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ORIGINAL ARTICLE

FACTORS ASSOCIATED WITH GLYCEMIC VARIABILITY IN MARKET VENDORS

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ABSTRACT
Objective: to analyze the factors associated with glycemic variability in market vendors.
Method: epidemiological survey with 399 workers. Data was collected between January and March 2018 through the administration of a sociodemographic, lifestyle, work and health, working and health conditions questionnaire, blood glucose dosage tests and weight and height measurement. The analysis involved frequency calculations and the Chi-square test (95% significance level).
Results: the frequency of glycemic variability found was 9.8%. Age group ($p < 0.001$), education ($p < 0.001$), physical activity ($p = 0.033$), body mass index ($p = 0.050$), use of medications ($p < 0.001$) and multimorbidity ($p < 0.001$) showed association with glycemic variability.
Conclusion: age group, education, physical activity, body mass index, periodical use of medications and reporting multimorbidity are variables that have factors associated to the development of glycemic variability in market vendors.

DESCRIPTORS: Worker; Worker's health; Diabetes Mellitus; Risk factors; Informal Sector.

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FATORES ASSOCIADOS A ALTERAÇÕES GLICÊMICAS EM TRABALHADORES FEIRANTES

RESUMO
Objetivo: analisar os fatores associados às alterações do padrão glicêmico em trabalhadores feirantes.
Método: estudo epidemiológico, do tipo inquérito com 399 trabalhadores. A coleta de dados ocorreu entre janeiro e março de 2018, com aplicação de questionário sociodemográfico, de estilo de vida, trabalho e saúde, condições de trabalho e de saúde, testes sanguíneos de dosagem de glicemia e aferição de peso e altura. A análise envolveu cálculos de frequências e teste do Qui-quadrado (nível de significância de 95%).
Resultados: a frequência encontrada de alterações glicêmicas foi de 9,8%. Faixa etária (p<0,001), escolaridade (p<0,001), prática de atividade física (p=0,033), índice de massa corporal (p=0,050), uso de medicações (p<0,001) e multimorbidade (p<0,001) apresentaram associação com alterações glicêmicas.
Conclusão: Faixa etária, escolaridade, prática de atividade física, índice de massa corporal, fazer uso de medicações periodicamente e relatar multimorbidade são variáveis que possuem fatores associados para desenvolvimento de alterações glicêmicas em feirantes.

DESCRITORES: Trabalhador; Saúde do Trabalhador; Diabetes Mellitus; Fatores de Risco; Setor Informal.

FACTORES ASOCIADOS CON ALTERACIONES GLUCÉMICAS EN TRABAJADORES DE MERCADOS COMUNITARIOS

RESUMEN:
Objetivo: analizar los factores asociados con las alteraciones del patrón glucémico en trabajadores de mercados comunitarios.
Método: estudio epidemiológico, del tipo encuesta, realizado con 399 trabajadores. La recolección de datos tuvo lugar entre enero y marzo de 2018, mediante la aplicación de un cuestionario sociodemográfico, de estilo de vida, trabajo y salud, condiciones de trabajo y de salud, análisis de sangre para medir la glucemia, y mediciones de peso y altura. El análisis implicó cálculos de frecuencias y la prueba de chi-cuadrado (nivel de significancia del 95%).
Resultados: la frecuencia de alteraciones glucémicas encontrada fue del 9,8%. Las variables de grupo etario (p<0,001), nivel de estudios (p<0,001), práctica de actividad física (p=0,033), índice de masa corporal (p=0,050), uso de medicamentos (p<0,001) y multimorbilidad (p<0,001) presentaron asociaciones con alteraciones glucémicas.
Conclusión: el grupo etario, el nivel de estudios, la práctica de actividad física, el índice de masa corporal, consumir medicamentos periódicamente y reportar multimorbilidad son variables que poseen factores asociados para el desarrollo de alteraciones glucémicas en trabajadores de mercados comunitarios.

DESCRIPTORES: Trabajador; Salud del trabajador; Diabetes Mellitus; Factores de riesgo; Sector informal.

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INTRODUCTION

In the 1990s, unemployment generated by the crisis in the capitalist mode of production caused significant changes in the organizational and social system of work. The rise in informal sector jobs, a strategy used by workers to seek their livelihood, is one of these changes [1,2].

Informal work environments expose workers to situations of vulnerability that directly interfere with the health-disease process [3]. In these spaces, precarious work, long hours, uncertain monthly earnings, lack of social security, as well as health and safety, are common[4]. Among the various places for exercising informality, street markets deserve mention.

Most informal workers do not have secure employment contracts or labor rights. Many exercise their activities in unhealthy conditions, which contributes to increased levels of stress and the incidence of various diseases [4,5]. In addition, changes in the epidemiological scenario in Brazil and in the world show a significant increase in chronic non-communicable diseases (NCDs), with emphasis on Diabetes Mellitus (DM) [6,7].

DM has a high prevalence, both in developed and developing countries, affecting mainly people over 60 years of age [8]. Furthermore, it is estimated that there will be 471 million people with diabetes in the world in 2035 [7].

From 2008 to 2018, 637. 603 people died in Brazil as a result of complications from DM, with higher mortality among the elderly [9]. Hospitalization rates for the treatment of this pathology have grown, with 1,661,050 hospitalizations in that period, 1.22% of the total hospitalizations in the country [10].

Authors point out that obesity has an important relationship with DM. Weight gain, as well as with the accumulation of adipose tissue in the abdominal region, results in numerous physiological changes that can negatively impact workers' health [11,12].

The justification for the present study is the need to estimate the factors associated with glycemic variability in market vendors, since the epidemiological transition has impacted health/ disease patterns, leading to an increase in chronic diseases, including DM. Therefore, the present study aims to analyze the factors associated with changes in the glycemic pattern of market vendors.

METHOD

This is an epidemiological, population-based survey that is part of the umbrella research project entitled "Occupational accidents in market vendors and health and working conditions: a prospective study", based on data on sociodemographic, occupational and health aspects of the market vendors.

The study was carried out at the Municipal Market of the city of Guanambi, a regional center of the productive hinterland territory of Bahia, Brazil. The site includes a large number of informal market vendors in Guanambi, who work in three pavilions and stands in an informal market area of the Municipal Market.

The following inclusion criteria were adopted: individuals over the age of 16 who perform their work activities in the market at least twice a week, at a fixed point determined by the market coordination, and who have no formal contract and registration in the labor and social security card. The exclusion criteria were: individuals who pay social security contributions and develop their activities in areas not specified by the market administration.

All the market vendors who met the criteria and agreed to participate in the study were included in the research. The final population consisted of 399 market vendors who answered the form and performed blood collection. As it is a census survey, there was no sample calculation.

Data was collected between the months of January and March 2018. The QSEST form (sociodemographic, lifestyle, work and health questionnaire), prepared in 1996 and updated in 2010 by Monteiro, was used [13]. For the assessment of health conditions, questions extracted from spreadsheet N of the National Health Survey [14] were administered, in addition to the measurement of height and weight. Subsequently, the body mass index (BMI) was calculated and laboratory tests were performed to check fasting blood glucose.

The sociodemographic variables examined were gender, age group, marital cohabitation, education and self-reported race-color. Regarding habits and lifestyle, the following items were analyzed: physical activity (yes or no), alcohol consumption (yes or no), tobacco use (yes or no), and average hours of sleep per night (less than 8 or more than 8 hours [13]. As for occupational aspects, the following variables were analyzed: having another job, working hours and perception of risk factors. For the assessment of health aspects, BMI, medication use, glycemic variability, self-reported medical diagnosis for diabetes mellitus, presence of multimorbidities were examined.

To check the height, a Sanny® estadiometer, profiled in anodized aluminum, with a tripod support device and measurement capability 115-210 cm was used. The participants were positioned with their backs to the measuring rod. Weight was determined using a Plenna portable digital scale with capacity of 150 kg. The body perimeters were determined using an inelastic anthropometric tape measure in fiberglass, capacity of 200 cm, with a locking mechanism.

The collection of blood samples was performed by trained personnel, using standardized procedures and instruments [15]. The samples were placed in insulated thermal boxes, of gelox type, and sent to the laboratory hired by the research project team. The reference values used to classify glycemic changes for fasting blood glucose were those recommended by the Brazilian Diabetes Society, namely: normoglycemia <100 mg/dl, pre-diabetes or increased risk for DM ≥ 100 mg/dl and established Diabetes ≥ 126 mg/dl [7].

BMI analysis was performed using the formula weight divided by height squared. The classification was based on the Brazilian Guidelines for Obesity (2016) [16], with a categorization for ideal weight, overweight and obesity.

Tabulation was performed in Microsoft Excel 2010, and the analysis with IBM Statistical Package for the Social Sciences, version 21.0. Absolute and relative frequency calculations were made for categorical variables. Chi-square test was used for the association test, and for variables less than five, Fisher's exact test was performed, with glycemic variability use as the outcome variable, and the variables related to sociodemographic and occupational aspects, lifestyle and health aspects used as independent variables. A value of $p \leq 0.05$ was adopted.

The study was approved by the Research Ethics Committee of Universidade do Estado da Bahia, under protocol No. 2,373,330/2017.

RESULTS

A total of 399 market vendors participated in the study. As for the sociodemographic profile, most participants were female (n = 241; 60.4%), aged 41-59 years (n = 190; 46.7%), lived in marital cohabitation (n = 254; 63.7%), attended elementary school (n = 249; 62.7%) and were black (n = 262; 65.7%).

Blood tests showed that 13 (3.3%) had glucose intolerance and 26 (6.5%) presented values consistent with the possibility of DM, totaling 39 (9.8%) people with glycemic variability (AG).

Regarding the self-reported diagnosis for DM, 31 (7.8%) of the marketers self-reported having DM and of these, 22 (71%) had glycemic variability, demonstrated in the fasting blood glucose test (Table 1).

Table 1 - Classification of fasting blood glucose values of market vendors. Guanambi, Bahia, Brazil, 2019

Blood glucose classification	n	%
Normal	360	90.2
Intolerance	13	3.3
Diabetes Mellitus	26	6.5
Total	399	100

Analysis of the sociodemographic and lifestyle variables (Table 2), showed that, with regard to gender, 16 (10.1%) men and 23 (9.5%) women presented glycemic variability. This outcome was predominant in the age group of 60 years or older (n = 20; 24.7%). Regarding marital cohabitation, the frequency found was 18 (12.4%) unmarried individuals, which is higher than the 21 (8.3%) obtained for the married participants.

Regarding education, the highest rates were found among the illiterate (n = 7; 46.7%), followed by elementary education (n = 29; 11.6%). Regarding self-reported color, the prevalence was higher in black individuals (n = 27; 10.3%).

As for life habits, there was a higher frequency of glycemic variability in the participants who did not perform physical activities (n = 31; 12.2%), did not drink alcohol (n = 28; 11.6%), did not use tobacco (n = 37; 10.2%) and who slept less than eight hours a night (n = 30; 11.6%).

Analysis of sociodemographic factors and lifestyle habits associated with glycemic variability using the Chi-square test showed that the variables age (p <0.001), education (p <0.001) and physical activity (p = 0.033) had statistical significance (Table 2).

Table 2 - Sociodemographic and lifestyle factors associated with glycemic variability in market vendors. Guanambi, Bahia, Brazil, 2019 (continues)

Variables	Glycemic variability				p-value
	Yes		No		
	n	%	n	%	
Gender					0.848
Male	16	10.1	142	89.9	
Female	23	9.5	218	90.5	

Age group (in years)					
15-40	4	3.1	124	96.9	<0.001
41-59	15	7.9	175	92.1	
60 and older	20	24.7	61	75.3	
Marital cohabitation					
Yes	21	8.3	233	91.7	0.180
No	18	12.4	127	87.6	
Education (n=397)					
Illiterate	7	46.7	8	53.3	<0.001
Elementary school	29	11.6	220	88.4	
Secondary education	3	2.3	130	97.7	
Self-reported race-color					
Black	27	10.3	235	89.7	0.621
Not black	12	8.8	125	91.2	
Performs physical activity					
Yes	8	5.6	136	94.4	0.033
No	31	12.2	224	87.8	
Drinks alcohol					
Yes	11	7.0	147	93.0	0.126
No	28	11.6	213	88.4	
Tobacco use					
Yes	2	5.7	33	94.3	0.397
No	37	10.2	327	89.8	
Average hours of sleep per night					
Less than 8	30	11.6	229	88.4	0.098
8 or more	9	6.4	131	93.6	

Regarding occupational aspects, having another job obtained the same frequency for yes and no (9.8%). However, the relative values were different, being 13 and 26 respectively. As for workers who had glycemic variability, only 23 (11%) worked less than 44 hours per week and 22 (10.2%) had the perception of a health risk factor in the workplace. However, for these variables there was no statistically significant association (Table 3).

Table 3 - Occupational factors associated with glycemic variability in market vendors. Guanambi, Bahia, Brazil, 2019

Variables	Glycemic variability				p-value
	Yes		No		
	n	%	n	%	
Having another job					
Yes	13	9.8	120	90.2	1.0
No	26	9.8	240	90.2	
Weekly working hours					
Less than 44	23	11.0	187	89.0	0.404
44 or more	16	8.5	173	91.5	
Risk factor perception					
Yes	22	10.2	194	89.2	0.764
No	17	9.3	166	90.7	

Analysis of aspects related to health showed a predominance of GA in workers with BMI classified as overweight (n = 17; 12.1%), who do not use medication periodically (n = 29; 16.7%) and with a report of multimorbidity (n = 23; 22.8%). The BMI variable showed a p-value of 0.05, the conventional threshold for statistical significance. All other variables had a statistically significant association with glycemic variability (Table 4).

Table 4 - Health aspects associated with glycemic variability in market vendors. Guanambi, Bahia, Brazil, 2019

Variables	Glycemic variability				p-value
	Yes		No		
	n	%	N	%	
Body mass index (n=394)					
Ideal weight	6	4.5	126	95.5	
Overweight	17	12.1	124	87.9	0.050
Obesity	16	7.6	105	92.4	
Uses periodical medication					
Yes	10	4.4	215	95.6	<0.001
No	29	16.7	145	83.3	
Multimorbidity report					
Yes	23	22.8	78	77.2	<0.001
No	16	5.4	282	94.6	

DISCUSSION

The prevalence for glycemic variability found in this study is 9.8%, which was verified by examination of fasting blood glucose. However, the lack of studies with informal workers made it difficult to compare the present study with other similar publications. Thus, it was related to studies on workers who carry out their work activities in various economic sectors.

The prevalence of DM has been increasing according to life expectancy and population growth, with a prevalence of 7.6% in the adult population [17]. Despite extensive knowledge about the disease and the need to change lifestyle habits early, the population is still very reluctant to follow the necessary treatment [18].

Analysis of the gender variable showed that women had a higher absolute frequency of glycemic variability, a result similar to that found in other studies [16,19-20]. This can be explained by the fact that since women seek health services more frequently, a diagnosis of DM is more frequent [21]. Thus, they can keep blood sugar levels more controlled than men. Verification of relative values shows that the male gender is the most affected by glycemic variability, without statistical significance. Probably because they do not often seek health services, men are not aware of such changes and of the development of a possible disease.

Regarding the age group, the elderly had a higher prevalence, which is consistent with other studies that evaluated the prevalence of DM [19,22-23]. The age group, as well as the family history, are considered non-modifiable factors that predispose the individual to have a greater chance of developing DM [24].

Another variable that showed significance was education, with a high frequency of DM found in the participants who had primary school and who were illiterate, corroborating other studies [17,19]. Individuals with low educational levels have twice as much prevalence for DM [25]. Therefore, education has a significant impact on well-being, both individually and collectively [26], whereas the lower the level of education, the greater the prevalence of DM [23], as education will directly influence the choices about health promotion and disease prevention [25].

The self-reported race-color and marital cohabitation variables did not show statistical significance. However, the study showed a high frequency among black individuals. This prevalence is similar to other findings, indicating that the black population is the most affected by DM, mainly due to genetic and cultural issues [27].

As for marital cohabitation, the study showed a higher frequency of DM for those who had marital cohabitation. However, studies showed that not being married increases the diagnostic possibility of DM, since living alone can make it difficult to treat the disease[25].

Analysis of the physical activity variable showed a significant association: most participants with glycemic variability did not perform physical activity. Type II DM is mainly caused by bad lifestyle habits. Performing physical activity is a protective factor, that is, it reduces the incidence of pathology and contributes to a better quality of life for individuals who already live with the disease [18].

Smoking and alcohol consumption were not relevant as an associated factor for glycemic variability [12]. However, it should be noted that in the case of tobacco, only its use during the study period was considered. Tobacco use in previous periods was not taken into account.

Verification of the average hours of sleep showed no significant association with DM, although there is a difference in the hours of sleep on days off compared to working days. Moreover, some studies revealed that having sleeping problems or working at night are risk factors for DM [11,28].

The variables having another job and working hours did not show significance associated with glycemic variability. This finding contrasts with a study on mismatch between sleep timing and working hours and risk of type II diabetes, which found a direct relationship between long working hours and development of DM [29].

Regarding the variable perception of risk factors, no statistically significant association was found with glycemic variability in market vendors. However, a study states that the quality of life (QOL) of people diagnosed with DM is lower compared to those who not affected by this condition [21], as the disease and its treatment impose changes in the daily lives of the individuals [18].

The BMI variable was associated with glycemic variability. Such condition, mainly when it is caused by sedentary lifestyle and unalterable factors such as age group, is considered a risk condition for glycemic variability [11-12,22,28].

There was also association between glycemic variability and the use of medications. According to one study, not all elderly people with diabetes use continuous medication for the treatment of the disease, as they often forget to take the medication [8].

Another variable with statistical significance was multimorbidity. It is believed that this condition can be generated by the long-term complications of DM and by other associated pathologies, such as systemic arterial hypertension and cardiovascular diseases [30].

One limitation of this study is its cross-sectional design, which does not provide evidence of a temporal relationship between outcome and exposure, as these are simultaneously assessed.

Another limitation is the fact that only one blood sample was collected, and, therefore, it would be possible that the variability or non-variability of a participant's glycemic levels had only occurred on the day of collection. However, it should be noted that the workers received all the necessary information about the fasting. Since few studies were conducted on glycemic variability in market vendors, further studies on this topic are suggested.

CONCLUSION

The prevalence rates of glycemic variability are within the average levels for DM, both in Brazil and worldwide. Age group, education, physical activity, BMI, periodical use of medications and reporting multimorbidity are variables that have associated factors for the development of glycemic variability in market vendors. The results of this study show the importance of controlling actions related to lifestyle habits, as these are strongly associated with the incidence of DM.

It is believed that the guidance provided by health professionals in primary care, especially by nurses, as well as the correct follow-up in the HIPERDIA program, can guide the population on the importance of healthy life habits.

However, although there are health programs for DM control, the informal sector has peculiarities that must be considered for the development of public policies aimed at improving informal workers' health, such as less access to information and education and the distance from basic health units, as these workers perform their activities during opening hours of health services. Thus, interventions targeted to this population are necessary.

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