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Type 2 Diabetes Mellitus and Chronic Complications

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Abstract:- Diabetes mellitus (DM) is a metabolic disorder, producing elevated levels of glucose in the blood, thus causing changes in the secretion and/or action of insulin. Objective: To determine the prevalence and chronic complications of type 2 diabetes mellitus in relation to the time of evolution of the disease in the urban area of Azogues County, September 2019-February 2020. Materials and Methods: Epidemiological, relational, cross-sectional study. The sample consisted of 216 patients with type 2 diabetes mellitus. Data collection was done using the survey validated by experts. For data analysis Microsoft Excel 2016 and SPSS v. 25 were used for the analysis of numerical and categorical variables. Results: The prevalence of type 2 diabetes mellitus in the urban area of Azogues, Ecuador, was 2.53%. Mean age was 67.7 years, SD 11.8. Sixty percent were women, 70% were in active employment, 49% did not engage in extra physical activity, the mean glycated hemoglobin was 7% and patients with 6-11 years of diabetes developed more chronic complications with 39%. There is a significant relationship between years of diabetes progression and chronic complications with a p value of 0.000 and a Chi square of 67.5. Conclusion: The frequency of chronic complications of Type 2 Diabetes Mellitus increases in older adults and with the years of evolution of the disease.

Keywords:- *Type 2 diabetes mellitus, chronic complications, urban area, quality of life.*

I. INTRODUCTION

Diabetes mellitus (DM) is a metabolic disorder that produces elevated levels of glucose in the blood and causes changes in the secretion and/or action of insulin (1). According to the Pan American Health Organization, it is the group of metabolic alterations, which is manifested by insufficient production of insulin by the pancreas or when the body does not effectively use the insulin it produces. When it is not controlled it can cause damage to different organs such as: heart, eyes, kidneys and blood vessels. The most general symptoms of diabetes are polydipsia, polyphagia, polyuria and weight loss (2). Internationally, at the beginning of the 21st century, there are 150 million diabetic patients; in 2010 the number of cases rose to 225-230 million, and it is expected that by 2025 there will be 380 million and by 2030 438 million.

Rojas-Martínez et al. (4) Mexico has a diabetes prevalence of 9.4% in 2018. 78.8% were women and presented microvascular complications: diabetic foot, retinopathy and nephropathy. In Ecuador, according to the Pan American Health Organization, Type 2 Diabetes Mellitus is the second cause of death after cardiovascular disease. In 2017, diabetes caused the death of 4,894 people (5). Altamirano L, Vásquez M, et al. (6) in 2018, in a study carried out in Cuenca, Ecuador; "Prevalence of type 2 diabetes mellitus and its risk factors in individuals" with 317 patients with diabetes, obtained a prevalence of 5.7%, aged between 40 and 49 years.

Diabetes mellitus is a chronic, degenerative disease that affects a person's quality of life. It demands constant medical assistance, patient and family education to help manage the disease and associated treatment to prevent chronic complications. Patients with Type 2 Diabetes Mellitus present physical, functional and psychological changes that affect the social environment and the family, it is a more relevant public health problem that causes a higher health cost, they are frequently hospitalized for presenting several complications in your health. The main causes of Type 2 Diabetes Mellitus are modifiable such as: overweight and obesity, sedentary lifestyle, smoking, diet and non-modifiable such as: age, ethnicity, family history, high blood pressure.

Glycosylated hemoglobin or HbA1c indicates whether the treatment applied in diabetes mellitus is effectively controlled and reveals the diagnosis of diabetes. It is a protein that is present in red blood cells and is made up of two globin dimers (7)(8). In the standards of the American Diabetes Association, HbA1c has been defined as follows: (9).

- Non-diabetic levels: < 5.6% Normal
- Pre-diabetic levels (increased risk of diabetes) 5.7% to 6.4%.
- Diabetic levels: > 6.5% compatible with the diagnosis of diabetes

Initial treatment of type 2 diabetes mellitus to maintain blood glucose within normal parameters includes adequate dietary management, weight reduction and physical exercise. Diabetics who do not achieve metabolic control after 3 months of non-pharmacological treatment will start with oral pharmacological treatment such as sulfonylureas and metformin, which are drugs that help insulin secretion stimulated by glucose without causing hypoglycemia or weight gain (10).

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A. Chronic complications of type 2 diabetes mellitus

Microvaculars-affecting the vascular system and causing damage to small vessels Among the most important are mentioned:

Cataracts: This is the loss of transparency of the crystalline lens and is divided into: congenital or developmental and acquired or degenerative, which produces difficulty in vision by interfering with movements ordered by light rays, diplopia, poor night vision (11).

Glaucoma: a group of diseases that cause damage to the optic nerve and lead to loss of vision due to increased intraocular pressure. The risk of blindness depends on: levels of intraocular pressure, severity of the disease, age of onset, family history (12).

Diabetic retinopathy: directly affects retinal microvasculature, caused by prolonged hyperglycemia. It is one of the main diseases causing blindness and visual weakness (13).

Diabetic Nephropathy: People with diabetes have a higher rate of glomerular filtration, with greater relaxation of the afferent arterioles compared to the efferent ones. It is characterized by increased levels of albumin, hypertension, and reduced glomerular filtration rate (14).

Diabetic neuropathy: This is a complication that damages the sensory, motor and autonomic fibers of the peripheral nervous system of the lower extremities. The symptoms at the beginning are usually bilateral in the fingers and feet. It may gradually progress to the calf and knee, and acute symptoms and/or paresthesia may be noted in the hands and feet, with deep, burning pain (15)

Diabetic Foot: The WHO defines as "the presence of ulceration, infection, and/or gangrene of the foot associated with diabetic neuropathy (ND) and varying degrees of peripheral vascular disease". It is estimated that about 15 to 20% of people with diabetes mellitus may develop an ulcerative lesion throughout their disease. Also, 40 to 60 % of non-traumatic lower-limb amputations occur in diabetics, and 85 % of amputations are preceded by an ulcer (16) (17).

Macrovascular: The central pathological mechanism in macrovascular disease is the process of atherosclerosis, which leads to a narrowing of the arterial walls throughout the body (18).

Ischemic heart disease: This occurs in the myocardium, which receives insufficient blood and oxygen and an imbalance in the muscle layer. It is divided into: Acute myocardial infarction, which is caused by a thrombus or clot in response to the rupture of an atherosclerotic plaque, which obstructs the blood supply; and, Angina pectoris, which is defined as oppressive chest pain, which are secondary to myocardial ischemia (19).

Stroke is a rapidly developing clinical syndrome due to a focal disturbance of brain function of vascular origin and lasting more than 24 hours (20). Peripheral arterial disease (PAD): These are complications affecting arterial, venous and lymphatic vessels that produce a high rate of morbidity and mortality. It is an asymptomatic condition (21).

II. METHODOLOGY

This is an epidemiological investigation, with an observational design, of a relational type. The population constituted 491 patients with Diabetes Mellitus type 2 registered in the Azogues Health Center Nº1 and Popular Medical Center. Probabilistic sampling technique was used and a sample of 216 patients with Type 2 Diabetes Mellitus was worked on. Prior to filling out the form, each participant signed the informed consent. Data collection was done through an anonymous, self-completed questionnaire. It consists of four dimensions: sociodemographic factors, quality of life, pathological factors and chronic complications.

The information collected was processed using Microsoft Excel 2016 and SPSS version 25 statistical programs. Frequencies and percentages were established for categorical variables; measures of central tendency (mean) and data distribution (standard deviation) were identified for numerical variables. To analyze the relationship between the categorical variables, chi-square was taken with a value of $p < 0.05$.

III. RESULTS

The prevalence of type 2 diabetes mellitus in the urban area of Azogues Canton is 2.53 per 100 people. The age of patients with type 2 diabetes mellitus is 35 to 93 years with an average of 67.7; SD + 11.8 years. The years of evolution of diabetes is 1 to 30 years with a mean of 8.8 and SD + 5.2 years. The treatment time from 1 to 28 years, with a mean of 7.5; SD + 4.8 years. The values of glycosylated haemoglobin reviewed in the clinical history show a value of 4 to 10% with an average of 7%.

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Variables		*f*	%
Gender	Male	86	40
	Female	130	60
Marital status	Single	21	10
	Married	131	60
	Separate	19	9
	Widower	45	21
Instruction	None	101	47
	Primary	94	43
	Secondary	19	9
	Superior	2	1
Total		**216**	**100**

Table 1:- Sociodemographic data of patients with Diabetes Mellitus type 2.

It is observed that the most predominant gender in patients with diabetes is female with 60%; 60% are married, 47% have no education, followed by 43% who have primary education. This is an older adult population, married and mostly uneducated.

Variables		*f*	%
Currently working	Yes	151	70
	No	65	30
Compliance with feeding schedules	Yes	145	67
	No	71	33
Get physical activity	Never	105	49
	Less than twice a week	88	41
	2-3 times a week	20	9
	More than 3 times a week	3	1
Family helps you in your treatment	Always	130	60
	Almost always	50	23
	Sometimes	26	12
	Never	4	2
	I don't have any relatives	6	3
Total		**216**	**100%**

Table 2:- Quality of life factors for patients with type 2 diabetes mellitus.

In relation to the quality of life of the patients, 70% are currently working; 67% comply with feeding schedules; 49% report that they do not do extra physical activity at work; and 60% receive help from the family in their treatment. Despite their age, this is an active population that complies with feeding schedules and receives help from their family.

Variables		f	%
Family history of diabetes	Yes	77	36
	No	139	64
Type of treatment	Tablets	168	78
	Insulin + tablets	9	4
	Insulin	32	15
	Diet	7	3
Body Mass Index	<18.5	6	3
	18.6-24.9	47	21
	25-29.9	75	35
	30-34.5	66	30
	35-39.9	17	8
	>40	5	2
History of hospitalizations	Yes	38	18
	No	178	82
Total		**216**	**100**

Table 3:- Pathological factors of patients with type 2 diabetes mellitus.

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Sixty-four per cent of patients did not report a family history; 168 (78%) of people used only tablets in treatment; in the body mass index, 75 (35%) of patients were overweight, followed by 31% who were obese; and in relation to hospitalization history, 178 (82%) mentioned not having a family history. It is important to emphasize overweight and obesity as pathological factors.

Of the total sample analysed, 84 cases (38.9%) of patients presented chronic complications during the 6 to 10 years evolution of diabetes, of which 17.5% presented high blood pressure, followed by 14.4% who presented more than one complication. Therefore, there was a very significant relationship between the years of evolution of diabetes and chronic complications, with a p value of 0.000 and a Chi table of 67.53. With regard to the most frequent complications, 37% suffered from high blood pressure, 7.4% had cataracts, 6% showed damage to their feet (diabetic foot) and 37% referred more than one complication.

Variables/ years		**1– 5**	**6-10**	**11-15**	**16-20**	**21-30**	**Total**	**p value**
High Blood Pressure	*f*	26	38	15	11	0	**80**	
	%	12	17,5	6,9	0,5	0	**37**	
Waterfall	*f*	**11**	3	1	1	0	**16**	
	%	5,1	1,4	0,5	0,5	0	**7,4**	
Glaucoma	*f*	0	1	1	0	0	**2**	
	%	0	0,5	0.5	0	0	**0,9**	
Retinopathy	*f*	0	0	1	1	0	**2**	
	%	0	0	0,5	0,5	0	**0,9**	
Nephropathy	*f*	0	1	3	0	0	**4**	
	%	0	0,5	1,4	0	0	**1,9**	
Neuropathy	*f*	0	1	2	0	0	**3**	
	%	0	0,5	0.9	0	0	**1,4**	**0.000**
Diabetic foot	*f*	6	6	1	0	0	**13**	
	%	2,8	2,8	0,5	0	0	**6**	
Amputation	*f*	1	0	2	0	0	**3**	
	%	0,5	0	0,9	0	0	**1,4**	
More than 1 complication	*f*	13	31	23	7	6	**80**	
	%	6	14,4	10,6	3,2	2,8	**37**	
None	*f*	10	3	0	0	0	**13**	
	%	4,6	1,4	0	0	0	**6**	
Total	***f***	**67**	**84**	**49**	**10**	**6**	**216**	
	%	**31**	**38,9**	**22.7**	**4,6**	**2,8**	**100**	

Tabla 4:- Complicaciones Crónicas Años de evolución de la enfermedad.

IV. DISCUSSION

The highest percentage of patients are found with an average age of 67.7 years + 11.8 and glycosylated hemoglobin of 7.4% + 1.4. This coincides with the literature researched by Fernandez (22), who states that the predominant age of diabetic patients was 61.4 + 14.6 years, and 42% of the patients presented a glycosylated hemoglobin of < 7%. Patients with chronic complications presented advanced age and higher BMI. In the years of disease evolution with a mean of 8.8 + 5.2, Maradiaga-Figueroa et al. (23) presented a mean of 11.6 + 7.6 years.

In relation to gender, the predominant is female with 60%, married 61%. Paternina-de la Ossa et al. (24) stated that 72% were female with an average of 66 years + 11 years, 57% of the population were married. Of the total number of patients, 70% worked, Salazar, Gutiérrez, et.al. (25) stated that 71.4% of men worked. Patients with diabetes always receive support from their families, with 60% of them relating to the data from García-Morales, Rodríguez-Pascual (26), 74.2% having a high level of family support and 25.8% having a medium level of family support.

These data coincide with the study by Brítez and Torres (27) where 67% were treated with oral antidiabetics and 21% with insulin. In terms of body mass index, 35% are overweight, which coincides with the study by Altamirano et al. (6) which predominated with 39.7% being overweight. Thirty-seven percent of the sample presented high blood pressure as one of the chronic complications, of which 17.5% occurred over a period of 6 to 10 years, and 14.4% presented more than one complication over the same period. In the study by Cárdenas, Hurtado et al (28) 32% presented high blood pressure.

More than one chronic complication presented 37% of those surveyed with an evolution of the disease from 6 to 10 years (14.4%). According to the study by Domínguez and Ortega (29). The data agreed that the years of evolution of the disease is < 10 years, 16% present several chronic complications such as: diabetic retinopathy 33%, diabetic foot 29%, cardiovascular disease 27% and diabetic nephropathy 11%.

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V. CONCLUSIONS

The prevalence of type 2 diabetes mellitus in the urban area of Azogues Canton is 2.5%, the average age of the patients under study is 67.7 years, with a predominance of women, married and without education. Diabetic patients are active in their work, do not engage in extra physical activity, comply with specific feeding schedules and receive family support.

The highest percentage has no family history of diabetes mellitus, but is related to overweight and obesity, they receive oral treatment, however, the average of glycosylated hemoglobin is 7%. According to the application of the p value 0.000 it is determined that the chronic complications are related to the years of evolution of the pathology in older adults.

It is important to develop educational programs for the prevention of catastrophic diseases. Carry out control and follow-up measures for diabetic patients in senior citizens' clubs, motivate health fairs with educational plans that help prevent chronic and irreversible complications in vulnerable groups.

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