safely infer that the participants with PSSLF showed higher values of DNS.

Chart 1. Parameter distribution of Diabetic Neuropathic Symptoms evaluation. Redenção (CE), Brazil. 2018

Diabetic Neuropathic Symptoms evaluated item	Participants (n=152)	%	IC95%
Feels pain or discomfort (feet and legs)?			
No	50	32.89	[25.5-40.9]
Yes	102	67.11	[59.0-74.5]
What does the patient feel?			
Burning, numbness, tingling	32	21.05	[14.8-28.4]
Fatigue, cramps or pain	55	36.18	[28.5-44.3]
Both above	15	9.87	[5.6-15.7]
What is the pain location?			
Feet	38	25.17	[18.4-32.8]
Legs	44	29.14	[22.0-37.0]
Feet and legs	16	10.60	[6.2-16.6]
Time of the day where the pain is stronger?			
During nighttime	31	20.39	[14.3-27.6]
During day and night	29	19.08	[13.1-26.2]
Only during the day	42	27.63	[20.7-35.4]
Has woken up because of the symptoms?			
Yes	48	31.58	[24.2-39.6]
No	53	34.87	[27.3-43]
What do you do to ease the pain?			
Walk	30	19.74	[13.7-26.9]
Stay standing	9	5.92	[2.7-10.9]
Sit or lay down	53	34.87	[27.3-43]

Source: Research data (2018).

Chart 02. Distribution of people with Diabetes Mellitus that took part on the study, in accordance with neuropathic symptoms and Visual Analogue Scale (VAS). Redenção (CE), Brazil, 2018

Variables	Participants (n=152)	%	IC95%
Neuropathic symptoms Score			
Normal	58		
Low	31	38.16	[30.4-46.4]
Moderate	33	20.39	[14.3-27.7]
Serious	30	21.71	[15.4-29.1]
Average [Standard deviation-SD]	3.6 [3.06]	19.74	[13.7-26.9]
Minimum-Median-Maximum	0-4-9		
Visual Analogue Scale of Pain			
0 (zero)	56		
1 (one)	1	36.84	[29.1-45.0]
2 (two)	11	0.66	[0.02-3.61]
3 (three)	3	7.24	[3.6-12.6]
4 (four)	12	1.97	[0.4-5.6]
5 (five)	13	7.89	[4.1-13.4]
6 (six)	11	8.55	[4.6-14.1]
7 (seven)	2	7.24	[3.6-12.6]
8 (eight)	21	1.32	[0.1-4.6]
9 (nine)	5	13.82	[8.7-20.3]
10 (ten)	17	3.29	[1.1-17.3]
Average [Standard Deviation-SD]	4 [3.72]	11.18	[6.6-17.3]
Minimum-Median-Maximum	0-4-10		

Source: Research data (2018).

Chart 3. Comparison between anthropometric variables and lifestyle habits with the Neuropathic symptoms score. Redenção (CE), Brazil, 2018

Variables	Participants (n=152)	Neuropathic symptoms score			Statistic [p-value] ¹
		Average	[SD]	Median	
Waist circumference					
Normal	26	2.57	[3.16]	0.00	0.064
Altered	126	3.81	[3.01]	4.00	
Neck circumference					
Normal	24	3.50	[3.18]	4.00	0.891
Altered	128	3.62	[3.05]	4.00	
Body/mass index (BMI)					
Not altered	21	2.71	[2.98]	2.00	0.166
Altered	131	3.74	[3.06]	4.00	
Tobacco use					
Yes	13	2.07	[2.53]	0.00	0.156
No	84	3.84	[3.08]	4.00	
Ex-smoker	55	3.60	[3.10]	4.00	
Alcoholic					
Yes	11	3.27	[3.60]	3.00	0.347
No	104	3.41	[2.97]	4.00	
Ex-alcoholic	37	4.24	[3.17]	5.00	
Sedentarism					
No	57	2.80	[2.72]	3.00	0.013
Yes	95	4.08	[3.17]	4.00	

¹ Kruskal-Wallis¹ Kruskal-Wallis; Source: Research data (2018).

Chart 4. Distribution of variables related to life style habits associated to DNS. Redenção (CE), Brazil, 2018

Variables	Neuropathic symptoms score		Statistic [p-value] ¹
	Normal [%]	Altered [%]	
Waist circumference			
Normal	15 [57.69]	11 [42.31]	0.024
Altered	43 [34.13]	83 [65.87]	
Neck circumference			
Normal	10 [41.67]	14 [58.33]	0.699
Altered	48 [37.50]	80 [62.50]	
Body/mass index (BMI)			
Normal	11 [52.38]	10 [47.62]	0.148
Altered	47 [35.88]	84 [64.12]	
Tobacco use			
Yes	29 [42.65]	39 [57.35]	0.305
No	29 [34.52]	55 [65.48]	
Alcoholic			
Yes	16 [33.33]	32 [66.67]	0.405
No	42 [40.38]	62 [59.62]	
Sedentarism			
No	27 [47.37]	30 [52.63]	0.070
Yes	31 [32.63]	64 [67.37]	

¹ Chi-square test of Pearson

Source: Research data (2018).

Chart 5. Comparison between pain or discomfort on the feet and legs, time with DM and protective sensibility on the sole of the feet in relation to the neuropathic symptoms score. Redenção (CE), Brazil, 2018

Variables	Neuropathic symptoms score			Statistic [p-value]
	Average	[SD]	Median	
Pain or discomfort on the feet and legs				
Yes	5.37	[2.11]	5.00	0.000 ¹
No	0.00	[0.00]	0.00	
Time with DM				
Less than 10 years	3.39	[2.90]	4.00	0.502 ¹
More or equal to 10 years	3.83	[3.27]	4.00	
Protective sensibility on the sole of the right foot (PSSRF)				
Normal	3.32	[2.98]	4.0	0.087 ²
Altered	4.41	[3.20]	4.0	
Protective sensibility on the sole of the left foot (PSSLF)				
Normal	3.32	[2.96]	3.5	0.056 ¹
Altered	4.50	[3.26]	4.5	

¹ Kruskal-Wallis H; ² Mann-Whitney.

Source: Research data (2018)

On the other side, people reporting to have pain on feet/legs showed higher values of DNS ($p < 0.001$) (Chart 05).

DISCUSSION

Most of the sample was composed by women, with an average age of 62.4 ± 12.4 years old who did not work. Such findings corroborate with other researches accomplished on Brazil (Santos *et al.*, 2015; Coutinho *et al.*, 2010; Ravazzani *et al.*, 2016) and Egypt (Kamel *et al.*, 2015) and China (Lu *et al.*, 2013), where most of the people investigated with DNS are elder women with no job occupation. This highlights that this populational group shows similar characteristics on several contexts of social behavior and geographic locations, where there is an urge to think about new resources and strategies that favors this group's life and health conditions, in addition to bigger analysis with the male public, since, these may not be so active in relation to health services. Regarding pain or discomfort, 67.11% reported to feel both on legs and feet and mentioned that sitting or lying down soothe the symptoms. A research on Brazil with a similar scope identified that most of the participants complained about discomfort on their feet with a subsequent improvement after they sat or laid down (Ferreira; Torre, 2013). The complaint of pain or discomfort

for long periods on lower members of patients with DM must be seen as an alert signal by the health professionals, because it is generally associated to injuries on peripheral nerves. There was a similar prevalence among low and moderate neuropathic symptoms on this study. A research on Brazil identified a similar case, where patients with diabetes showed a prevalence of low and moderate neuropathy (Oliveira *et al.*, 2017). This data strengthens the importance of the clinical evaluation accomplished by the nurse on people with DM, with the purpose of avoiding serious neuropathies, ulcerations or amputations on lower members. When comparing anthropometric variables and DNS, the score's highest values are related with alterations at the waist and neck circumference and BMI. A study on Italy highlighted a high positive correlation between obesity and neuropathic impairment (Battula *et al.*, 2017). A Japanese research identified that individuals with elevated BMI showed even higher significant scores of peripheral neuropathies (Hozumi *et al.*, 2016).

The weight excess on patients with DM is, therefore, related to the peripheral nervous system damage increase. Regarding the lifestyle habits and the practice of physical activities, there was a statistically significant correlation on people that did not accomplished physical exercises with DNS, which suggests that sedentarism has a direct relation to a most expressive neuropathic symptomatology. A Brazilian study identified that 35.5% of the patients with neuropathic diabetes did not practice any physical exercise (Brinati *et al.*, 2017). Regardless of age, the practice of aerobic exercise such as walks, dance, swimming, runs and cycling are recommended with a periodicity of three to five times a week, with duration of 30 to 60 minutes. Physical activities provide to the organism a better control of glycemic levels, including the decrease of glycated hemoglobin and cardiovascular risks, in addition to contribute for weight loss (SBC, 2014). It is worth to highlight that a sedentary lifestyle is an important source of morbidity and it is associated to the increase of waist circumference, elevated levels of lipids and cholesterol and reduction of glycemic control (Cooper *et al.*, 2014). At the analyzed sample, there was no correlation between tobacco use, alcoholism and neuropathy, corroborating with a study accomplished on South of Brazil (Brinati *et al.*, 2017).

However, it is valid to infer that tobacco use is associated to the sensibility reduction on lower members, since the nicotine stimulates adrenergic responses that increases glycoses values and minimize the insulin production. In relation to alcoholism the ingestion of alcoholic beverages promotes deficit on metabolic changes that enables the development of disfunctions of axonal transport that may result on the increment of neuropathies (Brinati *et al.*, 2017; Barriale *et al.*, 2013). One found significant correlation between the presence of pain and discomfort on the feet and legs and the higher average of DNS. A similar finding was reported on a research from the Northeast of Brazil, were 74.2% of the study's participants reported pain and discomfort on the feet and legs, with DNS between 5-6 (Ferreira; Torre, 2013). The correlation among time with DM and DNS was no significant on this study. Yet, a time with DM higher or equal to 10 years corresponded to and DNS average equal to 3.83. Researches on Brazil and Mexico found significance on this correlation, whereby the average time with DM higher than 10 years showed more elevated neuropathic symptoms (Santos *et al.*, 2015; Ibarra *et al.*, 2012) although a higher time of diabetes means a higher probability of developing diabetic neuropathy,

any individual, with diagnosis of DM must be tracked for risk factors for this complication's development (Rocha; Zanetti; Santos, 2009; Boulton, 2012). The DNS average was higher on people with protective sensibility on the sole of the feet with low or moderate alteration. Studies on South, mid-west and Northeast of Brazil identified that the sensibility loss is related to the emergence of diabetic neuropathies, in addition to determine that on individuals with loss of protective sensibility on the sole of the feet, there is twelve times more chances of developing neuropathies (Dutra *et al.*, 2018; Ferreira; Torre, 2013, Brinati *et al.*, 2017). Therefore, it is worth to highlight the urge of constantly educate people with diabetes about the risks, care and implications to their feet, because of their lower sensibility, aiming to avoid any type of trauma, being mechanic, chemical or thermal, using proper shoes. The evaluation of patients with DM in relation to the risk of developing ulceration on their feet via DNS, constitutes one of the main directives to prevent complications such as diabetic foot, a reason why the nurses must get familiar with this practice and incorporate them to their routine, specially at the context of primary care (Lucoveis *et al.*, 2018). At the nursing inquiry these professionals must precisely identify people with DM that shows neuropathic symptoms, in addition to accomplish a detailed feet evaluation, as a prevention strategy (Boulton *et al.*, 2010). The current study has a few limitations, such as: reduced sample number, moreover, given the age profile it is possible that some answers from the instruments may had been underestimated in relation to the real symptomatology condition. Therefore, one suggests that new researches study the associations explored on this manuscript with other microvascular disorders, such as diabetic retinopathy and chronic renal disease, in addition to diabetic neuropathy.

Conclusion

The study's data highlighted that on this sample, mostly female, elderly, with diabetes mellitus prevails the report of pain on the feet and/or legs, especially on the legs. By the way, higher scores of DNS occurred on the ones that complained of having pain on lower members (feet and/or legs), sedentary and on the ones with altered waist circumference. The low and moderate DNS were considerably identified. Through the findings, one has as offer to provide a return to the city, in order to subsidize this population with educative measures and actions guided toward this public, with the purpose of preventing complications and to improve their quality of life.

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