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Socio-Demographic, Clinical Characteristics and Blood Lipid profiles of Type 1 Diabetic Patients Followed in Regional Hospitals in The Northern Zone of Cameroon

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Abstract

Background and Objective: In Cameroon, given the galloping growth in the prevalence of diabetes, in particular type 1 diabetes in the northern regions, we undertook this study, with the objective to improve the management of type 1 diabetes by determining the socio-demographic, clinical characteristics and lipid profiles of the patients followed in the care centers of regional hospitals of Maroua, Garoua and Ngaoundere.

Methods: We undertook a descriptive cross-sectional study from 07 August 2018 to 07 May 2019 in the care centers of the regional hospitals. Sociodemographic and clinical data were collected by interview to consent patient through structured questionnaires in the survey sheet. Anthropometric data were also determined during the survey, and the blood was collected in referred laboratory for determination of some lipid profiles parameters.

Results: On a sample of 467 Patient suffering from diabetes, 68 were of type 1, representing a prevalence of 26%. Type 1 diabetes Patients were mostly female (61.8%) and the mean age was 20.72 ± 3.4 years with a high percentage between 20-30 years (51.5%). More than half of our patients were pupils and students, many of them practiced Muslims as religion (58.8%). In most of cases (51.3%), the disease was diagnosed after one year as a result of illness. The majority of our patients were non-smokers (98.5%) and less athletic (32.4%). The mean Body Mass Index (BMI) was 23.03 ± 2.7 kg /m^2 with an average waist circumference of 80.26 ± 9.23 cm in men and 82.15 ± 10.45 in women. Their treatment was based essentially on insulin therapy, mainly using regular and intermediate insulins. More than half of the subjects had high blood glucose (78.1%), high triglyceride (34.1%) and HDL-cholesterol (29.3%) levels. Most of the patients suffered from overweight/obesity, high blood pressure, arthritis, kidney failure and other diseases (malaria, jaundice, stomach ache). No significant relation was found between clinical and the sociodemographic and blood lipid profiles.

Conclusion: It emerges from this study that type 1 diabetes represent high proportions of diabetes cases in septentrional area of Cameroon, and affect mostly young of less than 30 years old, dominated by women, practicing Muslim as religion. Their clinical profile characterized by high frequency of overweight/obesity, kidney failure and arthritis vary, but not significantly, with neither their sociodemographic nor their blood lipid profiles. Absence of sport, female and less control of their hypoglycemia are factors risks of the progression of the disease.

Keywords: Type 1 Diabetes, Clinical and Lipid Profiles Features, Septentrion Regions of Cameroon

Introduction

Type 1 diabetes is one of the most common chronic diseases in childhood and it represents 5-10% of diabetes cases with a frequency up 3.4% per year [1] whose consequences are dramatic on the sanitary and socio-economic plan of the poorest countries [2]. Its prevalence has been less well studied, and varies by country. The first two published work in Nigeria and Sudan had reported prevalence of 3.3% and 9.5%, respectively [3,4]. Other prevalence ranging from 0.3% to 3.5%, were subsequently published in Tanzania, Mozambique, Zambia, Ethiopia, Mauritius and South Africa [5]. The low prevalence of type 1 diabetes has been explained by a premature over-mortality of the patients and its juvenile characteristic and symptoms which make the disease discovered before the age of 35 [6]. Indeed, studies conducted in Mali and Tanzania, between 1990 and 1998, report mortality rates between 40 and 50% after 8 years of follow-up [7,8]. In addition, the investigation of Beran et al. [9] showed that the cost of care for type 1 diabetic patients (consultations, diagnosis, drugs, care) in Mali and Mozambique represented 63% and 75% of income per person. Because of the diagnostics delay due to quality of treatments and poverty of the population in sub-Saharan areas, it is generally observed diagnostic delays, hence complications [10, 11]. In this respect, cardiovascular complications have been reported as the first cause of mortality related to diabetes [12]. In addition, retinopathy and nephropathy were reported in many cases during diagnosis of diabetes, and the frequency varied with delay in diagnosis [13]. In addition, studies have shown that certain social conditions also have an impact on the rate of diabetes in a population. Thus, according to the IDF in 2007 [40], diabetes is more common in older populations in general and less educated, in developing countries. It is this sense that Ouedraogo in 2002 [39] in this research in Mali had noted on the one hand a progressive increase in the frequency of diabetes with age, with a maximum between 40 and 60 years, and on the other except that only 30.4% of subjects were out of school. In order to avoid complications, it become urgent to identify factors that affect delay in diagnostic, the social conditions and what are sociodemographic factors and blood **lipid profiles** profiles associated with complications in patients with type 1 diabetes. Some profiles of patients with Type 1 diabetes have been investigated around the world. In view of the delay in the diagnosis leading to complications, diabetes constitutes a real public health problem in Africa and more particularly in our country Cameroon because of its morbidity and mortality and the cost of its care and therefore becomes a challenge to raise for the patient and all his family. Indeed, in Cameroon, some studies have looked at its clinical and lipid aspects as well as the association between the latter and complications in type 2 diabetics in the city of Yaoundé [14]. At the limit of our knowledge, studies carried out so far on type 1 diabetes are rather rare in the world, and particularly no data exist in the septentrional zone of Cameroon. The importance and interest in carrying out the research is to identify the social characteristics of population which may benefit for particular care, to develop strategies to limit complication/the disease and to improve treatment of the patients.

The study was undertaking with aim to evaluate the socio-demographic, clinical and some blood **lipid profiles** characteristics of patients with type 1 diabetics followed in the regional hospitals of the septentrional area of Cameroon.

Materials And Methods

Type, Period and Places of Study

It was a descriptive cross-cutting carried out from August 07, 2018 to May 07, 2019 in Regional Hospital Care Centers (town of Maroua, Garoua and Ngaoundere) in the septentrional zone of Cameroon.

Criteria for Recruiting Patients

This study concerned diabetics followed in the said care centers, recruited continuously, respecting the criteria of inclusion (being diabetic patients followed at the center of care of the hospitals and present at the time of the investigation, having given free and informed consent) and the exclusion criteria (hospitalized diabetics). All subjects surveyed have granted their informed consent and have been ensured confidentiality and anonymous data processing. The various information on the socio-economic, clinical/therapeutic characteristics of the subjects were collected using an individual inquiry sheet by interview. In particular information related to patient disease, anthropometric parameters, clinical and lipid parameters of the patient were taken. Anthropometric data were determined during the investigation after the patient's consent. In this respect, the weight was measured in kg using a mechanical scale (method described by Estryn *et al.* (1976) with a une balance of brand CAMRY). The waist trick was measured in centimeter (cm) using a ribbon meter after normal expiration. The body mass index (BMI) was determined from weight and height measurements according to the formula:

$$BMI = \frac{\text{Weight (kg)}}{\text{Size}^2(\text{m}^2)}$$

Determination Lipid Profiles and Clinical Parameters

Clinical data (arterial hypertension) and **lipid profiles** parameters were determined according to conventional methods and used in the laboratory of regional hospitals in the north.

Determination of Clinical Parameters

Arterial Hypertension : In fact, the measurement of arterial pressure is carried out in a standardized way according to the auscultatory method described by Korotkoff (1905). The OMRON brand automatic digital blood pressure monitor (Digital Automatic Blood Pressure Monitor DABPM, Model M3) was used for the measurement.

Determination of Fasting Blood Sugar

We used the brand ACUC-CHEK Active Meter, Model GB to determine fasting capillary blood glucose in the fasting diabetic patient of at least 8 hours of time. We selected one of their indexes and using a lancet we pricked at the level of the interdigital face, by light pressure, the first drop of capillary blood is cleaned and the second collected is applied to the tip of the strip previously inserted into the meter. Finally, read the fasting blood sugar on the screen of the glucose meter in mg / dl.

Determination of Lipid Parameters

Collection of samples. The blood sample is taken on an empty stomach for at least 12 hours. A tourniquet is placed around the forearm to protrude the vein, then the skin is cleaned with a cotton ball dipped in alcohol before pricking with a sterile syringe. The collected blood is put in dry tubes and left at laboratory temperature until a clot forms. After detachment, the coagulated blood is centrifuged at 3000 rpm for 15 minutes. The serum is then collected and stored in the eppendorf tube at room temperature 25 ° C for the various assays.

Determination of Total Cholesterol

Total cholesterol was determined by the enzymatic method described by Naito (1984) using kits from the SGM italia laboratory.

Determination of HDL-Cholesterol

HDL cholesterol was determined by the enzymatic method described by Rifai et al in 1999 using kits from the Dutch Diagnostics laborator.

Dosage of Triglycerides

The triglycerides were determined according to the enzymatic method described by Kaplan and Naito (1984) using kits from the Indian RANDOX laboratory.

Determination of LDL-Cholesterol

The concentration of LDL cholesterol is calculated from the concentration of total cholesterol, the concentration of HDL cholesterol and the concentration of triglycerides according to the following formula of Friedewald et al. In 1972:

$$\text{Cholesterol LDL} = \text{cholesterol total} - \text{cholesterol HDL} - \frac{Triglyceride}{5}\ (mg/dL)$$

Classification of Clinical and Biochemical Variables

BMI: According to WHO criteria, any patient with BMI ranged 25-29.9 kg / m^2 was considered overweight and patients with BMI>30 kg/m^2 was obese. Any patient having a size of size greater than 102 cm in man and 88 cm in the woman was considered obese. Any patient having an arterial tension ≥ 130/85 mm hg was considered hypertensive. For the biochemical parameters, the normal conditions were as followed: total cholesterol <200 mg/dl, HDL-c > 40 mg/dl for man and > 50 mg/dl for women, LDL-c <130 mg/dl or <100 mg/dl, triglycerides 150 mg/dl, glucose ranged 80 - 126 mg/dl. The other blood conditions were considered either hypo or hyper.

Ethical Considerations

Our study took place in respect of good medical practice. The free and informed consent of the diabetic patient was acquired before each participation in the investigation. We obtained the authorization of some authorities: Head of Department of Biological Sciences of the University of Ngaoundere, the Regional Public Health Delegates and the Directors of the hospitals of the three town under study. Anonymity numbers were used to ensure the confidentiality of each patient. Respect for the confidentiality of patients was de rigueur and no judgment was focused on the patient's behavior on our part. The possible withdrawal of the investigation was to no harm confidentiality. Only officers (doctors) and the Research Officer had access to individual data. In any case, the individual results of the participants were not communicated to other people. The research data were retained by the research officer until the end of the project. The objectives and methodology have been explained to patients. They were informed of the dissemination of results after the investigation.

Gathering Analysis and Statistics

The collected data were plotted on an individual survey form. These data were entered and processed using the software Sphinx Survey software - Edition Lexica-V5. Variables were expressed either as mean ±standard deviation or frequency. Cross tabulation between clinical variables and others were computed to check the link between them using the chi squared test, and the limit α for significance was fixed at 0.05. The Graph Pad Prism 5 software with the significance $p < 0.05$.

Results

Sociodemographic and Clinical Profile of the Patients

The sociodemographic profile of the patients is presented in table 1. The sex ratio of our sample population was 0.62 in favor of women who were the most represented. The patient with age 20-30 were the most represented followed by the age class 30-40 with frequencies of 51.5% and 22.1%, respectively. All the patients resided in the city (98.5%) and most of them studied at secondary (52.9%) while very few (4.4%) were illiterate. The patients were at 28% pupils/students, 17.7% were housewives while farmers and breeders were less represented (2.9% each). Muslim was the most practiced religion with a frequency of 58.8% while Christian religion represented only 33.8%.

Variables	Modalities	Number	Frequency (%)
Gender	Male	26	38,2
	Female	42	61,8
Living area	In town	67	98,5
	Out of town	1	1,5
Groups Ages (year)	<20	12	17,7
	20-30	35	51,5
	30-40	15	22,1
	40-50	5	8,4
level of education	Illiterate	3	4,4
	Primary	18	26,5
	Secondary	36	52,9
	Superior	11	16,2
Profession	Farmer	2	2,9
	Student	19	28
	Trader	8	11,8
	Housewife	12	17,7
	Breeder	2	2,9
	official	11	16,2
	Sector informal	14	20,6
Type of religions	christian	23	33,8
	muslim	40	58,8
	Others religions	5	7,4
Total		**68**	**100**

Table 1: Some Sociodemographic profile of patients suffering from Type 1 Diabetics

In Table 2 is resumed the clinical profile of the patients. Most of the patients (51.5%) had symptoms of illness between 1-5 years before being diagnose suffering for diabetes, while few of them (11.8%) had reach the hospital 5 years after the signs of sickness. As a result, 60.3% of our patients discovered their diabetes following an illness or accidentally, while 39.7% discovered during routine visit. Many of them had (23.7%) reported having a family history of diabetes. Many patients were not hypertensive (90.9%), do not practice sport (67.6%), and almost all of them do not smoke (98.5%). The most widely prescribed drugs for the treatment of type 1 diabetes were mostly insulin (35.3%) and actrapid (27.4%). In our sample population, herbs were poorly used by patients with type 1 diabetes (5.1%). Generally, the patients reported fewer side effects of their drugs with rate of 79.4.

Complications including hypertension, arthritis, obesity and kidney failure were reported in few cases, at rate of 14.3%, 11.9%, 4.8% and 2.4%, respectively. However other diseases including malaria, jaundice, and stomach ache were highly 66.6% rate.

Variables	Modalities	Number	Frequency (%)
Period for diagnoses	<1 years	25	36,8
	1-5 years	35	51,5
	> 5 years	8	11,8
Discovery of the disease	Routine visit	27	39,7
	Following illness	41	60,3
Family history	Present	16	23,5
	Absent	52	76,5
Hypertension	Hypertensive	5	9,1
	No hypertensive	50	90,9
Practice of sport	yes	22	32,4
	No	46	67,6
Smoker tobacco	Smoking	1	1,5
	No smoking	67	98,5
Medicines prescribed	Metformine	12	11,7
	Actrapide	19	27,4
	Insuline	24	35,3
	Muxtard	16	20,5
	Plante	4	5,1
Side effects of drugs	With effects	13	20,6
	No effects	50	79,4
Diseases associated with type 1 diabetes	High blood pressure Obesity	6 2	14,3 4,8
	Arthritis	5	11,9
	Renal failure	1	2,4
	Other Diseases	28	66,6

Table 2: Clinical Characteristics of Diabetics Type 1 Follow-up in the Septentrion Regional Hospitals

The patients claim facing many symptoms presented in Figure 1. The most important symptoms in patients were polyuria (95.5%), polydipsia (90.5%), weight loss (71.4%) and polyphagia (64.6%). Many other symptoms were observed, but relatively weakly represented and this included vision confusion, muscle pain, asthenia, headache, fever.

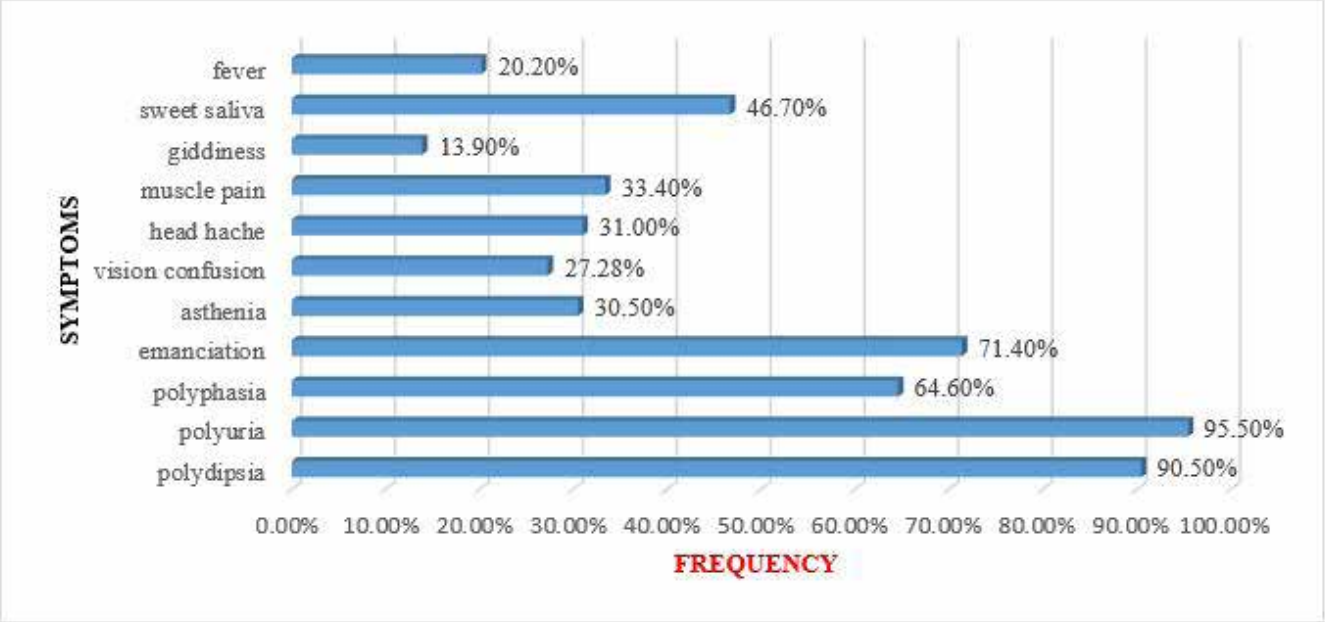

Figure 1: Distribution of Symptoms reported on patient's type 1 diabetics

Anthropometric And Blood Lipid Profile of Type 1 Diabetics

The average weight of patients was 67.3 ± 12.9 kg, with 78.1% having weight > 60kg. Mean Waist circumference was 80.3 ± 9.2 cm for men and 82.2 ± 10.5 cm for women. BMI revealed 26.8% overweight, 7.3% obesity and 65.9% normal.

Variables	Modalities	Number	Frequency (%)	Mean
Average Weight (kg)				67,3±12,90
weight (kg)	<40	1	2,4	
	40-50	3	7,3	
	50-60	5	12,2	
	>60	32	78,1	
BMI (kg / m2)	<25	25	65,9	
	25-30	11	26,8	
	>30	3	7,3	
Waist circumference mean (cm)	Masculin			80,3 ± 9,2
	Féminin			82,2 ± 10,5

Table 3: Anthropometric profile of type 1 diabetics

Variables	Modalities	Number	Frequency (%)
Total Cholesterol (mg/dl)	<200	27	67.5
	≥200	13	32.5
HDL-cholesterol (mg/dl)	< 40	29	70.7
	> 40	12	29.3
LDL-Cholesterol (mg/dl)	<130	28	68.3
	≥130	13	31.7
Triglycerides (mg/dl)	<150	27	65.9
	≥150	14	34.1
Blood Glucose (mg/dl)	<80	0.00	0.00
	80-126	09	21.9
	>126	32	78.1

Table 4: Distribution of some blood biochemical profile of Type 1 Diabetics patients

The **lipid profile** of patients is presented in table 3. According to this table, more than half, 67.5%, of our patients had normal level of total cholesterol. Similar distributions for normal blood LDL and triglyceride levels were observed in patients with respective frequencies of 68.3 and 65.9. Reverse distribution was observed for HDL cholesterol from which 70,7% had abnormal or lower blood levels. This tendency was similar to glycaemia with hyperglycemia representing 78.1% cases.

Variables	Modalities	Overweight / obesity			Arterial hypertension			Renal failure		
		(%)	RR(IC)	P.value	(%)	RR(IC)	P.value	(%)	RR(IC)	P.value
Gender	Male	48,2	1		33,3	1		80	1,200 (0,079-18,00)	0,7028
	Female	51,7	1,022(0,5657-1,845)	ns	66,7	1,556(0,3143-7,698)	0,4626	20	1	
Residence	In town	90	1,652(0,2650-10,30)	0,4895	83,3	3,067(0,5059-18,59)	0,3302	100		
	Out of town	9,1	1		16,7	1		0,00		
Groups Ages (year)	<20	20	1		0,00			0,00		
	20-30	65,4	1,625(0,4145-6,370)	0,3742	16,7	1		0,00		
	30-40	10,1	2,955(0,7069-12,35)	0,1224	16,7	2,400(0,2950-19,53)	0,3691	50	1	
	40-50	3,6	2,167(0,2799-16,77)	0,4893	66,7	5,000(0,4188-59,69)	0,3137	50	7,333 (0,6043-89,00)	0,2300
Level of education	Illiterate	7,27	2,786(0,5998-12,94)	ns	16,7	2,400(0,1839-31,21)	0,5147	21,7	8,000 (0,8619-74,26	0,0936
	Primary	25,4	1,950(0,4619-8,233)	0,2994	16,7	2,400(0,1839-31,21)	0,5147	49,5	7,000 (0,8619-74,26)	0,0936
	Secondary	47,2	1,529(0,3727-6,276)	0,4305	50	1,385(0,1600-11,98)	0,6252	21,7	4,800 (0,3567-64,60)	0,3202
	Superior	20,0	1		16,7	1		7,1	1	
Profession	Students	23,5	1		0,00			0,00		
	Trader	11,7	5,667(0,7197-44,61)	0,0775	0,00			22,26	1,400(0,1122-17,46)	0,6818
	House wife	19,1	6,476(0,8955-46,84)	0,0230*	33,3	1,167(0,2288-5,949)	0,6573	0,00		
	Breeder	4,41	5,667(0,4718-68,07)	0,2842	16,7	1,157(0,1605-8,481)	0,7083	0,00		
	Farmer	0,00			0,00			0,00		
	Official	19,1	5,368(0,7165-40,22	0,0613	16,7	0,8750(0,112-6,884)	07212	0,00		
	Sector informal	17,6	3,400(0,3942-29,32)	0,2531	33,3	1		77,74	1	
Types of Religions	Muslim	51,4	1		50	2,133(0,2724-16,71)	0,4555	66,7	3,000(0,2060-43,69)	0,4423
	Christian	32,3	0,9231(0,2990-2,850)	0,5855	33,3	1		33,3	1	
	Other religions	16,2	0,9220(0,3179-3,910)	0,6424	16,7	1,939(0,3712-10,13)	0,3799	0,00		0,00

Degree of significance: * (p<0.05), ** (p<0.005), *** (p<0.0005); RR: relative risk; CI: confidence interval; %: percentage

Table 5: Association of socio-demographic profile with deseases associated type 1 diabetes patients followed in regional hospital north (Maroua, Garoua and Ngaoundere) Cameroun

Variables	Modalities	Taste			Other diseases		
		(%)	RR(IC)	P.value	(%)	RR(IC)	P.value
Gender	Male	60	1,212(0,2225-6,597)	ns	35	1	
	Female	40	1		65	1,121(0,6320-1,989)	0,4414
Residence	In town	100			83,3	1,232(0,2992-5,074)	0,6535
	Out of town	0,00			17,7	1	
Groups Ages (year)	<20	0,00			28,6	1,038(0,4481-2,406)	0,6190
	20-30	0,00			9,6	1	
	30-40	80	1		26,2	0,7734(0,3229-1,853)	0,4280
	40-50	20	2,083(0,3323-13,06)	0,4594	2,4	0,7500(0,1291-4,357)	0,6364
Level of education	Illiterate	20	1		7,1	1	
	Primary	20	2,500(0,2768-22,58)	0,4335	7,1	1,286(0,3111-5,313)	ns
	Secondary	40	2,500(0,2768-22,58)	0,4335	21,4	1,059(0,2879-3,894)	0,6662
	Superior	20	1,042(0,1044-10,39)	0,7040	64,3	1,317(0,4033-4,302)	0,4885
Profession	Students	0,00			53,6	2,172(0,6044(7,808)	0,1600
	Trader	25	1,200(0,0979-14,70)	0,7273	7,1	1,500(0,2835-7,937)	0,5385
	Housewife	25	1		10,7	1,688(0,3709-7,677)	0,4367
	Breeder	0,00			3,6	1,500(0,2001-11,24)	0,6182
	Farmer	0,00			7,1	2,250(0,4695-10,78)	0,3538
	Official	50	1,33(0,1526-11,65)		7,1	1	
	Sector informal	0,00			10,7	1,125(0,2028-6,242)	0,6647
Types of religions	Muslim	40	1,650(0,2279-11,95)	0,5272	71,4	1	
	Christian	60	1		21,4	1,224(0,3759-3,989)	0,5444
	Other religions	00			7,1	1,200(0,3302-4,362)	0,5903

Degree of significance: * (p<0.05), ** (p<0.005), *** (p<0.0005); RR: relative risk; CI: confidence interval; %: percentage

Table 5: Association of socio-demographic profile with deseases associated type 1 diabetes patients followed in regional hospital north (Maroua, Garoua and Ngaoundere) Cameroun

The analysis of Table 5 shows, on the one hand, that there is a association between the variables studied and certain diseases from which type 1 diabetics suffer; and on the other hand that the degree of relative risk depends on the disease from which the diabetic patient suffers. Indeed, according to this table, the relative risk was higher in overweight / obese women 1.022 (0.5657-1.845), hypertensive 1.556 (0.3143-7.698) and suffering from other diseases 1.121 (0.6320-1.989). In men, this risk was more present in patients with renal failure (80%) and gout (60%). It also follows from this table that, the relative risk was higher in patients living in urban areas 1.652 (0.2650-10.30), 3.067 (0.5059-18.59) and 1.232 (0.2992-5.074) respectively for those overweight / obese, suffering from hypertension, renal failure, taste and other diseases (stomach ache, jaundice, typhoid, etc.), than those living in rural areas where the risks were low. Patients aged between 30-40 years had greater relative risk in those overweight / obese 2.955 (0.7069-12.35), hypertensive 2.400 (0.2950-19, 53). However, in patients with an age range of 40-50 years, the relative risk was greater in hypertensive 5,000 (0.4188-59.69) and those with insufficient blood pressure renal 7.333 (0.6043-89.00). The level of education of the patients reveals that those who attended up to high school and higher had a lower relative risk unlike the illiterate and those less educated overweight / obese, suffering from hypertension, renal failure, heart failure taste and other diseases with a higher relative risk. Analysis of the different socio-professional groups showed that the relative risk was higher among overweight / obese housewives 6.476 (0.8955-46.84) and shopkeepers 5.667 (0.7197-44.61) compared to other diseases. In Muslim patients, the relative risk was greater in patients with hypertension 2.133 (0.2724-16.71), and those with renal failure 3.000 (0.2060-43.69) than those with renal failure, other religions (51.47%). However, in patients with other illnesses, this risk was significant among Christians 1,224 (0.3759-3.989) and other religious, 1,200 (0.3302-4.362).

Variables	Modalities	Overweight / obesity			Arterial hypertension			Renal failure		
		(%)	RR(IC)	P.value	(%)	RR(IC)	P.value	(%)	RR(IC)	P.value
Period for diagnoses	<1year	40	0,8710 (0,1603-4,733)	0,6618	33,3	1		16,7	1	
	1-5yeras	56,3	0,8864 (0,1678-4,683)	0,6635	50	1,500 (0,1559-14,43)	0,5919	83,3	1,643 (0,1113-24,24)	0,6201
	>5years	3,63	1		16,7	2,250 (0,4218-12,00)	0,3079	0,00		
Family history	Présent	9,1	1		33,3	0,9118 (0,1857-4,477)	0,6441	16,7	1,750 (0,1172-26,13)	0,6004
	Absent	90,9	1,103 (0,3040-3,525)	0,6623	66,7	1		83,3	1	
Smoker tobacco	Smoking	0,00			0,00			0,00		
	No smoking	100			100			100		
Practice of sport	Yes	35	1		25	1		25	1	
	No	65	1,097 (0,2234-5,386)	0,6441	75	3,412 (0,6967-16,71)	0,1236	75	2,000 (0,1348-29,68)	0,5610
Total cholesterol (mg/dl)	<200	69,1	1		75	1		100		
	≥200	30,9	1,795 (0,5766-5,587)	0,2284	25	2,222 (0,2400-20,58)	0,4582	0,00		
LDL-cholesterol (mg/dl)	<130	9,1	1		16,7	0,3589 (0,4483-2,779)	0,4035	16,7	1	
	≥130	90,9	1,222 (0,5499-2,715)	0,4268	83,3	1		83,3	5,333 (0,4453-63,88)	0,2982
HDL-cholesterol \ (mg/dl)	<40	70	1,424 (0,6121-3,312)	0,2844	0,00			0,00		
	>40	30	1		100			100		
Blood glucose (mg/dl)	<80	0,00			0,00			0,00		
	80-125	39	1		16,7	1		0,00		
	>125	61	0,9519 (0,4801-1,888)	0,5740	83,3	2,444(0,2610-22,81)	0,4211	0,00		

Degree of significance: * (p<0.05), ** (p<0.005), *** (p<0.0005); RR: relative risk; CI: confidence interval %: percentage

Table 6 : Association of clinical and biochemical characteristics with diseases associated with type 1 diabetes

1 patients followed in regional hospitals in the north (Maroua, Garoua and Ngaoundéré)

Variables	Modalities	Taste			Other diseases		
		(%)	RR(IC)	P.value	(%)	RR(IC)	P.value
Period for diagnoses	<1year	40	1		28,6	1	
	1-5yeras	60	1,111(0,2089-5,909)	0,6309	50	1,021(0,5161-2,019)	ns
	>5years	0,00			39,3	1,212(0,5436-2,700)	0,4561
Family history	Présent	40	1,176(0,2176-6,362)	0,6034	39,3	1,095(0,6110-1,962)	0,4781
	Absent	60	1		60,7	1	
Smoker tobacco	Smoking	0,00			0,00		
	No smoking	100			100		
Practice of sport	Yes	40	1		25	1	
	No	60	2,719(0,5056-14,62)	0,2329	75	1,250(0,6345-2,463)	0,3479
Total cholesterol (mg/dl)	<200	75	1		58,3	1,050(0,4398-2,507)	ns
	≥200	25	1,455(0,1577-13,41)	0,6244	41,7	1	
LDL-cholesterol (mg/dl)	<130	17,3	0,3589(0,4483-2,779)	0,4035	91,7	1	
	≥130	82,3	1		8,3	1,269(0,2407-6,692)	0,6327
HDL-cholesterol (mg/dl)	<40	0,00			0,00		
	>40	100			100		
Triglycerides (mg/dl)	<150	0,00			0,00		
	≥150	100			100		
Blood glucose (mg/dl)	<80	0,00			0,00		
	80-125	50	1		41,7	1	
	>125	50	1,375(0,1002-18,86)	0,6784	58,3	1,012(0,4204-2,435)	0,6374

significance: * (p<0.05), ** (p<0.005), *** (p<0.0005); RR: relative risk; CI: confidence interval %:pourcentage

Table 6: Association of clinical and biochemical profile with diseases associated type 1 diabetes 1 patients followed in regional hospitals in the north (Maroua, Garoua and Ngaoundéré)

The analysis of Table 6 shows, on the one hand, that there is a association between the variables studied and certain diseases from which type 1 diabetics suffer; and on the other hand that the degree of relative risk depends on the disease from which the diabetic patient suffers. Thus, in patients whose disease duration was greater than 1 year, the relative risk was high and this risk depended on the disease from which the diabetic suffered, especially in those with hypertension 1,500 (0.1559-14.43), renal failure 1.643 (0.1113-24.24) and taste 1.111 (0.2089-5.909). Patients with a family history had a greater relative risk, particularly in those with renal impairment 1.750 (0.1172-26.13) and taste 1.111 (0.2089-5.909). All of the type 1 diabetic patients in our study did not smoke. Most of the patients did not participate in sport, and these patients had a higher relative risk compared to those who participated in physical activity. This risk was particularly observed in hypertensive patients 3,412 (0.6967-16.71), in patients with renal failure 2,000 (0.1348-29.68) of the taste 2.719 (0.5056-14.62), and other diseases 1,250 (0.6345-2.463). As for the biochemical parameters, the relative risk was observed in patients with HDL hypocholesterolemia (<40mg / dl), specifically in those overweight / obese 1.424 (0.6121-3.312); While those with LDL hypercholesterolemia (> 130mg / dl), the risk was observed in overweight / obese patients 1.222 (0.5499-2.715). All the patients suffering from all these different diseases had hypertriglyceridemia (> 150mg / dl). Patients with hyperglycemia (> 125mg / dl) presented a relative risk compared to those with normal blood glucose. This risk was observed in patients suffering from all the different listed diseases and particularly in those hypertensives 2.444 (0.2610-22.81), suffering from gout 1.375 (0.1002-18.86) and other diseases 1.012 (0.4204 -2.435).

Variables	Modalities	Period for diagnoses					
		< 1an			1-5 ans		
		(%)	RR(IC)	pvalue	(%)	RR(IC)	pvalue
Hypertension	No hypertensive	12,5	1		6,7	1	
	Hypertensive	87,5	4,200(1,381-12,77)	0,0016**	93,3	7,724(1,966-30,35)	<0,0001***
Practice of sport	Yes	32	1		34,3	1	
	No	68	1,670(0,8241-7,119)	0,1082	65,7	1,519(0,8601-2,682)	ns
Cholesterol total (mg/dl)	<200	23,1	1		34,6	1	
	≥200	76,9	2,319(0,7553-7,119)	0,1017	65,4	1,537(0,7838-3,016)	ns
LDL-cholesterol (mg/dl)	<130	15,38	1		7,4	1	
	≥130	84,61	3,438(0,8806-13,42)	0,0376*	92,6	6,971(1,777-27,35)	<0,0001***
HDL-cholesterol (mg/dl)	< 40	30,76	1		29,63	1	
	> 40	69,23	1,739(0,6438-4,696)	0,2131	70,37	1,807(0,8978-3,637)	0,0650
Triglycerides (mg/dl)	<150	38,46	1		37,04	1	
	≥150	61,53	1,371(0,5447-3,453)	ns	62,9	1,430(0,7482-2,731)	ns
Blood glucose (mg/dl)	<80	0,00			0,00		
	80-125	46,2	1		48,2	1	
	>125	53,9	1,108(0,4544-2,704)	ns	51,9	1,051(0,5671-1,947)	ns
BMI (kg/m²)	<25	76,9	1		63,0	1	
	25-30	15,4	1,867(0,1894-18,39	0,5268	33,3	7,00(0,9411-52,07)	0,0191*
	>30	7,1	6,087(0,8697-42,60)	0,0203*	3,7	10,82(1,523-76,87)	0,0005***
Symptoms	Vision confusion	2,0	1		0,9	1	
	Polydipsia	24,0	9,763(1,315-72,47)	0,0032**	18,8	18,42(2,252-134,5)	<0,0001***
	Polyuria	26,0	10,40(1,409-76,75)	0,0019**	19,7	19,11(2,622-139,3)	<0,0001***
	Polyphagia	14,0	6,222(0,7935-48,79)	0,0435*	18,0	17,72(2,422-129,6)	<0,0001***
	Asthénia	18,0	7,714(1,013-58,75)	0,0153*	12,0	12,50(1,670-93,50)	0,0007***
	Fever	6,0	2,880(0,3101-26,75)	0,3242	10,3	10,89(1,439-82,41)	0,0023**
	Head hache	4,0	1,959(0,1835-20,91)	0,5078	12,0	12,50(1,670-93,50)	0,0007***

Degree of significance: * (p<0.05), ** (p<0.005), *** (p<0.0005); RR: relative risk; CI: confidence interval % : pourcentage

Table 7: Association of clinical and **lipid profiles** characteristics with Period for diagnoses type 1 diabetes 1 patients followed in regional hospitals in the north (Maroua, Garoua and Ngaoundéré)

The analysis of Table 5 shows, on the one hand, that there is a relationship between the clinical and **lipid profiles** characteristics and the time to diagnosis in type 1 diabetics; and on the other hand that the degree of relative risk depends on the variables studied. Indeed, according to this table, the relative risk was significant in hypertensive patients, more precisely in those whose diagnosis of the disease was made beyond one year 7.724 (1.966-30.35). The finding is the same in diabetics with an LDL-cholesterol level greater than or equal to 130 mg / dl (6.971 (1.777-27.35). The same observation was also made in patients with a BMI greater than 30 kg / m2 (10.82 (1.523-76.87). However, with regard to the symptom variable, note that the relative risk was significant in both cases: in patients whose time of diagnosis was less than one year and beyond one year; And in particular in the case of polyuria, polydipsia, polyphagia.

Discussion

In our study there was a predominancy of female compared to male; in order words, women frequented health centers probably because they are much more sedentary than men. Sedentary lifestyle is a significant risk factor for the onset of diabetes and cardio-vascular events [15]. While similar distribution of frequency of sex in diabetic 1 population were reported elsewhere such as in Mali [16], our results contrasted with others such as that in Madagascar [17] where little difference in frequency was reported amongst sex.

The mean age of our patients was 20.7 ± 3.4 years, then corroborating with many others such as that in Algeria by Farouqi et al. [18] where the mean age was 22.5 ± 8.2 in type 1 diabetics. Based on the left shifted and unimodal (modal class 20-30 years) shape of the distribution frequency of patients with age, it appears that detection of the disease through its symptoms starts before the age of 20, but mainly in between 20-30 years old. The reduction of the frequency of patients from 30 to 60 years, and a null frequency above 60 years suggested the patient die rapidly less than 10 years after they are diagnosed from type 1 diabetes.

In our study, 51.3% of patients were diagnosed with diabetes after one year. Results approaching those obtained by Keita [20] 42.85%. This could be explained by the fact that diabetes is usually discovered late in our patients. This is why 60.3% of our patients discovered their diabetes following another disease or by accident. Also known as juvenile diabetes, type 1 diabetes is diagnosed at early stage of adolescence and lead to dead before the patient reaches 60 years old [19]. This raises the delicacy of this category of diabetes and the urgency to develop systematic educational, physiological, nutritional and clinical approaches to tackle the disease. For instance, patients with an history of diabetes may be aware and educated to manage the disease. Additionally, they must check their glucose status and put into adequate treatment as soon as the disease starts. Several studies have shown that the level of education impacts a practical knowledge of the management of the disease in order to maintain a blood sugar level in the normal range. Fortunately, most of the subjects in this study were students with a level of secondary education. Our sample patients leave in urban area, belonging to two main religions Islam (58.8%) and Christianism (33.8%) with domination of Islam. The religion is a risk factor of management of diabetes as education of women may encouraged the development of the disease. For instance, the outings of women outside the family or marital home are very limited is Islam religion of the septentrional part of Cameroon. This probably explain the low frequency of physical activity practice (32.4%) in our sample. In other words, physical activity is limited among muslim women because of religion. Worth to mention is the positive role of physical activity in diabetes patient which promotes increase muscle sensitivity to insulin and helps make the profile less atherogenic [21]. Important was the less proportion of smokers (1.5%) in our sample, which in some cases elsewhere was reported to 4.9% [23] or 9.3% [22]. Indeed, smoking is a risk factor for many diseases such as diabetes and many studies have reported a positive association between active or passive smoking and diabetes [90]. The patients included in the study were those admitted in the hospital and identified as diabetes I following internal and recommended protocols. It was reported in number of studies that less than 100 % of diabetes patients had high blood sugar. While Traore [29] reported in Mali 90% of type 1 diabetes patients had elevated fasting blood sugar (≥ 126 mg / dl), we found 78.1% in the present work. The elevated fasting blood sugar levels found in type 1 subjects support the theory that type 1 patients almost always have very high fasting blood sugar levels which require a daily injection of insulin proportional to the amount of food ingested [28].

Hypertriglyceridemia and hypercholesterolemia were frequent to 34.1% and 32.5% of our sample population. Similar range (26.7%) of frequency of hypertriglyceridemia was reported elsewhere [29]. With an average total cholesterol in our study population of 197.3 ± 10.2 mg / dl, the picture of total cholesterol level is normal, probably as a consequence of diet high in vegetables and low in fat. Similar low average 182 mg/dl of total cholesterol was observed by Tchakonté et al. [32]. In contrast, relatively high hypercholesterolemia (53.33%) was reported by Traore [29] in his study carried out in Bamako, Mali. For LDL-cholesterol known as bad cholesterol and leading to an accumulation of fat in the body [30], we note in our study that 31.7% of our patients had hyperLDLemia against, in conformity with the value 29.1% reported in other study [23]. The frequency calculated may be affected by the limit from which the value is considered higher. In our study, we considered as hyperLDLemia any value of LDLc ≥ 1.3g / l (130mg / dl) against 1.6g / l for Guira [23]. HDL cholesterol, known as an anti-risk marker for cardiovascular disease and promoting lipid excretion, was low in most of our patients (70.7%). This result is similar to that found by Alnozha et al. [31] which was 74.8% for men and 81.8% for women. The results could be explained by the physical inactivity and sedentary lifestyle of our patients.

The average Body Mass Index (BMI) was 23.0±2.7 kg/m^2 in type 1 diabetics, value which fitted withing the normal weight. Similar normal mean weight (24.3 ± 4.1 kg / m^2) was reported for type 1 diabetes in studies by Farouqi et al., (18). Similarly, the mean waist circumference of our sample for men and women corroborated those reported elsewhere, 86.6 ± 13.0 and 87.5 ± 11.81 cm, respectively, in type 1 diabetes males and females [18].

Treatment of type 1 diabetes is based on insulin therapy [24,25). These molecules are mainly recommended to patients because of their good long-term tolerance, no weight gain, low risk of hypoglycemia, low cost and its availability in many hospitals [26]. But insulin treatment is a long-term treatment which is generally out-of-rich of many families. For instance, a study in Mali revealed that 38% of a family's income was spent on caring for a diabetic member on insulin [27].

The most important complication associated with physiopathology of diabetes is the development of associated diseases as obesity, renal failure, etc. Controlling the development of associated diseases is then fundamental for the management of diabetes. In this respect factors that reduce the frequency of the associated diseases are key points. Although our sample size (n=60) appears as a limit to statistical inference, we may point out women as risk to develop hypertension with RR= 1.56 (0.31-7.70); In addition, urban area equally appeared as risk to develop overweight/obesity, hypertension and renal failure with respective mean relative risk of 1.65 (0.27-10.30), 3.07 (0.51-18.59) and 1.23 (0.30-5.07). Although the RR values were not significant, their mean value higher than 1.5 in many cases gave a clear picture of the position as factor risk. The position of women as at risk to develop hypertension could be explained by their socio-cultural conditions in the northern regions of Cameroon which do not allow them to go out of the family home and therefore, they are more sedentary than men. In addition, patients living in urban areas may be influenced by the phenomenon of urbanization, and the nature of leisure activities which lead to a significant sedentary lifestyle, unlike those in rural areas which have a lifestyle based primarily on physical effort. This situation is consistent with the assertion that the increase in diabetes in urban areas is due to economic development and increasing urbanization which are factors leading to greater sedentarization and increased consumption of harmful foods associated with overweight, to obesity, hypertension and other diseases [18].

Patients aged between 30-40 years were equally reported with high RR value to overweight / obesity 2.96 (0.71-12.35) and hypertension 2.40 (0.30-19,5), while patients with an age range of 40-50 years had higher relative risk with hypertension 5.00 (0.42-59.7) and renal failure 7.33 (0.60-89.00). The result suggests a chronology of development of associated diseases. Obesity and hypertension probably firstly appear in the early stage of the complication of the disease (between 30-40 years), then followed cardiac/renal failure around 40-50 years. But the progression of the disease would depend the duration of the disease. Specifically, we found that patients with disease duration greater than 1 year, were at risk to develop hypertension 1.50 (0.16-14.43), renal failure 1.64 (0.11-24.24). However, this time may be delayed depending on the proper management of the glycemic control, and also the early diagnosis of the disease. Unfortunately, patients usually do not get consulted early because of the insidious progression of the disease and can thus present for the first time with the signs of complications of diabetes such as visual disturbances related to retinopathy, pain and / or tingling of the feet related to neuropathy, foot ulcers stroke, and other diseases. The progression of the disease then mainly depended on the early-stage strategy taken to manage it. In this respect less educated or illiterate can cause the patient to have an inappropriate diet which may accelerate the outset of obesity. This was relevant in this work since illiterate and less educated patients were at risk to develop overweight / obesity, hypertension, kidney failure, arthritis and other illnesses. In fact, less education may limit therapeutic education and consequently lead to poor glycemic control by the patient. In addition, many studies revealed that aging is strongly linked to the increase prevalence of diabetes, and its association with a low level of education, is generally accompanied by poor glycemic control (leading to overweight, obesity, and other diseases) and poor disease tracking [34].

Other socio professional parameters were found as potential risk factors in developing associated diseases. In this respect, compared to state officials, housewives 6.48 (0.90-46.84) and traders 5.67 (0.72-44.61) were at much risk to develop overweight/obesity. Similarly, Muslim patients were found more exposed than catholic patients to develop hypertension with RR = 2.13 (0.27-16.71) and renal failure with RR=3.00 (0.21-43.69). This situation is believed to be due to the fact that housewives in the septentrional area of Cameroon are mostly Muslim and, in this respect, are generally at home, and in many cases do nothing than eating and feeding babies with maternal milk, and then more exposed to a sedentary lifestyle.

Most patients with a family history had a significant relative risk especially to renal impairment 1.75 (0.117-26.13) and arthritis 1.11 (0.209-5.909). Because, according to the third National Health and Nutrition Survey in the United States, diabetic patients with a family history were more exposed to certain diseases [34]. Patients not practicing sport had a significantly significant relative risk

to develop hypertension (RR= 3.41; 0.70-16.71), renal failure (RR=2.00; 0.135-29.68), arthritis (RR=2.719; 0.5056-14.62), and other diseases such as typhoid, stomach ache, etc. (R=1.250; 0.635-2.463). This situation could be due to the accumulation of fatty acids in fatty tissue, not burned by physical activity. Our findings then corroborated instruction of WHO towards management of diabetes that physical activity plays an important role in the fight against overweight, obesity and hypertension in diabetics [35].

Hyperglycemia (blood glucose > 125 mg / dl) presented a significant relative risk to develop associated diseases compared to those with normal blood glucose. In this respect relative high risk were observed for hypertension (RR=2.44; 0.26-22.81) and arthritis (RR= 1.38; 0.100-18.86). Very low association was observed with obesity; in addition, LDL hypocholesterolemia was observed in most patients with normal weight. This could be due to diet low in fatty foods. Lowering LDL cholesterol have been shown to improve adipose tissue function and therefore reduce the risk of developing overweight/obesity and cardiovascular diseases (36). Patients with HDL hypocholesterolemia (<40mg / dl) and hypertriglyceridemia (> 150mg / dl) were at risk to develop overweight / obesity (RR= 1.42 (0.61-3.31). Insulin resistance impairment appeared generally in diabetes patients, thanks to the excess of intra-abdominal fats freed in the liver, which in turn will lead to the development of dyslipidemia associating high triglyceride levels and low HDL cholesterol.

The relative risk observed in the different variables in Table 7 can be explained by a delay in diagnosis which can lead the patient to ignore his disease, believing he is in good health. Therefore this situation can lead the patient to have an inappropriate diet which can lead to complications by promoting the progression of the disease in the body and the deterioration of the latter. Indeed, epidemiological studies carried out in Africa show that the diagnosis of diabetes is often unrecognized (2-3 undiagnosed cases for each known case) [37]. The LDL hypocholesterolemia observed in most patients with normal weight is thought to be explained by a diet low in fatty foods. This finding supports the Canadian study that lowering LDL-cholesterol may improve fatty tissue function and therefore reduce the risk of developing diabetes and cardiovascular disease in people who are overweight, obese and suffer from conditions like typhoid. , upset stomach, jaundice [36]. The relative risk observed in patients with HDL hypocholesterolemia (<40mg / dl) is explained by the fact that insulin resistance appeared thanks to the excess of intra-abdominal fat induced the influx of excess free fatty acids in the liver, which itself will subsequently lead to the appearance of dyslipidemia associating high triglyceride levels and low HDL cholesterol. The relative risk significantly reported in patients with hyperglycaemia (> 125mg / dl) is explained by a transformation of excess sugars into fats in adipose tissue due to the inability of the liver to contain the high sugar level.

Conclusion

Type 1 diabetes represents 26% total diabetes followed in hospital of septentrional regions of Cameroon. They are generally females, aged 20-30 and belong to Muslim religion. Many of them do not practice sport, have no family history of diabetes and their clinical symptoms include polydipsia, polyuria and relatively emaciation and polyphagia. Their **lipid profiles** characteristics are hyperglycemia, hypo-HDL-cholesterolemia and hyper-triglyceridemia. Diabetes is associated to diseases which may accelerate the progression ase to death and these include overweight/obesity, hypertension, renal failure, arthritis and other infectious diseases. Factors contributing much too associated diseases are less sport, less control of hyperglycemia probably through better food practices, aging. Controlling these factors is one of the multiple approaches and strategies that may be used for better management of patients with type 1 diabetes in this part of the country.

Limits

No Extrapolable Result in Rural Areas

All the patients surveyed were followed in regional hospitals in the north by general practitioners. Most of them live in urban areas. Due to the low representativeness of patients living in rural areas, we could not generalize the results to patients treated in all areas of the three northern regions of Cameroon

Information Bias

During the survey, some patients were uncomfortable being asked about their lifestyle in this way by someone who is neither their doctor nor a loved one. This may have influenced their responses.

Recommendations

To the Authorities

- Organize awareness and screening campaigns
- Subsidize drugs
- Support regional hospitals in the north with specialists in diabetology

To the Nursing Staff

- Correctly examine the new diabetic and systematically search for other risk factors and associated pathologies
- Collaborate with other specialists (cardiologist, nephrologist, and ophthalmologist) in the event of a chronic complication - Request a diabetic assessment as soon as diabetes is discovered

To the Population

- Have a regular health check-up including at least one blood sugar level
- Regularly practice physical activity

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