

CASE STUDY

Reasons for the increase in the incidence of diabetes mellitus in Pemba, Mozambique

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Introduction: Despite diabetes mellitus being a condition whose treatment, causes, and consequences are well-known, its prevalence continues to increase, with an incidence comparable to that of epidemics.

Objectives: The primary objective of this study was to investigate whether patients with type 2 diabetes mellitus (DMII) who visit the Pemba Hospital in Mozambique adhere to the recommended treatment and have the socioeconomic conditions to follow the diet recommended for controlling their condition.

Results: This case study included 28 patients, using a food frequency questionnaire and questions related to the patients' daily lives. The results were related to the dependent variable of social class. It was found that patients adhere to the recommended treatment, but there is a general difficulty in accessing food regardless of the respondents' social class. It was also found that there is a high level of awareness among the respondents regarding DMII and its treatment.

Conclusion: The socioeconomic conditions of the study population determine their level of adherence to DMII, especially regarding adopting a diet favorable to controlling the condition.

Keywords: diabetes mellitus, Mozambique, health, food habits, education

Introduction

Diabetes mellitus (DM) is a metabolic disorder that can have various causes, in which the body is resistant to the effect of insulin and/or does not produce enough of this hormone to process glucose (1). As a result, there is an accumulation of glucose in the blood (hyperglycemia), which can lead to serious health complications.

The number of worldwide people with diabetes increased from 108 million in 1980 to 463 million in 2019, resulting in a prevalence increase in the adult population over 18 years old from 4.7% to 9.3%, respectively (2). According to the WHO (3), the number of individuals with this problem could reach 570 million by 2030.

Most individuals with DM live in developing countries, where the disease has a higher incidence, with a growing proportion of people affected in younger age groups, also coexisting with other health problems such as infectious diseases (4).

There are three main types of diabetes mellitus: type 1 diabetes mellitus (DMI), type 2 diabetes mellitus (DMII), and gestational diabetes mellitus (DMG).

DMII accounts for approximately 90% of all diabetes cases. The increasing trend can be attributed to the aging of the global human population and/or a rapid increase in urbanization. The treatment of DMII involves the change of the patient's lifestyle, particularly in their diet. Only

with careful and specific diet care can this pathology be controlled (5).

According to Silva-Matos and Beran (6), Mozambique is one of the poorest countries in the world. Currently, untreated diseases are responsible for 28% of deaths in Mozambique. Risk factors such as tobacco use, alcohol consumption, and poor diet are present in both urban and rural environments. Diseases such as hypertension and diabetes affect large proportions of the population, but people are often unaware of their condition or cannot conveniently manage it. Data from studies on diabetes conducted by Borde *et al.* (7) highlight financial difficulties in managing untreated diseases in Mozambique, both for the individual and for the health system.

According to Silva-Matos *et al.* (8), the prevalence of diabetes in the Mozambique population aged 25–64 years of age is 3.8%. This means there are a total of 271,088 people with type 2 diabetes in Mozambique. The same author found that the prevalence of overweight individuals is 30.1%, with 10.2% in rural areas. Obesity rates and the lifestyle of DM patients were identified as one of the main risk factors for type 2 diabetes.

This work is a case study focused on DMII patients who attend the Provincial Hospital of Pemba in Cabo Delgado (Mozambique). The study is descriptive and explanatory as it seeks to analyze and describe difficulties in the field of food consumption among DM patients. The main objectives focused on (i) assessing the difficulties that patients with diabetes face in composing their dietary patterns and (ii) evaluating the level of awareness and adherence to treatment regarding diabetes mellitus.

Methodology

This study was authorized by Pemba's Hospital Management and the Ethics Committee of the Provincial Hospital of Pemba.

The study took place at the provincial hospital of Pemba, and the analysis period considered was January to September 2022.

The Provincial Hospital of Pemba serves various DM patients from different neighborhoods in the city and surrounding areas, such as places and villages. Overall, a total of 90 patients were considered during the study period and at the time of the surveys. The sampling focused on a subgroup of the target population based on information provided by Pemba Hospital, such as patients attended daily and hours of service. The number of patients included in the study was influenced by two main factors: the willingness of the patients to participate in the study and the time available for a relatively lengthy interview, as many of the people treated at the hospital must travel from relatively distant locations, with access routes not always being easy.

The study involved individuals between 20 and 59 years of age (adults) and individuals aged 60 or more (elderly) of both sexes and residents in the city with a confirmed diagnosis of diabetes mellitus and in conditions to answer the questions. We adopted a food frequency questionnaire as well as questions related to the patients' daily lives. The questionnaire was presented to individuals to assess the characteristics of the interviewees and their households. Aspects related to variables such as gender, education, occupation, age, and household income, among others, were also addressed. Descriptive statistics and variable frequencies were calculated. These results were recorded in the form of tables to identify the variables related to the dependent variable of social class. Three groups/classes were used: low class, middle class, and high class, according to Silva (9). Considering the data collected, it was found that the study only encompasses two social classes: the low class and the middle class.

Results and Discussion

Sample Characterization

The 28 patients that responded to the questionnaire were all from the urban area. **Table 1** presents the sample description, showing that 53.6% of the patients were male and 46.4% were female. They were divided into two age categories, with 64.3% aged between 27 and 59 years (adults) and 35.7% aged 60 or more (elderly). The educational level of the patients varied between basic, secondary, and higher education, although there was a percentage without any schooling. It was observed that 21.4% and 35.7% had basic and secondary education, respectively, 25.0% had higher education (between bachelor's and master's degrees), and 17.9% had not attended school.

Regarding the professional situation, it was found that 25.0% were unemployed, 53.6% were employed, one patient was self-employed, and 17.9% were retired (**Table 2**). As noted, 75% of the respondents had an income enough

TABLE 1 | Characterization of the study sample.

Variable		Frequency	%
Gender	Male	15	53.6
	Female	13	46.4
Age	Adult (27–59 years of age)	18	64.3
	Elderly (60 or more years of age)	10	35.7
Educational level	Basic education	6	21.4
	Secondary education	10	35.7
	Higher education	7	25.0
	No schooling	5	17.9

for their survival. Patients in the “unemployed” category reported living on social support from family or friends.

Regarding the food situation, **Table 3** shows the situation of the respondents, considering that access to food is a determinant factor in the quality of life, crucial in the treatment of diabetes mellitus, and not equal for everyone. Respondents who answered “yes” to the question “Do you have an easy access to food?” were considered to have easy access to food and accounted for 17.9%, while those who answered “no” were considered to have difficult access to food and accounted for 42.9%. However, 39.3% said they had some difficulties in obtaining food (“somewhat” in **Table 3**). This discrepancy reflects the purchasing capability of patients that attend the Provincial Hospital of Pemba.

Contingency tables, or cross tables, describe two or more classes of variables simultaneously, relating their frequency. In the present study, contingency tables were used to analyze the relationship between predefined independent variables.

Table 4 relates the gender of the surveyed patients to their social class. It shows that 47.8% of men and 52.2% of women belong to the low social class and that in the middle social class men (80%) prevail over women (20%). This situation is explained by the social inequalities and differences in opportunities between men and women in Mozambique, which has a challenging social and economic context, with significant inequalities between men and women. Social inequalities between genders are evident in various fields, such as education, employment, and political representation, but also in health. According to the World Bank (10), women’s literacy rates in Mozambique are significantly lower than men’s, as are employment opportunities (11) and access to health services (12). These gender inequalities in Mozambique reflect structural and cultural challenges that require consistent public policies and efforts from the society to promote gender equality.

TABLE 2 | Characterization of the professional situation.

	Frequency	%	Cumulative percentage (%)
Unemployed	7	25.0	25.0
Employed	15	53.6	78.6
Self-employed	1	3.6	82.1
Retired	5	17.9	100
Total	28	100	

TABLE 3 | Easy access to food.

Answers	Frequency	%
Yes	5	17.9
No	12	42.9
Somewhat	11	39.3
Total	28	100

Regarding the ability to meet the basic needs of life *versus* the educational level, it is found that the inability to meet basic food needs is recorded at all levels of education, but with greater predominance in those with a middle level, which may seem incongruent. This means that even respondents with a higher level of education have difficulties in maintaining a quality of life that can be considered acceptable, although belonging to the middle social class. However, it is noted that within the low social class there are also patients with higher education alongside people with basic education and no schooling (**Table 5**). In relation to the variable middle social class, patients with higher education are represented in a higher percentage (60%), followed by patients with basic and middle education (both with 20%).

This aspect is important since it shows that the effort and investment in acquiring higher education do not guarantee access to the most essential good in life: food.

Relating the social class with the professional situation of the respondents, we found that most of them consider themselves as being of low social class, in terms of the cost of living and employability conditions, with 7 patients (30.4%) being unemployed and 13 (56.5%) employed. One person was self-employed, and 2 were retired.

This illustrates the problem of food access faced by most respondents compared to a total of only 5 persons that claimed to belong to the middle social class for their current professional situation (**Table 6**).

The largest number of patients from the low social class (43.5%) have difficulties in accessing food. 39.1% live in uncertainty about daily food acquisition, and only 17.4% of patients have easy access to food. In addition, in the middle social class, only 1 person has easy access to food, 40% report having difficult access, and the other 40% state having many difficulties in obtaining food. In general, one may say that the respondents (42.9%) categorically reported not having easy access to food. This situation is illustrated in **Figure 1**.

The results reported here show that all patients included in the study have economic difficulties, which certainly hinders the success of DMII treatment.

Regarding the sources of economic income and social factors affecting these patients, it became clear that most participants rely on their salaries as their source of income.

TABLE 4 | Evaluation of social class versus patient gender.

	Social class		Patient gender		Total
			Male	Female	
	Low	Frequency	11	12	23
		%	47.8	52.2	100
	Medium	Frequency	4	1	5
		%	80.0	20.0	100
Total		Frequency	15	13	28
		%	53.6	46.4	100

TABLE 5 | Patient's social class versus educational level.

			Educational level				Total
			Basic	Secondary	Higher	No schooling	
Patient's social class	Low	No. of patients	5	9	4	5	23
		% in social class	21.7%	39.1%	17.4%	21.7%	100%
	Medium	No. of patients	1	1	3	0	5
		% in social class	20.0%	20.0%	60.0%	0.0%	100%
Total		No. of patients	6	10	7	5	28
		% in social class	21.4%	35.7%	25.0%	17.9%	100%

TABLE 6 | Social class versus professional situation.

			Professional situation				Total
			Unemployed	Employed	Self-employed	Retired	
Patient's social class	Low	No. of patients	7	13	1	2	23
		% in social class	30.4%	56.5%	4.3%	8.7%	100%
	Medium	No. of patients	0	2	0	3	5
		% in social class	0.0%	40.0%	0.0%	60.0%	100%
Total		No. of patients	7	15	1	5	28
		% in social class	21.4%	35.7%	25.0%	17.9%	100%

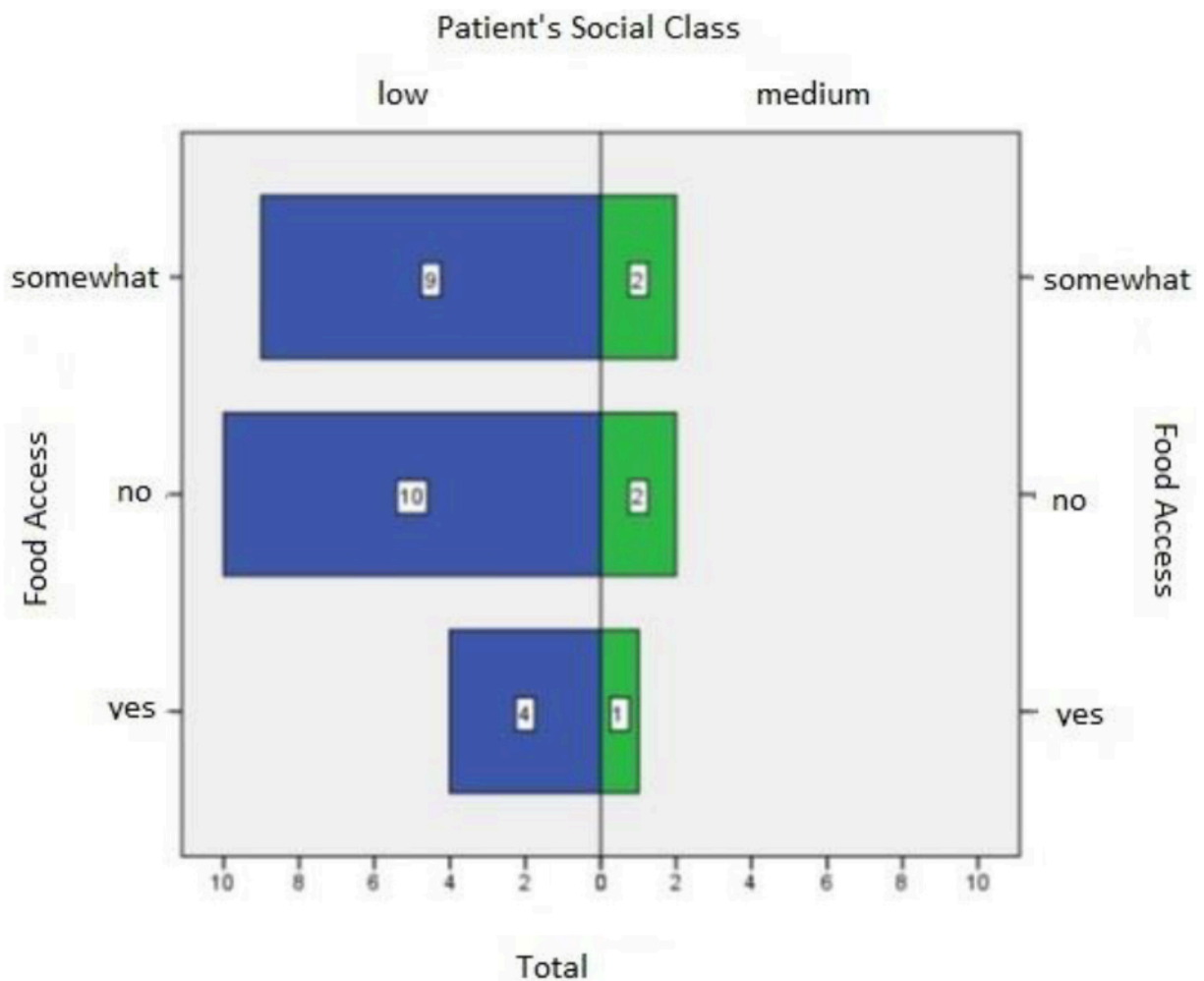


FIGURE 1 | Relationship between social class and easiness in obtaining food.

Even stipendiary patients cannot meet their dietary needs owing to the low wage levels in Mozambique, combined with the high cost of living. These results support those of Saeedi *et al.* (2), who found a situation of low income among diabetics, as well as the study by Shaikh *et al.* (13), which reported that diabetes mellitus is a global health problem, even more so in countries with poor resources that also have low to middle incomes. Even worse is the fact that the patients included in this study exhibit what Crespo and Gurovitz (14) consider to be absolute poverty as opposed to relative poverty.

Many of the factors discussed here are, theoretically, inversely related to poverty and diabetes complications. Education, occupation, economic income, and gender differences all have a link between poverty and diabetes. For patients with lower economic income, there is a higher incidence of diabetes. This occurs not only in resource-poor countries but also in more affluent ones, as shown by Bhojani *et al.* (15), which found the occurrence of these factors in developed countries. The indicators of this study, despite dealing with a smaller sample, are consistent with the social determinants found by Raphael *et al.* (16), confirming that poverty is a fundamental factor for the development and progression of type II diabetes, as well as its incidence and prevalence, since individuals with lower income and lower education are between 2 and 4 times more likely to develop diabetes than more affluent individuals.

In this study, we found that the participants were all from the urban area, that is, from the neighborhoods of the city of Pemba; they had lower purchasing capabilities owing to their low income regardless of their education level or academic degree. Most reported facing food difficulties, which contributes to the noncompliance of medical dietary recommendations. It is noteworthy that the interviews revealed a high level of awareness among patients regarding health care, although with less concern about the recommended diet for diabetes, especially for patients with a recent history of the condition. These results contrast with those of Silva-Matos *et al.* (8), who mentioned a low awareness of diabetes in general, with most patients not being treated pharmacologically.

We also found an asymmetry regarding the age of the patients, with a peak in diabetes observed between the ages of 50 and 60. This age distribution asymmetry in urban patients was also reported in another study conducted in Guinea by Baldé *et al.* (17), where the peak of diabetes was in the age range of 45–54. For the present study, the differences between age groups were somewhat unexpected but may be explained by differences in body mass composition and fat distribution, possibly as a result of different dietary consumption patterns.

It was also found that the level of education did not significantly influence the social class of patients, as it was observed that people with higher education had a low social class, with only 3 belonging to the middle social class.

Cabo Delgado follows the global trend of an increasing diabetes incidence. However, when interviewing nine health

professionals affiliated with the Provincial Hospital of Pemba, Cabo Delgado, to better understand the reality of the patients and the dimension of the problem, it was found that, in their opinion, the patients included in this study strictly follow the guidelines given to them, with most attending medical appointments every three months. Regarding the possible reasons for the increase in diabetes cases in the neighborhoods of Cabo Delgado, they suspect that dietary habits are the main cause for the increase in the number of diabetes patients, along with other causes such as hereditary factors, the increase in the number of displaced people due to war, or simply the increase in the number of inhabitants. It should be noted that these doctors and nurses have an average of eight years of experience in treating people with DM, so their opinion may be considered as based on experience.

Education still is a major determinant in improving living conditions, as literacy and health literacy increase a person's ability to understand, use, and access health information and services. Grundlingh *et al.* (1) observed a lower probability of being pre-diabetic and diabetic in populations with a high level of education in adulthood compared to people with low levels of education. The results of this case study only proved the existence of high awareness regarding health care, most likely influenced by the good literacy level of the participants.

As education, employment provides important benefits for individuals' health, social, and emotional well-being. Unemployment has a negative impact on mental health and on the rates of chronic diseases such as diabetes. Not only does this situation negatively affect health, as poverty may also affect employment, causing individuals to enter a cycle that is difficult to escape. Adults need to be physically and mentally healthy to work. Adults with physical or mental health problems are more likely to perform poorly at work, have more sick leaves, have longer periods of unemployment, and have a lower probability of reemployment. In the present work, it was found that 25% of the participants were "unemployed," which redirects health problems to the socioeconomic problems of the country, although most participants (even the employed) mentioned difficulties in obtaining food.

Conclusion

Effective prevention of diabetes risk factors in patients with low socioeconomic status and education levels requires early implementation, as these are the most vulnerable individuals.

In the present study, it was found that people with low income and type II diabetes face greater financial difficulties in acquiring the recommended foods for a healthy diet. It was also found, from comments of the respondents, that their physical, social, and economic conditions provide them with few opportunities to implement behaviors aimed at improving their health condition and changing eating habits,

despite the high awareness demonstrated about diabetes and health problems related to the condition.

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