Biochemical profile of people with *diabetes mellitus* and hypertension in primary health care

Gabriel Ribas Nascimento de Melo[1], Júlio Cezar de Carvalho Nogueira[1], Elidiane Moreira Kono[1], Juarez de Souza[1], Silvania Yukiko Lins Takanashi[1], Luiz Fernando Gouvêa-e-Silva[2]

ABSTRACT

Introduction: *Diabetes mellitus* (DM) and systemic arterial hypertension (SAH) are chronic non-communicable diseases that are associated with a high risk of mortality. **Objective:** To analyze the laboratory profile of people with DM and SAH followed up in primary health care. **Methods:** Descriptive and cross-sectional study, with a sample of 345 people being monitored by family health strategies belonging to two Basic Health Units in the urban area of the city of Santarém, Pará, Brazil. Participants were divided into four groups according to their diagnosis: SAH; DM; both (DM-SAH); or neither (NO). Socioeconomic and clinical information was collected from the participants, with subsequent blood collection for biochemical variables. Descriptive and inferential statistics were used for data analysis, adopting a significance of $p<0.05$. Results: In all groups, female participants, married, brown, with an income of up to two salaries, 4-7 years of schooling, non-smokers, and non-alcoholics predominated. Compared to NO, DM was associated with altered values for glucose ($p<0.001$), HDL-c ($p=0.048$), urea ($p=0.025$), creatinine ($p<0.001$), and hemoglobin ($p=0.002$). DM-SAH was associated with the presence of alterations in glucose ($p<0.001$), urea ($p<0.001$), creatinine ($p=0.005$), and glomerular filtration rate ($p=0.004$). **Conclusion:** In conclusion, the results using the proposed method indicate that the presence of DM and/or SAH is able to negatively modify the biochemical profile. In addition, the importance of monitoring this population in primary health care was demonstrated, since some people presented potentially worrying biochemical alterations that are not being followed up.

Keywords: Primary health care, *Diabetes Mellitus*, Hypertension, Health status indicators.

INTRODUCTION

Diabetes mellitus (DM) and systemic arterial hypertension (SAH) are chronic noncommunicable diseases (NCDs)[1] that are among the main diseases with a high risk of mortality in the world. It is estimated that type 2 DM has a higher prevalence than type 1, with approximately 95% of involvement in the general population. Increases in cases of up to 69% of adults in developing countries and 20% in developed countries are predicted between the 2010s and the 2030s. In Brazil, this increase could reach approximately 9 million, with a higher incidence according to the increase in age group. Regarding SAH, there is an estimate of cases in 50% of older people. In addition, it should be noted that both diseases can be triggered by multifactorial causes[2].

Globally, DM affects approximately one in every 11 adults, while arterial hypertension had a prevalence in 2010 of around 30% of adults, with approximately half of the affected individuals having knowledge of their diagnoses, reinforcing that the prevalence of these diseases has a direct relationship with age, as well as geographic location and ethnicity. Studies report that in 2015 there were 7.8 million deaths due to uncompensated arterial hypertension and in 2017, up to 1.4 million in people with diabetes[3].

In addition, there is a three times greater chance of a diabetic individual developing hypertension when compared to a person

[1] Universidade do Estado do Pará, Santarém, (PA), Brasil.
[2] Universidade Federal de Jataí, Jataí, (GO), Brasil.

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without the disease. The same risk occurs for hypertensive people and the chance of developing diabetes. The patient who acquires SAH and/or DM may present manifestations with multimorbidities that increase the risk of death, in addition to reducing the quality of life and increasing their dependence on health services, which, depending on the severity, may require assistance at all levels of care[1]. Within this scenario, it is important to emphasize the increase in life expectancy with the aging of the population, which ends up favoring the emergence of NCDs, in addition to the increase in abdominal obesity that predisposes the individual to these diseases and other cardiovascular complications[4].

DM, as well as SAH, are already independent risk factors for the onset of cardiovascular diseases, such as acute myocardial infarction (AMI), stroke, heart failure, and peripheral artery disease. The number of hospital admissions of patients with cardiovascular diseases tends to be higher in those with DM, in addition to the fact that the proportion of deaths due to AMI is higher than in patients without DM. Cases of heart failure are also increased in patients with DM, which generates a worse evolution of these diseases, as well as an increase in the need for hospitalizations and the risk of death[5]. Another reflection of DM is the increased chance of reinfarction and heart failure, as well as a worse prognosis after acute coronary syndrome events. In addition, DM is considered a modifiable risk factor affected by hypertension, dyslipidemia, and smoking[6].

In this sense, it is important to have a quality health system to serve this population, with primary care being the main gateway to the Unified Health System (UHS), responsible for providing assistance and monitoring to people with DM and SAH, with the aim of reducing occurrences that require hospital admissions and deaths, improving quality of life, and reducing expenses for the UBS and for the patient. Furthermore, the impact of these diseases can be reduced by lifestyle changes, and regulating metabolic and blood pressure alterations, which can be worked on in primary care[7].

One of the challenges of this strategy is therapeutic failure, due to the abandonment or incorrect use of medications, since the treatment is continuous, often with the association of several medications, and their use depends, on certain occasions, on a person to help the older patient. In addition, the risk of drug interactions or adverse effects of these drugs, which is prevalent in this population, is highlighted[8]. Thus, the objective of the present study was to analyze the laboratory profile of people with *diabetes mellitus* and systemic arterial hypertension monitored in primary health care.

METHODS

The study is characterized as descriptive, cross-sectional, and quantitative, carried out in two Basic Health Units (BHU) in the urban area of the municipality of Santarém, Pará, Brazil. The study population involved people monitored by the BHU family health strategy.

For sample selection, the following inclusion criteria were adopted: participants of legal age; of both sexes; accompanied by one of the teams of the family health strategies belonging to the BHU. Exclusion criteria were: bedridden people, those with severe or unconscious health conditions, and pregnant or postpartum women. Thus, the study sample consisted of 345 participants.

The study was approved by the Ethics Committee for Research with Human Beings (Opinion: 2,055,979), and all study participants gave their consent to participate in the study by signing the Free and Informed Consent Form.

Study participants were organized into four groups: NO (n=123; 35.7%), people without a diagnosis of DM or SAH; DM (n=36; 10.4%), people diagnosed with DM; SAH (n=130; 37.7%), people diagnosed with SAH; and DM-SAH (n=56; 16.2%), people diagnosed with both DM and SAH.

The study was carried out from 2018 to 2019, in two stages, that is, in the first stage, socioeconomic (age, sex, marital status, income, self-description of skin color, education, income, smoking, and alcoholism) and clinical information (diagnosis of DM/SAH, presence of other diseases/comorbidities) of the participants was collected. In the second stage, blood was collected to measure biochemical variables. At this time, the participants were instructed to return to the BHU, fasting, to perform the venipuncture and, subsequently, the laboratory analysis. This analysis involved blood glucose, total cholesterol, triglycerides, high-density lipoprotein (HDL-c), urea, and creatinine. Based on this information, low-density lipoprotein (LDL-c)

was calculated using the Friedewald formula and non-HDL-c[9].

For the laboratory variables, the following normality references were adopted: <150 mg/dL for triglycerides; <190 mg/dL for total cholesterol; <150 mg/dL for LDL-c; <160 mg/dL for non-HDL-c[9]; <100 mg/dL for blood glucose[10]; >40 mg/dL of HDL-C for women and >50 mg/dL of HDL-C for men[11]; from 0.6 to 1.3 mg/dL for creatinine[12]; 15-45 mg/dL for urea.

Mild anemia was considered a hemoglobin concentration of 11-11.9 g/dL and 11-12.9 g/dL, for women and men respectively. For moderate anemia, values of 8-10.9 g/dL were adopted and for severe anemia, <8.0 g/dL, for both sexes[13]. The reference value[14] for platelets was 140-360 thousand cells/mm^3.

Renal function was assessed using the glomerular filtration rate (GFR) equation[15]. The GFR was considered altered[16] when the value was <60 ml/min/1.73m^2.

Descriptive statistics were used for data analysis, using mean, standard deviation, minimum, maximum, 95% confidence interval (95%CI), and absolute and relative frequency. Subsequently, the D'Agostino-Pearson Test was applied to verify the normality of the data. Thus, the unpaired T test was used for parametric data and the Mann-Whitney test for non-parametric data to make comparisons between the DM, SAH, and DM-SAH groups with the NO group. To verify the association of biochemical variables and GFR of the DM, SAH, and DM-SAH groups with the NO group, the Chi-square Test was applied and, if significant, the chance of the event occurring was verified with the Odds Ratio. For statistical analysis, the BioEstat 5.3 program was used, adopting a significance level of $p<0.05$.

RESULTS

The mean age of the NO group was 53.77±15.19 years (minimum= 18 years; maximum= 87 years), of the DM group 56.42±13.02 years (minimum= 22 years; maximum= 83 years), of the SAH group 61.94±11.90 years (minimum= 36 years; maximum= 89 years), and of the DM-SAH group 62.95±10.59 years (minimum= 41 years; maximum= 86 years). In addition, the mean age was higher in the SAH ($p<0.001$) and DM-SAH ($p<0.001$) groups compared to the NO group, and the DM group was younger than the SAH ($p= 0.017$) and DM-SAH groups ($p=0.009$).

Table 1 shows the distribution of the groups of participants in terms of sex, marital status, skin color, education, income, type of income, smoking, alcoholism, and the presence of other diseases, other than DM and SAH.

Table 2 shows the minimum, maximum, and mean values of the participants' biochemical, hematological, and glomerular filtration rate variables. The NO group, in relation to the DM, presented lower values of glucose ($p<0.001$) and urea ($p=0.023$). Regarding the SAH group, the NO had a lower value for non-HDL-c ($p=0.037$) and urea ($p<0.001$). Finally, the NO group demonstrated, in relation to the DM-SAH group, lower values for glycemia ($p<0.001$), non-HDL-c ($p=0.036$), triglycerides ($p=0.024$), urea ($p<0.001$), and GFR ($p=0.015$).

Table 3 shows the associations between the NO group and the other groups, that is, the DM group is 19 times more likely to have altered blood glucose than the NO group ($p<0.001$), while the DM-SAH group is 18.5 times more likely to have altered blood glucose compared to the NO group ($p<0.001$). HDL-c is 3.1 times more likely to be altered in the DM group compared to the NO group ($p=0.048$). The DM group is 3.6 times more likely to have altered urea ($p=0.025$), and the DM-SAH group is 4.6 times more likely to have altered urea ($p<0.001$) compared to the NO group.

The DM group is 8.5 times more likely to have altered creatinine than the NO group ($p<0.001$), and the DM-SAH group is 5.7 times more likely to have altered creatinine ($p=0.005$), compared to the NO group. GFR, in relation to the NO group, is 3.2 times more likely to be altered in the DM-SAH group ($p=0.004$). Of the hematological parameters, only hemoglobin was associated ($p=0.002$), that is, the DM group is 9 times more likely to develop alterations in hemoglobin concentration compared to the NO group (Table 3).

It is noteworthy that the only hemoglobin alterations in the NO group were for mild anemia. In the DM group, mild anemia was observed in 50% (n=3) of the participants and moderate in the other 50% (n=3). In the SAH group, mild anemia was 80% (n=8) and moderate was 20% (n=2). Finally, in the DM-SAH group, mild anemia was present

Table 1

Distribution of participants according to sociodemographic characteristics, smoking, alcoholism, and the presence of other diseases.

Variables	NO	DM	SAH	DM-SAH
	n/%	n/%	n/%	n/%
Sex				
Male	36/29.3	12/33.3	34/26.2	16/28.6
Female	87/70.7	24/66.7	96/73.8	40/71.4
Marital status				
Married/stable union	72/58.5	22/61.1	71/54.6	31/55.4
Not married	27/22.0	6/16.7	26/20.0	11/19.6
Widower	17/13.8	5/13.9	26/20.0	11/19.6
Divorced	6/4.9	3/8.3	7/5.4	3/5.4
Not informed	1/0.8	0/0	0/0	0/0
Skin color				
Brown	91/74.0	27/75.0	92/70.7	41/73.2
White	11/8.9	5/13.9	20/15.4	6/10.7
Black	8/6.5	3/8.3	11/8.5	8/14.3
Yellow	6/4.9	0/0	3/2.3	1/1.8
Indigenous	2/1.6	1/2.8	0/0	0/0
Not informed	5/4.1	0/0	4/3.1	0/0
Schooling				
None	10/8.1	3/8.3	14/10.8	9/16.1
1 to 3 years	10/8.1	7/19.4	29/22.3	6/10.7
4 to 7 years	47/38.2	15/41.7	42/32.3	20/35.7
8 to 11 years	35/28.5	4/11.1	30/23.1	16/28.6
12 or more years	19/15.5	6/16.7	15/11.5	5/8.9
Not informed	2/1.6	1/2.8	0/0	0/0
Income				
< 1 minimum wage	29/23.6	10/27.8	37/28.5	9/16.1
1 to 2 minimum wages	86/69.9	25/69.4	83/63.8	43/76.8
3 to 4 minimum wages	4/3.3	1/2.8	9/6.9	4/7.1
5 to 6 minimum wages	2/1.6	0/0	1/0.8	0/0
Not informed	2/1.6	0/0	0/0	0/0
Type of income				
Active	63/51.2	19/52.8	55/42.3	29/51.8
None	31/25.2	6/16.7	34/26.2	15/26.8
Retired/Benefit	27/22.0	9/25.0	38/29.2	11/19.6
Not informed	2/1.6	2/5.5	3/2.3	1/1.8
Smoking				
Yes	10/8.1	3/8.3	6/4.6	4/7.1
No	112/91.1	32/88.9	123/94.6	50/89.3

Not informed	1/0.8	1/2.8	1/0.8	2/3.6
Alcoholism				
Yes	20/16.3	4/11.1	12/9.2	4/7.1
No	99/80.5	32/88.9	111/85.4	51/91.1
Not informed	4/3.2	0/0	7/5.4	1/1.8
Other disease				
Yes	43/35.0	15/41.7	63/48.5	28/50.0
No	80/65.0	21/58.3	67/51.5	28/50.0

DM – group with isolated diabetes mellitus; SAH – group with isolated systemic arterial hypertension; NO – group without the presence of DM and SAH; DM-SAH – group with the presence of both DM and SAH.
Source: elaborated by the authors.

in 80% (n=4) and moderate in 20% (n=1) of the participants.

DISCUSSION

The data found for age in this study (lower mean age and lower minimum age in the NO group and higher mean age and higher minimum age in the SAH and DM-SAH groups) can be partially explained by the Buford review[17], in which the aging process evolves with intrinsic mechanisms that are also physiopathogenic bases of SAH, such as oxidative stress and endothelial dysfunction and that, therefore, aging itself increases the risk of developing SAH.

The higher prevalence of females in all four groups analyzed in the study (NO, DM, SAH, and DM-SAH) reflects the greater demand for health services by this population when compared to males, which is observed in Brazil, from adolescent populations[18] to older populations[19].

Alcoholism, in this study, was not associated with a greater risk of having SAH, which is in line with what was found in the study by Lavôr et al.[20], who analyzed, in 1,057 adults aged 20 to 59 years from the municipalities of Teresina and Picos, several variables to define which were associated with a higher prevalence of SAH, and alcohol consumption did not demonstrate this association. Still on alcoholism, no association was found between the habit and a higher prevalence of DM. On the other hand, Malta et al.[21] demonstrated that alcohol consumption, in an abusive way, can be associated with a higher prevalence of DM.

The fact of being a smoker did not increase the risk of the patient being in the groups diagnosed with SAH. This result is in line with that observed by Sohn[22] who found no association between smoking and SAH. Smoking was also not associated with a greater risk of the patient belonging to the groups diagnosed with DM. This result is different from that highlighted by Maddatu et al.[23], who found an association between chronic smoking and hyperglycemia and type 2 DM, through different mechanisms, including worsening glucose tolerance and insulin sensitivity.

Mean blood glucose levels, 146 mg/dL for the DM group and 152 mg/dL for the DM-SAH group, demonstrate the need for stricter control in the clinical management of patients, since these values are above the reference values for fasting glycemia, used as a therapeutic goal by the Brazilian Society of Diabetes[10], which postulates a fasting glucose <100 mg/dL as a goal, and by the American Diabetes Association[24], which recommends a target is 80 to 130 mg/dL.

It is important to point out that in all groups there were high values of maximum glycemia, including in the group without an established diagnosis of DM (NO group: 364 mg/dL), which may denote a failure in primary health care to track the disease, since in the aforementioned guideline of the Brazilian Society of Diabetes[10], any blood glucose values greater than 200 mg/dL in a symptomatic patient already establishes the diagnosis, as well as values equal to or greater than 125 mg/dL in two different samples of fasting blood glucose. The high glycemia values found for the DM (390 mg/dL) and DM-SAH (412 mg/dL) groups demonstrate that the treatment is uncontrolled in part of the patients, since the glycemic targets for patients undergoing DM treatment, from the same guideline, are less than 100 mg/dL fasting or less than 160 mg/dL after a meal[10]. This lack of control may be the result of a weakness in the monitoring of the patient by primary health care and poor adherence by the patient to

Table 2
Presentation and comparison of biochemical variables and glomerular filtration rate among participants.

Variables	NO	DM	SAH	DM-SAH
Glucose				
Min/Max	50/364	56/390	53/158	50/412
Mean±SD	85.76±41.16	152.67±90.44*	79.70±16.84	146.68±76.92*
Total Cholesterol				
Min/Max	127/335	121/312	100/363	143/335
Mean±SD	212.56±43.90	207.11±45.43	218.89±45.11	225.27±40.52
HDL-c				
Min/Max	29/68	34/60	33/62	34/66
Mean±SD	46.70±9.32	42.74±7.56	45.68±7.53	46.45±9.52
LDL-c				
Min/Max	59/235	48/180	52/257	80/252
Mean±SD	132.49±36.13	119.79±35.62	142.01±40.71	143.19±39.43
Non-HDL-c				
Min/Max	81/273	80/226	70/308	117/300
Mean±SD	166.15±41.96	152.42±41.37	179.75±46.52*	184.68±46.56*
Triglycerides				
Min/Max	60/1,084	74/1,136	50/668	60/650
Mean±SD	188.00±131.30	220.08±186.29	197.53±113.03	231.82±135.17*
Urea				
Min/Max	12/58	18/89	17/82	15/77
Mean±SD	29.41±9.21	35.33±13.94*	36.12±11.30*	37.23±12.94*
Creatinine				
Min/Max	0.6/1.56	0.52/2.9	0.5/2.4	0.57/2
Mean±SD	0.94±0.18	1.01±0.48	0.96±0.28	1.02±0.31
GFR				
Min/Max	41/135	18/127	18/121	35/121
Mean±SD	78.70±18.23	79.11±27.00	74.55±19.31	71.11±21.34*
Hemoglobin				
Min/Max	11.7/18.8	9.6/16	10.2/16.8	9.9/17.1
Mean±SD	13.91±1.27	13.38±1.63	13.59±1.17	13.70±1.38
Platelets#				
Min/Max	72/397	142/422	136/382	129/392
Mean±SD	249.46±50.94	246.62±59.24	241.90±52.43	245.34±56.42

DM – group with isolated *diabetes mellitus*; SAH – group with isolated systemic arterial hypertension; NO – group without the presence of DM and SAH; DM-SAH – group with the presence of both DM and SAH; HDL-c – high density lipoprotein; LDL – low density lipoprotein; GFR - glomerular filtration rate; # - values must be multiplied by one thousand; Min/Max – minimum and maximum values; SD - standard deviation; *Statistical difference from the NO group; $p<0.05$.
Source: elaborated by the authors.

Table 3
Association of biochemical variables and glomerular filtration rate in participants.

Variables	NO	DM	p OR 95%CI	SAH	p OR 95%CI	DM-SAH	p OR 95%CI
Glucose							
Adequate (n/%)	114/92.7	12/33.3	<0.001 19 7.6-47.3	119/91.5	0.937	19/33.9	<0.001 18.5 8.2-41.6
Altered (n/%)	12/7.3	24/66.7		11/8.5		37/66.1	
Total cholesterol							
Adequate (n/%)	39/31.7	13/36.1	0.769	35/26.9	0.485	11/19.6	0.136
Altered (n/%)	84/68.3	23/63.9		95/73.1		45/80.4	
HDL-c							
Adequate (n/%)	65/59.1	6/31.6	0.048 3.1 1.1-8.8	42/52.5	0.449	16/51.6	0.590
Altered (n/%)	45/40.9	13/68.4		38/47.5		15/48.4	
LDL-c							
Adequate (n/%)	78/70.9	16/84.2	0.355	52/65.0	0.479	19/61.3	0.422
Altered (n/%)	32/29.1	3/15.8		28/35.0		12/38.7	
Non-HDL-c							
Adequate (n/%)	50/45.5	11/57.9	0.450	28/35.0	0.194	10/32.3	0.268
Altered (n/%)	60/54.5	8/42.1		52/65.5		21/64.7	
Triglycerides							
Adequate (n/%)	55/44.7	15/41.7	0.894	54/41.5	0.701	18/32.1	0.154
Altered (n/%)	68/55.3	21/58.3		76/58.5		38/67.9	
Urea							
Adequate (n/%)	114/92.7	28/77.8	0.025 3.6 1.2-10.2	111/86.0	0.133	41/73.2	<0.001 4.6 1.8-11.4
Altered (n/%)	9/7.3	8/22.2		18/14.0		15/26.8	
Creatinine							
Adequate (n/%)	119/96.7	28/77.8	<0.001 8.5 2.3-30.2	117/90.7	0.087	47/83.9	0.005 5.7 1.6-19.3
Altered (n/%)	4/3.3	8/22.2		12/9.3		9/16.1	
GFR							
Adequate (n/%)	107/87.0	28/77.8	0.274	103/79.8	0.176	38/67.9	0.004 3.2 1.4-6.8
Altered (n/%)	16/13.0	8/22.2		26/20.2		18/32.1	
Hemoglobin							
Adequate (n/%)	117/97.5	26/81.3	0.002 9 2.11-38.35	107/91.5	0.078	47/90.4	0.100
Altered (n/%)	3/2.5	6/18.7		10/8.5		5/9.6	

Platelets							
Adequate (n/%)	114/95.0	31/96.9	0.980	114/97.4	0.521	48/92.3	0.735
Altered (n/%)	6/5.0	1/3.1		3/2.6		4/7.7	

their therapeutic approach, since in a study carried out in Teresina, with patients being followed up for SAH and/or DM, through the HIPERDIA group, the majority of patients presented poor adherence to drug treatment in both cases[25].

The value found for total cholesterol was higher in all groups, including the NO, than that detected for the Brazilian population by Malta et al.[26], which was 185 mg/dL, after analysis of laboratory data from the National Health Survey. This result may be due to the cultural-dietary habits of the local population evaluated in the study.

The maximum values found for serum triglyceride are notably high in the four evaluated groups (650-1,084 mg/dL). According to a study by Parhofer and Laufs[27], values above 150 mg/dL can be considered moderate hypertriglyceridemia, with increased cardiovascular risk, and values above 1,000 mg/dL are considered severe hypertriglyceridemia and significantly increase the risk of acute pancreatitis. However, considering the SAH and DM-SAH subgroups, it is important to highlight that hypertriglyceridemia is an isolated risk factor for the development of chronic kidney disease (CKD) in patients with SAH[28].

The data obtained in the study suggest that SAH and DM are independent variables that increase the risk of the patient presenting high creatinine and high urea, especially in the DM group, and that the two associated conditions potentiate these risks. Pandya et al.[29] also detected that serum creatinine and urea are elevated in patients with SAH and in patients with DM, as well as concluding that analysis of serum creatinine and serum urea levels, as well as salivary creatinine and salivary urea, are recommended for screening Renal function status in patients with DM and patients with SAH. This information is important, as DM is a strong risk factor for CKD, including its final stage, with a relative risk compared to non-diabetics of 3.34 for women and 2.84 for men[30]. In this sense, in the present study, the association observed in the DM-SAH group, in relation to the NO, for the alteration of the glomerular filtration rate stands out. In addition, SAH is the main comorbidity found in CKD and the main risk factor for renal failure, and arterial hypertension and CKD are important causes of cardiovascular diseases[31]. Within this context, the study by Zhang et al.[32] demonstrated that a reduction in the glomerular filtration rate is an independent risk factor for mortality and stroke in patients with arterial hypertension.

Finally, belonging to the DM group increased the risk of the patient presenting moderate anemia and these results are in agreement with Gauci et al.[33] who concluded in their study that DM increases the risk of anemia by at least twice. This association is a real problem for diabetic patients, as highlighted by Sahay et al.[34] who emphasized that chronic anemia in DM predicts the progression to micro and macrovascular complications of the disease, including stroke and nephropathy.

The main limitation of the study was not being able to detect the reasons behind the laboratory alterations found: were they due to the pathophysiology of the diseases?; to the drugs used in the therapeutic management?; to the nutritional factors of the patients? Future research with this object of investigation is encouraged by the authors of the article, as they can contribute to the discovery of improvements in the therapeutic management of patients with DM and SAH, as well as better guide Primary Health Care professionals

CONCLUSION

This study, according to the proposed method, observed a predominance of females in the studied groups, as well as married, brown skin color, 4-7 years of study, income of 1-2 minimum wages, and active type of income, non-smokers and non-alcoholics. In addition, age was higher in patients with SAH compared to the NO group.

It is also noteworthy that the diseases, isolated or associated, are able to negatively modify the biochemical profile, in particular this observation was made for fasting blood glucose, total cholesterol, non-HDL-c, and triglycerides. In addition, there is an association between altered values in the groups

and disease, in relation to the group without disease, for glycemia, HDL-c, urea, creatinine, glomerular filtration rate, and hemoglobin.

According to the results of the present study, the importance of monitoring patients with DM and/or SAH by primary health care is emphasized, since many alterations were observed that can or will further compromise people's health and quality of life.

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Participation of the Authors:
GRNM – Data collection, data organization, text composition, and approval of the final version to be published. *JCCN* – Data collection, data organization, text composition, and approval of the final version to be published. *EMK* – Data collection, data interpretation, text composition, and approval of the final version to be published. *JS* – Conception and design of the study, composition of the text and approval of the final version to be published. *SYLT* – Conception and design of the study, analysis and interpretation of data, composition of the text, and approval of the final version to be published. *LFGS* – Guidance, conception, and design of the study, analysis and interpretation of data, composition of the text, and approval of the final version to be published.

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Corresponding Author:
Luiz Fernando Gouvêa-e-Silva
lfgouvea@yahoo.com.br

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