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Research Article

Diabetes and Metabolic Disorders,a Study amongPopulation of Adults inTebessa (City of Eastern Algeria)

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Abstract

Diabetes is now a truly global disease in particular because of the problems associated with it.

This study aims to establish the relationship between diabetes and some biochemical parameters to assess the metabolic profile of a diabetic population in Tebessa. For this we conducted a cross-sectional survey at the Public Health facility nearby (Department Of Health: DOH) and the house of the diabetic inTebessa. This study included 200 subjects (100 controls and 100 diabetic) aged 18 to 85years, chosen quite randomly.

The results obtained show that DNID (37%) was significantly more frequent than DID (13%). It is significantly more frequent in women than in men. The diabetes is strongly correlated with the age and BMI. They thus indicate that two types of diabetics have significantly more diseases and metabolic disorders than control subjects. This study confirms the data and the results of other work as well as those in the literature. In the end, we find that diabetics especially type II have significantly higher metabolic disorders and associated diseases than control subjects.

Keywords:Diabetes; DID; DNID; BMI; biochemical parameters.

Introduction

In less than a quarter of a century, the diabetes mellitus became a major public health problem in developing countries [1-2]. Nowadays, it is among the five main chronic diseases for which the WorldHealth Organization (WHO) recently published a report calling for action [1].

Diabetes mellitus is a chronic non-communicable disease due to either genetic or acquired deficiency in production of insulin (type I diabetes), or lack of action of this hormone (type II diabetes). It is considered a serious public health to its frequency, its social cost and its complications [3]. In fact, nearly 100 million cases of diabetes are reported and rependus worldwide [4]. Different clinical forms of diabetes mellitus share hyperglycemia, usually chronic [5-6], and sometimes hyperlipidemia and / or hyperproteinemia and consequently the ability to grow after a few years of degenerative complications [5-7]. Indeed diabetics are generally more affected by different diseases including obesity, hypertension, micro-angiopathy and metabolic syndrome [7].

In addition, type II diabetes is the leading public health, particularly in Europe where 10 million people, or one in 25 of the total population, are diabetic [8] . Experts predict a global epidemic in the next 25 years, where they announced an alarming figure for the number of diabetics could reach 300 million worldwide [9-8].

In Algeria, the prevalence of this disease is constantly increasing both in urban and rural populations [2]. Thus, the number of diabetics has increased from one million in 1993 to more than 2.5 million people in 2007, representing 10% of the national population in 2010[10-11].

Globally, the risk of developing type I diabetes is low; because it is in fact influenced by inherited genetic factors. However, the risk of developing type II diabetes is higher. This risk increases with

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age, where studies have shown that 20% of people over 65 years suffer from type II diabetes [12-13-8]. It is a multifactorial form. In addition to environmental and cultural factors, there is a strong genetic component [2-11]. Heredity, inbreeding, geographical and ethnic variations also play an important role. Factors such as body mass index (BMI), age group, reduced physical activity and dyslipidemia are also determinants[11].

The significance that takes diabetes in the world in general and in developing countries in particular, this study focuses on studying this problem in the Wilaya of Tebessa (Northeast Algeria). This work represents a cross-sectional survey conducted in two hospital settings in Tebessa, which aims to evaluate the metabolic profile of patients with type I and II subjects, and to determine the impact of diabetes in the development of other pathologies.

Materials and methods

Part of the study and data collection

This is a prospective cross-sectional survey conducted at the laboratory of Public Health Facility proximity (Department Of Health: DOH) and the house of diabetic in Tebessa. This study included 200 subjects of both sexes, including 100 diabetic patients (26 type I diabetic subjects and 74 subjects with diabetes mellitus type II) and 100 control subjects selected quite randomly.

During the course of the investigation, age, sex, metabolic status (fasting glucose, total cholesterol, HDL, LDL, triglycerides, creatinine, and uric acid) and physical examination (weight, size, various pathologies associated with diabetes) were performed.

Biochemical assay and anthropometric measurements

The biochemical parameters (glucose, triglycerides, total cholesterol, HDL, LDL, creatinine and uric acid) were measured using a digital mark BIOCHROMLIBRAS1 spectrophotometer.

As for body weight, was determined using a portable scale 150kg range, brand SECA, to the nearest gram. Blood pressure was measured by a manual sphygmomanometer Brand PIC.

For each subject, all the data collected during an interview and the results of biochemical tests were recorded on a record individual survey.

BMI was calculated based on simple measures of body weight (kg) and height (m): BMI = Weight / (Height) ^{2}

The subjects investigated are classified into 3 groups according to the anthropometric parameters, including BMI: normal weight (BMI between 18.5 and 24.9 kg / m^2), overweight subjects (with a BMI between 25 and 29.9 kg / m^2) and obese subjects (BMI ≥ 30 kg / m^2). Then, obese subjects were grouped into three classes: Class I: moderate obesity (BMI 30 to 34.9 kg / m^2); Class II: severe obesity (BMI 35 to 39.9 kg / m^2); and Class III: massive or morbid obesity (BMI ≥ 40 kg / m^2) [14].

Statistical analyses

All results were reported on average with standard deviation. The Student t test was used to compare the means between age, height, BMI and various biochemical parameters in diabetic subjects with two types with the averages of these parameters of controls. Comparison of percentages of sex, hypertension and microangiopathy between the two types of subjects studied was performed using the Chi-square test (χ^2). The Pearson correlation test was used to identify the relationship between blood glucose, the parameter characteristic of diabetes, and share the various biochemical parameters and hypertension other. At a significance level alpha = 0.05, treatments and data analyzes were done using Minitab Version 15 software Staistica 9.0 and Excel 2007.

Results

Age and sex

The study population is characterized by an age between 18 and 85 years, with average of 47, 44 ± 16.84 years. The average age of controls for a range of 18 to 72 years is significantly different (P = 0.001) in the mean age of diabetic subjects ranged from 19 to 85 years. Whether men or women, diabetics were statistically significantly older.

Diabetic subjects with type II being significantly older than patients with type I subjects (Table 1).

About sex, women were significantly (P = 0.004) more numerous in the two study groups. However, there are no significant differences between sex in diabetics and controls subjects whatever the type of diabetes.

The study of the correlation indicates that there is a statistically significant relationship between blood glucose and age of the control subjects (r = 0.154, P = 0.025), as well as the diabetic subjects of both type I (r = 0.075, P = 0.046) and type II (r = 0.128, P = 0.006) regardless of sex.

Table 1: Distribution of the population according to age and sex (P value obtained is that of Student's t test).

Parameters	Men	Women	sexes combined
control subjects			
N (%)	38	62	100
Age (years)	39,26 ± 15,22	40 ± 15,44	39,72 ± 15,29
Type I diabetes			
N (%)	26,93	73,07	100
Age (years)	40,71 ± 21,24	48,16 ± 16,63	46,15 ± 17,85
P	0,714	0,068	0,072
Type II diabetes			
N (%)	31,08	68,92	100
Age (years)	59,35 ± 10,75	57,88 ± 12,63	58,34 ± 12,02
P	<0,001	<0,001	<0,001

Body measurements (weight, height and BMI)

Diabetics (type I and II) have an average BMI and middle weight significantly higher than control subjects. While the controls have sizes relatively higher than those of diabetic subjects (Table 2).

The percentages obtained for the different classes of BMI are shown in Figure 1.

In diabetic subjects, regardless of the type of diabetes, obesity was significantly (P = 0.001) more frequent (type I: 53.77% type II: 53.92%), whereas in control subjects the most important part is that of normal weight (43%). Diabetics are significantly more obese than control subjects.

Diabetics type II were significantly (P <0.001) obese and overweight than diabetics type I.

The study of correlation revealed a positive and significant relationship between blood glucose and BMI in type I diabetic subjects (r = 0.013, P = 0 .002) and type II (r = 0.114, P = 0.001) regardless of sex. Thus, in control subjects (r = 0.331, P = 0.001).

State personal health

The microangiopathies include nephropathy, retinopathy and diabetic neuropathy. Taking into consideration the type of diabetes and sex, diabetic patients with type I and II have significantly more personal history than control subjects (Table 3).

The results indicate that hypertension was significantly (P = 0.003) more common in type II diabetic subjects regardless of sex. Despite the non-dependence revealed by the χ^2 test, it is interesting to note that microangiopathies are more common in diabetics type I particularly in female sex.

All biochemical parameters studied were significantly higher in diabetics of both types than in control subjects, except for HDL cholesterol was significantly higher in control subjects (Table 4).

Taking into consideration the type of diabetes, we find that there is no significant difference between subjects with diabetes type I and II.

The study of the correlation between blood glucose and various biochemical parameters shows that there is a significant positive correlation between blood glucose and all these parameters (Table 5).

Discussion

The age of the subjects surveyed presents figures of the same order as in numerous publications, in which the average age of diabetes was 54.7 ± 14 years regardless of sex and type of diabetes[15-16]. The

Table 2: Distribution of total population by the means of anthropometric parameters (P: probability value of the Student test).

	control subjects	Type I diabetes	P	Type II diabetes	P
weight (kg)	71,38 ± 13,6	75,08 ± 17,6	0,026	77,73 ± 15,28	0,005
size (m)	1,62 ± 0,12	1,56 ± 0,12	0,307	1,58 ± 0,13	0,321
BMI (kg/m²)	28,65 ± 7,49	31,52 ± 9,56	0,016	31,78 ± 8,33	0,012

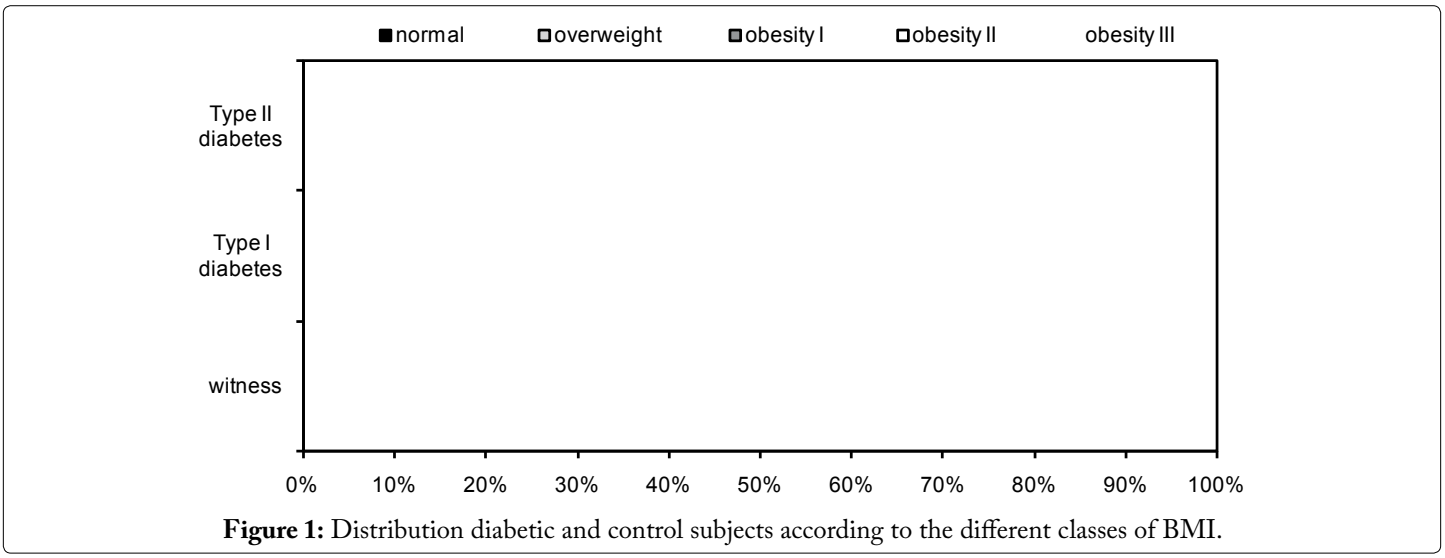

Figure 1: Distribution diabetic and control subjects according to the different classes of BMI.

Table 3: Distribution of the population according to personalhealth. (P : probability value of χ^2 test).

	Control subjects	Type I diabetes	*P*	Type II diabetes	*P*
HTA	21%	39%	0,006	62%	<0,001
Microangiopathies	5%	43%	<0,001	32%	<0,001

Table 4: Distribution of total population by biochemical parameters.

	Control subjects	Type I diabetes	*P*	Type II diabetes	*P*
Glycemia (g/l)	0,95 ± 0,24	2,17 ± 0,95	<0,001	2,74 ± 0,99	<0,001
Total cholesterol (g/l)	1,72 ± 0,53	2,12 ± 0,69	0,009	2,09 ± 0,74	0,008
HDL cholesterol (g/l)	0,55 ± 0,20	0,38 ± 0,12	0,003	0,42 ± 0,14	0,004
LDL cholesterol (g/l)	1,10 ± 0,44	1,59 ± 0,66	0,016	1,87 ± 0,58	0,001
Triglycerides (g/l)	1,50 ± 0,81	1,86 ± 1,31	0,005	1,94 ± 1,45	0,004
Creatinine (mg/l)	9,58 ± 4,02	13,20 ± 8,44	0,043	13,96 ± 11,60	0,013
Uricacid (g/l)	35,71 ± 14,22	40,77 ± 16,79	0,002	38,78 ± 15,08	0,008

Table 5: Study of the correlation between blood glucose and various biochemical parameters.

biochemical parameters	Control subjects		Type I diabetes		Type I diabetes	
	r	*P*	*r*	*P*	*R*	*P*
Glycemiavs Total cholesterol	0,520	<0,001	0,450	<0,001	0,250	0,018
Glycemiavs HDL cholesterol	0,433	0,048	0,322	0,001	0,120	0,029
Glycemia vs LDL cholesterol	0,637	<0,001	0,241	0,003	0,331	0,040
Glycemia vs Triglycerides	0,170	0,001	0,515	<0,001	0,490	0,001
Glycemia vs Creatinine	0,250	0,012	0,709	<0,001	0,501	<0,001
Glycemia vs Uric acide	0,143	0,025	0,234	0,004	0,165	0,021

type II diabetic subjects in this study were significantly older than subjects with diabetes type I. Figures for the same type II diabetes have been found in other studies, particularly in Chuengsamarn etal. (2013) who reported an average age of 57 years [17] and Radi et al. (2009)whose age was 53 ± noted 10 years [18].

Taking into consideration the type of diabetes, age was significantly correlated with glucose. These results are consistent with other studies such as the National Health Survey conducted in 2005 by the National Institute of Public Health, which shows that the total prevalence of diabetes in Algeria and glucose increased significantly with age especially between 35 and 70 years for type II diabetes [2]. According to Zaoui et al. (2007), the prevalence of diabetes also increases with age [2]. And several studies have denoted an association between age and blood glucose. For example Blickle et al. (2009) in their study on diabetes in the elderly, they showed an increase in blood glucose with age in diabetic subjects[12].

According to Beaglehole Lefebvre (2009), regardless of sex, the prevalence of diabetes increases with age [19]. The risk of developing diabetes (especially type II) increases with age. Indeed, the age group most affected is that of 40-59 years. In the elderly, there is a decrease in insulin secretion and increased insulin resistance [20].

In the study population, women are significantly more likely in both groups of diabetes (type I: 73.07%, type II: 68.91%). These results are similar to other studies. Indeed, the total prevalence of diabetes was 14.2% in Tlemcen; it is higher in women with 20.4% against 10.7% for men [2] .

A survey on the lipid profile in diabetics in Morocco indicates that the prevalence of diabetes is higher among women [21]. Cicolella et al. (2012),have also found similar results [22]. In fact, according Belkhadiret El Alaoui (1993),the distribution of diabetes by sex reveals globally a female predominance (55%), probably related to the high longevity in women [23]. According to Beagleholeet Lefebvre (2009),women who presented with diabetes during pregnancy (gestational diabetes) are at higher risk of type II diabetes[19]. Beyond 65 years, diabetes affects benefit women.

The results indicate that diabetic subjects were significantly more obese than control subjects, and this in both sexes. Taking into consideration the type of diabetes, type II diabetic subjects were significantly more obese and overweight than diabetic's subjects with type I. These results are similar to those obtained by Buysschaert (2012) in his study ObEpi Roche conducted in France in 2009, which found that the prevalence of overweight and obesity in adults over 18 years, is respectively 31.9% and 14.5% . The study also shows that there are 3 times more type II diabetes in overweight and 7 times higher in obese [24].

Fumeron (2005) found that the 25% increase in the prevalence of diabetes in the United States is due to the increasing number of obese [25]. In fact two-thirds of adults with diabetes type II are overweight. In 80% of cases, diabetes is related to overweight or obesity. These results confirm data from the literature, in addition to the inactivity and decreased physical activity, obesity plays a major role through insulin resistance [26].

Obesity is characterized by a chronic condition where the fat cannot store so normal triglycerides, which resulted in the

deposition of lipids in these compartments other than those conferred this function as visceral adipose tissue, muscle, liver, heart and pancreas [27]. Visceral adipose tissue releases a large amount of free fatty acids, which promotes hepatic triglyceride synthesis and stimulates hepatic gluconeogenesis and therefore the increase in blood glucose [28].

In the present study, blood glucose was significantly correlated with BMI in both types of diabetes regardless of sex. Obesity and DNID are closely related in humans. Both have a strong genetic component and are associated with insulin resistance [28]. Indeed, the risk of diabetes increases linearly with BMI: 2% in overweight subjects, 21% obese. Similar results were observed byDarmon (2012), who has studied the relationship between BMI and diabetes [29].

The importance of diabetes as a risk factor for a number of diseases including hypertension and microangiopathy has been reported by many work in the world as those ofBertalFilali et al. (2009) and Bauduceau and Santosh (2013) [30-31]. In this study, a general diabetic subjects have significantly more diseases including hypertension and microangiopathy than control subjects. Regarding hypertensionTurton(2006) observed a link between diabetes and hypertension [32]. Hypertension is readily associated with a constellation of metabolic abnormalities together under the term "syndrome X" which includes: carbohydrate intolerance or non-insulin dependent diabetes (type II diabetes), hyperinsulinemia, hypertriglyceridemia and reduced HDL cholesterol. The same results were found by Bonnet and Laville (2005) [33] .Hypertension is particularly more frequent and severe in type II diabetic subjects [34].

The HTA-type II Diabetes Association is particularly common in the elderly, and is responsible for an increase in cardiovascular risk and an acceleration of the degenerative disease of diabetes. The population of diabetic hypertensive patients is exposed to cardiovascular complications population [35]. According to BauduceauetSantosh (2013), Among 309 patients with type I studied, 120 had at least microangiopathic complication [30]. Support all elderly diabetic requires to set therapeutic objectives, including glucose, adapted to the patient. In the still young diabetic glycemic lowering reduces the risk of microvascular and macrovascular [13].

The results show that all the studied biochemical parameters were significantly higher in diabetic subjects; except for HDL cholesterol was significantly low and strongly correlated with glucose. In fact, according to FondrèdeetChevenne (2001), diabetes mellitus is defined as a metabolic disorder, various etiologies, characterized by the presence of chronic hyperglycemia accompanied by disruption of carbohydrate metabolism, lipid and protein, resulting from a defect in insulin secretion, its activity or both partners [36].

Insulin exerts a different action on carbohydrate metabolism, lipid and protein. It promotes the use of glucose by the liver and its storage as glycogen, whereas adipose tissue increases the uptake and metabolism of glucose by adipocytes and in muscle, it activates capture glucose by the cell and glycogen synthesis [37].

Plasma lipids are purified by the action of lipoprotein lipase which tissue synthesis requires the presence of insulin. It stimulates lipogenesis and inhibits lipolysis in adipose tissue and liver. In addition, insulin decreased the rate of circulating amino acid by increasing the cellular uptake of amino acids, by increasing protein synthesis; the latter is achieved by stimulation of the activation of amino acids and mRNA ribosomal reading, but also by decreasing the proteolysis [24]. Therefore the absence of insulin (type I diabetes) or insulin resistance (type II diabetes) induces the following consequences:

Increases the rate of glucose in the blood responsible for the observed hyperglycemia.

Increases the lipoprotein (total cholesterol, LDL cholesterol, triglycerides) with a decrease in HDL cholesterol in the blood, indicating a dyslipidemia.

Increases the rate of proteins in the blood (creatinine and uric acid) characteristic of renal failure.

Conclusion

Diabetes mellitus is now in Algeria a real public health concern. Its prevalence increases significantly over the years. At the end of this study we find that diabetes is a common disease in Tebessa. All results show a significant relationship between diabetes and different biochemical parameters studied indicating a close link between this disease and certain diseases including hypertension, microangiopathies and obesity. Indeed diabetics especially type II have significantly more metabolic disorders and diseases than control subjects.

This link between diabetes including DNID and many complications highlighted by several studies is confirmed in our work. Disturbances recorded in the results of biochemical balance observations are noted and need further work to better illustrate. Thus, to establish studies a larger scale (regional or national) is required to identify benefit scale of the problem. Countries and national organizations urgently need to invest more in the fight against diabetes in particular DNID.

This work is a first approach to know the link between diabetes and some biochemical parameters. Further of larger studies are needed to better diabetes and its associated pathologies.

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