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Diabetic Retinopathy in Patients Over 50 Years Old in Cuba during 2016

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Abstract

Objectives: To determine the prevalence and description of the epidemiological characteristics of diabetes and diabetic retinopathy in diabetic adults in Cuba.

Methods: An epidemiological, cross-sectional, descriptive investigation was conducted in the Cuban population aged 50 years and over. Three thousand nine hundred twenty inhabitants were selected through cluster sampling, grouped into 35 people from each 112 Family physician clinics. The format of the rapid survey of avoidable blindness recognized as ERCE5 was take on, validated by the WHO to conduct studies on the prevalence of blindness, low vision and diabetic retinopathy.

Results: The prevalence of diabetes was 15.5%. 8.3% of the people surveyed were unknown diabetics. The prevalence of diabetic retinopathy was 16.8%, the risk of having a severe form and the proliferative one is 1.9% and 1% respectively and of any degree of maculopathy is 8.5%. The risk of severe visual disability and blindness is 1%.

Conclusion: The prevalence of diabetes is low in people 50 years of age and older, different from the world estimations and others similar studies. The highest risks is for the third age people and female. There is low risk of developing diabetic retinopathy, including the proliferative form of the disease and visual impairment from this cause.

Keywords: *Diabetes Mellitus; Diabetic Retinopathy; Visual Impairment*

Introduction

In this 21st century there is talk of a "Global Diabetes Epidemic", a phenomenon particularly related to Type 2 Diabetes Mellitus, which is taking place in both developed and developing countries [1,2].

The International Diabetes Federation (IDF International Diabetes Federation) considers diabetes one of the greatest global health emergencies of this century and made global estimates; that 415 million people had diabetes in 2015 [3] and in 2017 it increased to 425 million; In the Central and South America area, 26 million diabetics are estimated that by 2045 it will increase by 62% and reach 42 million [4].

Diabetic retinopathy (DR) is a microvascular complication that causes damage to the capillaries of the retina, which leads to leakage and obstruction.

Diabetes is not just a health crisis; it is a global social catastrophe [5] as the prevalence of diabetes increases, the risk of diabetic retinopathy increases. According to IDF estimates, more than a third will develop some form of DR throughout their lives [3]. It is estimated that more than 93 million people suffer some type of eye damage from diabetes [6]. The World Health Organization (WHO) aims to de-

velop national plans for the prevention of visual impairment that includes moderate visual impairment, severe and blindness. DR is the third leading cause of blindness worldwide but the first in working-age people in developing countries [7].

WHO estimates that the DR produces almost five percent of the world's blindness; It is preventable in 80% of cases with early detection and treatment associated with general management. 10% of patients with diabetes have severe visual impairment and 2% of them reach blindness [7].

Together with the situation of diabetes, there is an increase in the aging population that has become a key issue, given by the increase in the absolute number of people aged 60 and over in populations around the world. In the second half of the century, many countries will have a percent of people 60 years of age or older than 30% [8] what makes it necessary to draw up health strategies in order to face this challenge.

WHO, concerned about the magnitude and causes of visual impairment worldwide, confirms that there is an excellent opportunity to change the lives of millions of people [9].

Currently 19.8% of people in Cuba are 60 years of age and older [10]. In 2050, it will be within the countries that will have these figures above 30% [8]. The life expectancy of Cubans for both sexes is 78.45 years [11].

In Cuba, Diabetes Mellitus is on the rise as is the case throughout the world [10]. The increase in diabetes and the growth of the aging population becomes a future challenge.

The Cuban health system has the characteristic of being universal and free, with full responsibility of the state. Ophthalmological services, therefore, have a national coverage, with qualified medical personnel and with different treatment alternatives essential for the care of patients with DR [12,13].

Statistical data related to diabetes and diabetic retinopathy are necessary, in order to determine the prevalence and describe the clinical epidemiological characteristics of diabetes and diabetic retinopathy in the diabetic adult in Cuba.

Methods

An epidemiological investigation classified as a cross-sectional descriptive study was conducted in the Cuban population aged 50 years and over during 2016.

The sample size was calculated using the program that is the ERCE Software, Version 5 for Windows (courtesy of PhD Hans Limburg, WHO consultant for the prevention of blindness), prepared for conducting similar studies [14].

To determining the sample size was assumed as the size of the universe the 3 802 063 inhabitants of 50 years and over in Cuba with an estimated prevalence of 2.3%, in addition to an expected prevalence variability of 25% (which equivalent to ± 0.57%) and up to five percent of expected losses (denial or absence of subjects to be surveyed).

For the selection of the sample, was performed systematic sampling by clusters was performed. The sample size was 3,920 inhabitants, grouped into 112 conglomerates of 35 people 50 years of age and older. In the random selection of conglomerates, population distribution by polyclinics and family doctor's offices was used.

In order to determine the variables to be studied, the format of the rapid survey of avoidable blindness recognized as ERCE5, validated by the WHO for studies of prevalence of blindness, low vision and diabetic retinopathy was assumed [15].

Once the conceptual assessments were determined and to guarantee the validity of the investigation, an inter-observer variation test was performed, one for ophthalmologist of the anterior segment and another only for those of the posterior segment.

The survey includes general patient and diabetes data, visual acuity (VA) was evaluated using a Snellen optotype with the letter "E" with sizes equivalent to the VA of 0.3 and 0.05, changing the distance of six and three meters, with optical correction available. The check-up of the vision was in daylight, in a garden. When the VA was less than 0.3 in any of the eyes, the vision was evaluated with a pinhole. A sample of capillary blood from all respondents with a random measurement of blood glucose taken with a biosensor for blood glucose

SUMA Sensor. Both known and unknown diabetics underwent examination of the fundus with indirect ophthalmoscope and pupillary dilation in a dark place in the house. The classification used for the retinopathy classification was The Scottish Diabetic Retinopathy Grading Scheme 2007 v1.1 [16].

Two teams of work; each one with two ophthalmologists, one from the anterior segment and one from the posterior segment of the Cuban Institute of Ophthalmology "Ramón Pando Ferrer", validated for research.

The investigation was carried out under strict compliance with bioethical principles (in accordance with the provisions of the National Health System and provided for in Law No. 41 of Public Health), informed consent and procedural information were fundamental premises to perform on the patient.

Results

General survey data

From 3,920 people to be surveyed, 3 890 were examined for an exam coverage of 99.2%. The cases not examined were 30, of them 22 people not available despite returning to the survey site, two people who refused the exam and six had some impediment for the examine.

Diabetes mellitus

The prevalence of Diabetes Mellitus that includes known and unknown diabetics is 15.5% with a range between 14.5% and 16.5%. The risk of having diabetes is higher in women being 17.5%, that fluctuates between 16.0% and 19.1% and in men it is 12.6% that varies between 11, 0% and 14.2% ($p < 0.001$) (See table 1).

Patients between 70 and 79 years of age had the highest prevalence for both sexes with 22.0% and a range between 19.4% and 24.7%. Within this age group, women presented a higher risk, with 23.6% given that in men it is 19.9% (See table 1).

There is a tendency for both sexes to increase the risk of diabetes from the age of 50 until the 70s, to decline later in the older ages. The tendency is always greater in women than in men 8.3% of the people surveyed were unknown diabetics, with similar behavior for both sex (See table 1).

Group of ages	Sex	Surveyed	Diabetic*	Prevalence	IC
50 - 59	Male	602	45	7,5	(5,5-10,0)
	Female	806	85	10,5	(8,5-12,6)
	Total	1 408	130	9,2	(7,8-10,7)
60 - 69	Male	481	63	13,1	(10,2-16,0)
	Female	753	166	22,0	(19,1-25,0)
	Total	1234	229	18,6	(16,6-20,5)
70 - 79	Male	337	67	19,9	(15,8-24,0)
	Female	484	114	23,6	(19,9-27,2)
	Total	821	181	22,0	(19,4-24,7)
80+	Male	184	27	14,7	(9,3-20,1)
	Female	243	36	14,8	(10,3-19,3)
	Total	427	63	14,8	(11,4-18,1)
Total	Male	1 604	202	12,6	(11,0-14,2)
	Female	2 286	401	17,5	(16,0-19,1)
	Total	3 890	603	15,5	(14,5-16,5)

Table 1: *Prevalence of Diabetes Mellitus according to age group and sex.*

Note: $p < 0.001$ associated with X^2 with Yates correction comparing the general prevalence by sex.

**Diabetes Mellitus known and not known.*

Diabetic retinopathy

The exam coverage to determine whether the patient had, retinopathy was 97.7%, of the known diabetics, 1 who refused the exam (0.2%) and 13 (2.3%) could not perform the ophthalmoscopy: nine had total opacity of the bilateral lens, one had a monocular cataract, one had bilateral corneal leucoma of non-trachomatous cause and the other a bilateral ocular prosthesis. All the newly diagnosed diabetics were examined.

The prevalence of DR in diabetics 50 years of age and older, which includes any retinopathy and/or maculopathy due to this cause, is 16.8%, so the risk of having DR is in a range between 13.7% and 20.5% (See table 2).

In known diabetics 50 years of age and older, the risk of developing DR is 17.9%, with a range that ranges from 14.6% to 21.9%. Diabetics who have not been diagnosed have a 4.0% risk of having DR, with a range that ranges between 0.5% and 14.5% (See table 2).

Diabetic	Diabetic*	Diabetic Retinopathy**	Prevalence (CI)
Known	539	97	17,9 (14,6-21,9)
Unknown	50	2	4,0 (0,5 -14,5)
Total	589	99	16,8 (13,7-20,5)

Table 2: *Prevalence of diabetic retinopathy after examination of the fundus.*
*Note: *Known and unknown diabetes mellitus patients examined.*
***Includes any retinopathy and/or diabetic maculopathy.*

The risk of developing DR is similar for both genders, in men it is 16.6% and in women it is 16.9% (See table 3).

The risk of DR is similar (17.1%, 17.5% and 16.7%) for almost all age groups, except for the group of those 80 and older who is under 13.8% (See table 3).

In men, the group with the highest risk of DR is between 50 and 59 years of age with a prevalence of 27.3%, however in women the highest risk is between 70 and 79 years of age with 19.2%. Men tend to decrease the risk of DR with age, and in women it tends to increase to be similar for both sexes after 80 years (See table 3).

Group of Ages	Sex	Diabétic*	Diabétic** Retinopathy	Prevalence	CI
50 - 59	Male	44	12	27,3	(14,1-47,6)
	Female	85	10	11,8	(5,6-21,6)
	Total	129	22	17,1	(10,7-25,8)
60 - 69	Male	62	9	14,5	(6,6-27,6)
	Female	166	31	18,7	(12,6-26,5)
	Total	228	40	17,5	(12,5-23,9)
70 - 79	Male	65	8	12,3	(5,3-24,3)
	Female	109	21	19,2	(11,9-29,5)
	Total	174	29	16,7	(11,2-23,9)
80+	Male	22	3	13,6	(2,8-39,8)
	Female	36	5	13,9	(4,5- 32,4)
	Total	58	8	13,8	(5,9-27,2)
Total	Male	193	32	16,6	(11,3-23,4)
	Female	396	67	16,9	(13,1-21,4)
	Total	589	99	16,8	(13,7-20,5)

Table 3: *Prevalence of diabetic retinopathy according to age group and sex.*
*Note: *Examined known and unknown diabetic patients.*
***Includes any retinopathy and/or maculopathy.*

The DR contains retinopathy and maculopathy. The prevalence of any degree of retinopathy is 15.3% with an interval that fluctuates between 12.0% and 18.6% and the risk of a diabetic patient having a mild form of it is 8.1%, having a moderate (observable) form is 4.2%, while the severe (remittable) and proliferative form is 1.9% and 1% respectively (See table 4).

The prevalence of any degree of maculopathy is 8.5% with a range between 6.1% and 10.8% and the two degrees of the same behaved in the same way with 4.2% (See table 4).

Grade	N* (589)	Prevalence (CI)
Mild background retinopathy (R1)	48	8,1 (5,7-10,6)
Obsevable background retinopathy (R2)	25	4,2 (2,6-5,9)
Referable background retinopathy (R3)	11	1,9 (0,7-3,0)
Proliferative diabetic retinopathy (R4)	6	1,0 (0,2-1,8)
Any retinopathy	90	15,3(12,0-18,6)
Observable maculopathy M1	25	4,2 (2,2-6,0)
Referable maculopathy (M2)	25	4,2 (2,2-6,0)
Any maculopathy	50	8,5 (6,1-10,8)

Table 4: *Prevalence of the degree of retinopathy and diabetic maculopathy.*
*Note: *Diabetics: known diabetic patients and unknown were examined.*

The DR with a threat to vision are diabetics with proliferative forms of retinopathy and/or severe (remittable) maculopathy. The risk that a diabetic has of having their vision threatened by DR is 4.9%, ranging from 3.1% to 6.8%.

Visual impairment due to DR presented with a low prevalence, both for the moderate one that was 1.4% (0.6% - 2.7%) and for the severe one and the blindness that was 1.0% with a range between 0.4% and 2.2% (See table 5).

Visual impairment*	Diabetic Retinopathy** (589)	Prevalence (CI)
Moderate	8	1,4% (0,6-2,7)
Severe and blidness	6	1,0% (0,4-2,2)

Table 5: *Prevalence of visual impairment due to diabetic retinopathy.*
*Note: *According to the evaluation of visual acuity with the available correction (Without pinhole) in known and unknown diabetics*
***Includes any retinopathy and/or maculopathy.*

Discussion

Rapid Assessment of Avoidable Blindness (RAAB) carried out for the first time in Cuba. A population study of preventable blindness related to DR throughout the country, it is the second of its kind in Latin America, given that the first at the country level was in the Republic of Suriname [17].

The prevalence of Diabetes Mellitus in Cuba published in the Statistical Yearbook of Health in 2016 is 58.3 per 1 000 inhabitants. For the total population (5.8%), although the age ranges are not equivalent to those used in the research, for the group of 65 years and more reflected in the yearbook a prevalence of 16% is estimated, with a higher risk for women (18.6%), similar values to those found in the study [10].

In an active research of Diabetes, performed in Jaruco Mayabeque province in 2007, a prevalence rate of diabetic patient was 10.2% (known and new detected) patients were over 15 years of age, and if patients with altered glucose intolerance test were added, the sum reaches a rate of 15.6% [19].

Although the prevalence referred to, are not comparable, due to the differences in ages at which they were determined, there is a coherence between these estimates; since the onset of diabetes becomes more frequent after the age of 45 [19].

When compared to other international publishes studies, the prevalence of diabetes in Cuba is above the Republic of Moldova (11.4%) [20]. But it is below the rest as they are: Cape Town (19.1%) [21], Hungary (20.0%) [22], Chiapas Mexico (21.0%) [23], Gilan (21.4%) [24], Republic of Suriname (24.6%) [17] Saudi Arabia (27.8% and 29.7%) [25,26] and in the Irbid region of Jordan (28.6%) [27].

Our study showed that the risk of Diabetes Mellitus is more in female than in male. In small-published studies done in Cuba, they found a predominance of diabetes in women [28-31].

In the reports of the Republic of Moldova there is also an increased risk of diabetes in women (12.1%) over men (10.1%) [20]. Similar was in Suriname the prevalence in women was 26, 8% and in men 21.9% [17]. In Hungary [22] and Chiapas, Mexico [23] there was no significant difference in relation to sex. In Jazan, Saudi Arabia predominated the risk of diabetes in men (54.4%) over women (45.6%).

In the book, Update of the clinical guide of diabetic retinopathy for Latin America, show that developing countries with the greatest number of diabetic people are between 40 and 60 years of age. In developed countries the majority of people with diabetes are over 60 years and this will increase as time passes [7]. Cuba behaves as a developed country, with an increased risk of diabetes between 60 and 79 years of age for both sexes, even the greatest risk is in the most advanced age between 70 and 79 years.

In Hungary, the highest risk was in the group between 70 and 79 years of age (24.4%) and the lowest was between 50 and 59 years of age (13.0%) and increased with age, but when performing the analysis taking into consideration the sex group with the highest risk are women 80 years of age and older (25.2%) [22].

In Moldova the highest risk of diabetes was reported between 60 and 69 years of age, With a risk of 13.9% for men and 15.5% for women, the latter being the highest risk [20]. In Suriname The highest risk is also between 60 and 69 years for both sexes (28.0%) and the greatest risk is for women in the same age group (31.8%) [17].

In Moldova and Suriname, the highest risk of diabetes occurred at earlier ages than in Hungary and Cuba, but in Chiapas they found a statistically significant difference ($p = 0.05$) between 50 and 59 years of age (21.6%) and those 80 years of age and older (13.8%), so that diabetes presented with more risk in younger people [17,20,22,23].

Although there seems to be consensus regarding the increase in prevalence with increasing age and the clear predominance of women, there is no scientific evidence explaining this behavior.

The IDF states that in high-income countries, about one in three people have undiagnosed diabetes [4]. Diabetics newly diagnosed or unknown, in these types of studies is a fact that could be undervalued, given by the way in which The blood glucose measurement was performed, but it allows us to have a very important approximation data. Although WHO includes within its diagnostic criteria for Diabetes Mellitus a random measurement of plasma glucose ≥ 200 mg/dl in the presence of classic symptoms of diabetes [19].

In this survey the percentage of unknown diabetics was 8.3%, which coincides with the active research conducted in Jaruco, Mayabeque where they found 8.0%, although the latter was in people over 15 years old [18].

In Chiapas, they found 20.0% of unknown diabetics [23] in Jazan and Maldova a somewhat lower percentage was found 14.1% and 14.2% respectively [20,26], in Suriname and Taif was lower than the percentage 10.4% [17] and 12.0% [25] but not yet reach the figures of this investigation. In Hungary it was 6.2%, the lowest of all [22].

In Latin America, it is estimated that there are 17% of undiagnosed diabetics, and it will increase by 55% in the year 2035 [7].

In Cuba, undiagnosed diabetes is lower than estimated for the region; favored by having a universal, free health system.

In relation to diabetic retinopathy, in a meta-analysis published in 2012, its prevalence was estimated at 34.6%, based on data from research conducted in the United States, Australia, Europe and Asia, which allowed us to state that one of each three diabetics have some degree of DR [32].

The prevalence of DR (any degree of retinopathy and/or maculopathy) estimated at approximately 16.8% is considered a low rate, when compared to global estimates, and small work done Previously in Cuba that raised a range between 20.0% and 30.8% for all ages [21,22]. In recent studies in areas of Havana published in 2011 from an area of the municipality of Marianao, they refer to low prevalence rates of 16.0% [23].

Another two areas of the municipality of Playa were also low 13.1% and 10.6% [24]. If these figures are for all ages, they would be higher for people 50 years of age and older, but it is evident that in latest studies the prevalence has a tendency to decrease as research shows.

The prevalence of this research is the lowest of all when compared to published diabetic retinopathy surveys. In Hungary 20.7% were found [22], Suriname has 21.6% [17], 25.3% was found in Gilan Iran [24], in Cape Town was 27.4% [21], in Saudi Arabia in its two surveyed areas was of 33.4% in Taif [25] and 28.1% in Jazan [26]. The highest prevalence are in Chiapas Mexico with 38.9% [23], in Irbin Jordan where it is 48.4% [27] and in Moldova which has the highest rate with 55.9% [20].

China has a work published in 2016 with a prevalence of DR of 34.08% in a screening of 13 473 inhabitants [33]. In the United States, Shah A, published a study from 2011 to 2014 that poses a prevalence of DR for a population of 40 years and more, which is 14.7%, it raises a range between 11.7% and 17.8% [34].

The low prevalence of DR estimated for Cuba is related to the Cuban system, which conceives health as a main component of the quality of life and as a strategic objective in the growth and development of society. Cuba consists of the National Diabetic Comprehensive Care Program [13,18,19] and the Cuban Diabetes Education Program [35]. Several are the normative documents that support the protocols for diabetic patient care, such as the Cuban Guide to evidence-based clinical practices on the screening, diagnosis and treatment of Type II Diabetes Mellitus, published in 2010. More recently in 2013, the Manual for the Diagnosis and Treatment of the diabetic patient at the primary level of health was published [19].

The universal coverage of the Cuban health system and the interrelation between the primary and secondary level of health allows carrying out promotion and prevention actions in a healthy or at-risk population. Active research for the early diagnosis of the disease and the prevention of complications, including rehabilitation when treatment does not achieve satisfactory results.

This strategy allows offering low indicators of disease prevalence and diabetic retinopathy, despite being a country with a high degree of population aging, which implies a greater number of people at risk of diabetes and its complications.

According to the IDF, there are studies that have found many people with undiagnosed diabetes who have complications, these not only include retinopathy but also chronic kidney disease, neuropathies and cardiovascular diseases [19].

The Cuban manual for the diagnosis and treatment of diabetic patients at Primary level of health, expresses that untreated diabetes, where the relative deficit of insulin action and its resistance is progressive, causes chronic complications to appear [19].

Despite all the diabetes efforts made in Cuba, this survey found 4.0% (0.5% and 14.5%) of people with diabetes without diagnosis and already have retinopathy. It is necessary to increase the active screening of diabetes and DR, to which is an obligation to perform an eye fundus at the time of diagnosis of Type II Diabetes Mellitus [19].

In the Chiapas study, they found a prevalence of RD in newly diagnosed diabetics of 16.9% (7.0% - 26.8%) [23], likewise 6.9% (2.8%) were found in Surimam - 16.0%) [17], slightly higher than the one found in this investigation.

Regarding the prevalence of DR according to age and sex, the risk of DR is similar for both sexes, similarly for the three age groups that are between 50 and 79 years. This demonstrates the equal rights of the entire Cuban population to the benefits offered by the Cuban health system, already set out above.

In Hungary, the behavior is very similar to that of this research, a slight increase in men in all age groups but there were no significant differences [22]. In Suriname, a slight increase in the risk of men is also reported (20.4%; 15.0 - 25.9) compared to women (18.8%; 15.7 - 21.9) [17] and yet, in Jazan there is a higher risk of DR in men (31.3%) compared to women, it is 23.7% [26] which differs from the rest of the studies.

Both in Suriname [17] and Jazan [26] in relation to age, the greatest risks were found in diabetics aged 80 years and over with 30.8% and 34.9% respectively, which differ from this study.

In this investigation, the prevalence of retinopathy and maculopathy separately were low 15.3% and 8.5%. We include maculopathy in talked about DR since these may or may not concomitant with retinopathy.

Within retinopathy it is important to highlight the low prevalence of the severe non-proliferative form (remittable) with 1.9% and the proliferative form that is 1.0%.

When the prevalence of proliferative diabetic retinopathy is compared in other published surveys, only Hungary with 1.4% (0.6 - 2.3) [22] and Jazan in Saudi Arabia with 1.1% [26] have similar figures to those found in this study. The rest have higher figures Moldova 2.5% (1.0 - 4.0), [20] Cape Town 3.1% [21], Taif Saudi Arabia 3.4% [25], Suriname 3.8% (2,2 - 5.3) [17] and Chiapas 8.6% (5.5 - 11.7) [23].

In the case of severe form of retinopathy (remittable) only Hungary has 1.4% (0.6 to 2.3) [22] lower prevalence than this study, the other countries have higher figures Jazan 3.5% [26], Moldova 3.8% (2.1 - 5.6) [20] Suriname 4.5% (2.7 - 6.3) [17] and Chiapas 5.8% (3.1 - 8.5) [23].

In the Cuban study, maculopathy, both mild and moderate (observable) grades, presented with the same prevalence of 4.2% (2.2 - 6.0). As for severe (remittable) maculopathy, Hungary also reports lower figures than this research 3.5% (2.2 to 4.9) [22] and the other countries Jazan 5.3% [26], Suriname 5.8% (4.0 - 7.6) [17], Moldova 13.7% (10.5 - 17.0) [20] and Chiapas 16.1% (12.0 - 20.3) [23] have higher results.

Global estimates recognize that one in 10 people (10.2%) with DR will have vision impairment [32].

In this investigation the prevalence of DR with threatened vision is 4.9% (3.1% - 6.8%), similar to Hungary with 4.3% (2.8 to 5.8) [22] which are lower than Jazan, it has 5.7% [26], and others like Suriname, it has 8.0% (5.7 - 10.2) [17], Cape Town with 10.0% [21], Gilan in Iran with 8.0% [24], still higher in Moldova with 14.6% (11,3 - 1,0) [20], in Taif with 15.4% [25] and in Chiapas with 21.0% (16.4 - 25.7) [23].

Blindness for DR is irreversible, since when it reaches an advanced state and the efforts that can be made are few and in many cases none.

DR is responsible for 1 to 4.8% of blindness globally [29,36]. The latest estimates for 2015 are 1.0% [37] similar to our study.

The prevalence of DR blindness, which was found in the other published preventable blindness studies, was very similar to those found in this study 1.0% since in Chiapas 1.4% was reported [23], in Jazan 1.0% [26] and in Moldova 0.5% [20].

Conclusion

Our study conclude that: the prevalence of Diabetes Mellitus in Cuba in people 50 years of age and older is low, differs from global estimates and similar studies published, the greatest risk of getting sick is for the older adult and the female sex. Cuban health programs for diabetic care allow a low risk of developing diabetic retinopathy, including the proliferative form of the disease, and of suffering visual impairment from this cause.

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