



ORIGINAL

## Preparation of blueberry blueberry muffins

### Elaboración de muffins de arándanos para diabéticos

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#### ABSTRACT

**Introduction:** diabetes mellitus (DM) is a set of metabolic disorders, whose main common characteristic is the presence of high concentrations of blood glucose persistently or chronically.

**Objective:** prepare a blueberry muffins that allow expanding diabetic feed options.

**Method:** a quantitative, experimental and transverse study was conducted, the study was conducted during the year 2020 at the Santo Domingo de Ecuador headquarters. A study sample of 100 cases was selected to whom the survey was applied and were selected by a simple random sampling. For data collection, a survey was applied under the quantitative approach, divided into three sections.

**Results:** 62 % of the sample is male, 76 % have an age between 18 and 35 years, consume fresh water and natural water by 38 % and fruits and vegetables 46 %, 90 % of respondents would be arranged To consume cakes or muffins that is healthy, 30 % consider the difficult diets to make, it is evident that the % fat of the product is 3,02 %, which is beneficial for people suffering from diabetes.

**Conclusions:** you can see in the study that people like fast food and that they would be willing to eat healthy muffins, appreciating that a healthy product can help change eating habits. It is considered that the most difficult aspect in the treatment of diabetes is to maintain an adequate diet.

**Keywords:** Diabetes; Glucose; Daily Requirement; Healthy Product; Quality of Life.

#### RESUMEN

**Introducción:** la diabetes mellitus (DM) es un conjunto de trastornos metabólicos, cuya característica común principal es la presencia de concentraciones elevadas de glucosa en la sangre de manera persistente o crónica.

**Objetivo:** elaborar un muffins de arándanos que permita ampliar las opciones de alimentación para diabéticos.

**Método:** se realizó un estudio cuantitativo, experimental y transversal, el estudio se realizó en el transcurso del año 2020 en la Sede Santo Domingo de Ecuador. Se seleccionó una muestra de estudio de 100 casos a quienes se les aplicó la encuesta y fueron seleccionados mediante un muestreo simple aleatorio. Para la recolección de datos se aplicó una encuesta bajo el enfoque cuantitativo, dividida en tres secciones.

**Resultados:** el 62 % dela muestra es de sexo masculino, el 76 % presenta una edad comprendida entre 18 y 35 años, consumen agua fresca y agua natural un 38 % y frutas y vegetales el 46 %, un 90 % de los encuestados estaría dispuesta a consumir pastelillos o muffins que sea saludable, el 30 % consideran las dietas difíciles de hacer, se evidencia que él % de grasa del producto es de 3,02 %, el cual resulta beneficioso para las personas que padecen diabetes.

**Conclusiones:** se puede apreciar en el estudio que a las personas les gusta la comida rápida y que estarían dispuestos a comer muffins saludables, apreciándose que un producto saludable puede ayudar a cambiar hábitos alimentarios. Se considera que el aspecto más difícil en el tratamiento de la diabetes es mantener una dieta adecuada.

**Palabras clave:** Diabetes; Glucosa; Requerimiento Diario; Producto Saludable; Calidad de Vida.

## INTRODUCTION

Diabetes is a chronic condition that occurs when the body cannot produce enough insulin or cannot use insulin. It is diagnosed by observing high blood glucose levels. Insulin is a hormone produced in the pancreas. It is required to transport glucose from the blood into the body's cells, which are used as energy. The lack, or ineffectiveness, of insulin in people with Diabetes means that glucose continues circulating in the blood. Over time, the resulting high levels of glucose in the blood (known as hyperglycemia) cause damage to many body tissues, leading to the development of health complications that can be disabling and life-threatening. Hyperglycemia is associated with long-term damage to organs such as the eyes, kidneys, pancreas, heart, and blood vessels.<sup>(1)</sup>

People with Diabetes have a higher risk of developing numerous disabling and potentially life-threatening health problems than people without Diabetes. Consistently high blood glucose levels can lead to serious diseases affecting the heart, blood vessels, eyes, kidneys, and nerves. People with Diabetes have an increased risk of developing infections. In almost all high-income countries, Diabetes is a leading cause of cardiovascular disease, blindness, kidney disease, and lower limb amputation. The growing prevalence of type 2 diabetes in low- and middle-income countries means that, without effective strategies to support better control of Diabetes, the rates of these complications are certain to rise.<sup>(2)</sup>

The global prevalence of Diabetes is increasing rapidly as a result of population aging, urbanization, and associated lifestyle changes. It remains a major cause of morbidity and premature mortality throughout the world.<sup>(1)</sup>

The main goal of diabetes treatment is to maintain the amount of glucose in the blood as close to normal figures as possible; in this way, it is believed that the onset of symptoms and complications can be prevented or delayed. The pillars on which the treatment of Diabetes has been based in recent years are diet, physical exercise, patient education, insulin, and oral hypoglycemic agents. These aspects continue to evolve and develop to achieve the basic objective of treatment for these patients truly.<sup>(3)</sup>

A good lifestyle is based on a set of activities and habits that favor health, preventing the risk of new diseases appearing as well as having control of your health, as in the case of Diabetes, for example in the treatment of this disorder, physical exercise, diet, and pharmacological treatment are the pillars for optimal treatment, the new acquisition of routines establishes a greater commitment to health, not only by following the rules set by the doctor but by the need to be constant in the treatment, based on this, it is observed that people can identify and explain the dynamics that exist in their routines, mainly about the care they must follow according to their treatment.<sup>(4)</sup>

Diabetes mellitus has increased its frequency, and it is stated that there are more than 347 million people with the disease in the world. In addition to this figure, the number of pathologies related to it has also increased. The prevalence of Diabetes Mellitus type 2 increases from 2,6 % between 20 and 44 years old to 11,7 % between 45 and 64 years old and reaches 18,9 % in people over 65 years old. The estimated number of adults living with Diabetes is around 366 million; this corresponds to 8,3 % of the world's adult population.<sup>(5)</sup>

The main complications of Diabetes are avoidable and preventable by controlling glucose levels, as well as blood pressure and cholesterol. This requires that people with Diabetes be highly educated about managing their condition and access to insulin, oral medication, and monitoring equipment.<sup>(2)</sup>

Diabetes is the fourth leading cause of death in Ecuador; it affects all people of different ages and social statuses; taking into account the rates that are increasing in the country, the deficiency in the prevention and control of this disease has visualized a problem that needs a solution, Diabetes can be prevented and controlled. A healthy diet helps protect against poor nutrition in all its forms, as well as non-communicable diseases such as Diabetes, heart disease, stroke, and cancer. Caloric intake should be commensurate with caloric expenditure. Available scientific data indicate that fats should not exceed 30 % of total caloric intake to avoid weight gain. This implies a shift from saturated to unsaturated fats and the gradual elimination of industrial trans fats.<sup>(6)</sup>

One should not think that what one eats and does with the human body is of little importance just because, on principle, we discard foods that irritate the stomach and destroy health. An impoverished diet is not recommended; it should be rich in nutrients.<sup>(7)</sup>

For those mentioned above, the objective of this article is to elaborate on a blueberry muffin that allows for the extension of the options for feeding people with Diabetes.

## METHOD

A quantitative, experimental, and cross-sectional study was carried out because percentages were obtained from the results of the bromatological examination, and numerical data were also obtained from the results of the surveys. A new product has been created, which does not exist in the market, and aims to expand the food options for people with diabetes. The study was conducted in 2020 at the Santo Domingo headquarters in Ecuador.

A study sample of 100 cases was selected to whom the survey was applied and was selected by simple

random sampling.

For data collection, a survey was applied under the quantitative approach, divided into three sections: general data, sociodemographic data, and frequency of consumption, using numerical terms such as name and surname, sex, age, marital status, city, education level, city, which were included in the instrument consisting of 17 questions with the alternatives (never, 1 time a week, 2-3 times a week, 1 time a day, every day, 2 times a day, every day), (yes, no, maybe). It was carried out digitally using Google Forms tools, the data obtained were analyzed, and the necessary operations were performed to transform the results into meaningful information for the research.

With the information collected in the survey, the results are automatically processed in the Excel database, which allows us to observe the exact tabulation of the survey results. The research adhered to ethical principles, respecting the person's individuality, confidentiality, anonymity, and informed consent.

## RESULTS

Table 1 shows the sociodemographic data, in which 62 % were male, the age between 18 and 35 years was the most frequent with 76 % and the basic/high school level predominated with 59 cases.

Table 1. Distribution of cases according to sociodemographic data		
Respondents	100	%
Sex		
Male	62	62
Female	38	38
Age		
18 - 35 years old	76	76
36 - 49 years old or older	24	24
Level of education		
Basic / Baccalaureate	59	59
Third / Fourth Level	41	41
Total	100	100

In table 2 we observe the frequency of consumption in which we can say that we find a higher percentage in the column of 2-3 times a week except in the case of consuming food outside the home and consuming dairy products, which predominates once a week.

Table 2. Characterization of consumption frequencies						
Ask	Never	1 time per week	2 and 3 times per week	1 time a day every day	2 times a day every day	Total %
How often do you eat fruit?	1	17	50	22	10	100
How often do you consume whole-grain products?	10	40	37	6	7	100
How often do you consume food away from home?	18	51	22	3	6	100
How often do you consume dry grains?		23	57	17	3	100
How often do you eat vegetables?		24	51	18	7	100
What is the frequency of dairy consumption?	2	39	37	17	5	100
How often do you consume meat, poultry, fish and eggs?	1	9	39	32	19	100

In table 3 we observe the knowledge of the amount of sugar in foods, and 90 % mention that lettuce contains no sugar at all; 72 % mention that peach contains little sugar and 53 % mention that strawberry contains quite a lot of sugar.

Table 3. Knowledge of the amount of sugar in foodstuffs				
Food	No sugar	Little sugar	A lot of sugar	Total %
Peach	6	72	22	100
Grapefruit	41	55	4	100
Red fruits	11	44	45	100
Cauliflower	84	16	-	100
Carrot	34	63	3	100

Corn Tortilla	63	32	5	100
Broccoli	82	18	-	100
Oatmeal	67	29	4	100
Barley	76	19	5	100
Lettuce	90	10	-	100
Beets	25	54	21	100
Spinach	87	12	1	100
Strawberries	8	39	53	100
Pears	6	51	43	100
Apple	5	46	49	100

Table 4 shows a higher percentage of respondents consuming fresh water and natural water with 38 % and only 3 % consuming milk.

Table 4. Characterization of the consumption of liquids during the day		
	Number	%
Fresh water	38	38
Natural water	38	38
Industrial soft drink, juice or tea	17	17
Milk	3	3
Other	4	4
Total	100	100

Table 5 shows that the majority of respondents consume fruits and vegetables between meals with 46 % and a lower percentage of 4 % consumes nuts and dried fruits.

Table 5. Characterization of foods consumed between meals		
	Number	%
Sweets	6	6
Fruit or vegetables	46	46
Cookies or sweet bread	18	18
Yogurt	14	14
Snack	12	12
Nuts and dried fruit	4	4
Total	100	100

Table 6 shows that 90 % of the respondents would be willing to consume healthy muffins and only 10 % do not agree with the consumption.

Table 6. Willingness to consume healthy muffins for diabetics			
Questions	Sí	No	No Total %
Do you like fast food?	84	16	100 %
Would you be willing to eat a muffin or cupcake that is both healthy and palatable?	90	10	100 %
Would you accept the muffins with stevia, blueberries, whole wheat flour and low-fat milk?	91	9	100 %
Do you eat cupcakes or muffins?	69	31	100 %

Table 7 shows that 44 % of the respondents have family members with diabetes.

Table 7. Presence of diabetes in respondents and family members		
	Number	%
You have diabetes	19	19
Do you have a family member with diabetes	44	44
You do not have diabetes, nor do you have a family member with diabetes, but you are interested in the subject and taking care of your health	37	37
Total	100	100

Table 8 shows that 22 % of the respondents find it bothersome to follow the treatment for diabetes and 15 % do not find it bothersome.

<b>Table 8. Respondents' considerations about diabetes treatment</b>		
<b>Considers the treatment of diabetes to be bothersome</b>	<b>Number</b>	<b>%</b>
Yes	22	22
No	15	15
I am not diabetic	63	63
Total	100	100

Table 9 shows that 21 % of the respondents try to adhere to the treatment regimen and 28 % do not adhere to the treatment.

<b>Table 9. Characterization of treatment adherence</b>		
	<b>Number</b>	<b>%</b>
Yes	21	21
Most of the time	31	31
Sometimes	20	20
Rarely or never	28	28
Total	100	100

Table 10 shows that a higher percentage of respondents find it difficult to comply with the diet treatment, to be exact 30 %.

<b>Table 10. Considerations of the respondents about the most difficult part of the treatment</b>		
	<b>Number</b>	<b>%</b>
Exercises	25	25
Diet	30	30
Medication	18	18
Benedict	1	1
All	6	6
None	20	20
Total	100	100

Table 11 shows that 77 % of the respondents consume muffins or cupcakes 1 time per week and 5 % 3 times per week.

<b>Table 11. Distribution according to consumption of muffins or cupcakes</b>		
<b>Frequency</b>	<b>Número</b>	<b>%</b>
1 time per week	77	77
2 times a week	18	18
3 times a week	5	5
Total	100	100

Table 12 shows that 77 % of the respondents mentioned that a healthy product can serve to change a person's eating habits and 27 % mentioned that it depends on the person.

<b>Table 12. Respondents' considerations on the effect of healthy products on eating habits</b>		
	<b>Number</b>	<b>%</b>
Yes	77	77
No	0	0
Depends on the person	23	23
Total	100	100

Table 13 refers to the report of the bromatological examination, which shows that the fat content of the

product is 3,02 %, which is beneficial for people suffering from diabetes.

**Table 13.** Bromatological analysis of the product  
(healthy muffins for diabetics)

# of samples	3068
Identify	Blueberry muffins, whole wheat flour and stevias
% of fat	3,02
% of protein	2,73
% of fiber	1,04
Energy (KOLPCAL/100g)	407,7

## DISCUSSION

Diabetes is a serious and costly public health problem that affects everyone regardless of age or socioeconomic level; the diabetes program should be framed within the policies and health plans of each country and fundamentally should be adapted and integrated into the administrative structures of each one of them, millions of people do not know they have the disease or some even though they know they do not receive appropriate treatment. The impact of diabetes on societies and individuals is underestimated. Many diabetic patients whose disease is poorly controlled have an increased risk and high incidence of heart attacks, stroke, blindness, renal failure, amputation, and premature death; this disease not only shortens productive life but has serious repercussions on the quality of life of the patient and his family.<sup>(8)</sup>

There is no current research in Ecuador on the creation of healthy products, health personnel does not raise awareness about nutrition, and people do not have the decision to want to change their eating habits; on the other hand, there are no specific food services for people with diabetes which do not provide or encourage good lifestyles. Diabetes is of great importance for Ecuador since it is considered a public health problem. Part of the state's intervention in this problem is to guarantee the quality of care these patients receive.<sup>(9)</sup>

Noguera Castillo CP<sup>(10)</sup> states that it is complicated to maintain an adequate diet because not all places have food for people with diabetes. Then, what do they consume and practice the use of insulin? For example, they may only consume a hamburger with some of its ingredients but eat a lighter one. In this way, the interviewees state that events prevent them from eating healthy food daily, recognizing that they practice unhealthy behaviors, such as consuming foods rich in fat, skipping meals, or consuming alcoholic beverages.

The product is suitable for people with diabetes as mentioned in a study conducted by Chulca R<sup>(3)</sup> mentions that the main goal of diabetes treatment is to maintain the amount of glucose in the blood as close to normal figures as possible; in this way, it is considered that the appearance of symptoms and complications of the disease can be prevented or delayed. The pillars on which the treatment of diabetes has been based in recent years are diet, physical exercise, patient education, insulin, and oral hypoglycemic agents. These aspects continue to evolve and develop to truly achieve the basic objective of treating these patients.

Noguera Castillo CP<sup>(10)</sup> mentions that in the same way, diet is an important aspect; they consider that for a correct diet, it is necessary to educate on how to adjust the time, size, frequency, and composition of food so that hypoglycemia can be avoided; and can have negative consequences if not controlled in time, the ideal is to perform frequent measurements before each meal time and a correct follow-up that will allow greater flexibility for caloric intake, it is important to consider that in the case of type 1 diabetes, the patient should frequently monitor their blood glucose levels, which will allow a rational adjustment in the doses of insulin to be injected with similar frequency.

People with diabetes have a higher risk of developing numerous disabling and potentially life-threatening health problems than people without diabetes. Consistently high blood glucose levels can lead to serious diseases affecting the heart, blood vessels, eyes, kidneys, and nerves. People with diabetes have an increased risk of developing infections. In almost all high-income countries, diabetes is a major cause of cardiovascular disease, blindness, kidney disease, and lower limb amputation.<sup>(2)</sup>

Likewise, in another study carried out in Cuba, about the level of knowledge about diabetes mellitus type 2 in patients of a polyclinic, it was evidenced that it is low for 45 % since they presented difficulties in the knowledge about symptoms, clinical classification, risk factors and consequences of the disease. It was also demonstrated in the same study the absence of self-care in type 2 diabetic patients in almost all of them. Difficulties are related to physical exercise, adequate nutrition, and self-monitoring of blood glucose. Knowledge about diabetes and healthy eating contributes to its prevention and treatment. The scientific literature recognizes that the knowledge that patients have acquired about the disease and the treatment allows them to act consciously, stimulating adequate behaviors to face the demands of the treatment.<sup>(11)</sup>

Food Security refers to when there is "at all times, physical and economic access to sufficient, safe and

nutritious food to satisfy needs and preferences, leading to an active and healthy life.” Household Food Security is “when households have year-round access to the quantity and variety of safe food their members require to lead an active and healthy life.” Thus, poor access to food leads to food insecurity. DM and food insecurity in the home may be associated with an increased risk of impaired glycemic control due to several hypotheses: the first is that of the thrifty gene (which proposes an adaptation to be more efficient fat accumulation when food is unpredictable); the secondly, it could be because food insecurity could increase the difficulties of the diabetic patient to follow an appropriate diet; and the third explains that DM2 is highly sensitive to nutritional intake so that poor quality of intake can hurt the patient’s glucose levels, regardless of nutritional status.<sup>(12)</sup>

The proportion of calories provided by the main nutrients in the daily diet constitutes the basic nutritional principles for Diabetes Mellitus: carbohydrates: 55 - 60 %, proteins: 12 - 20 %, and fats: 20 - 30 %. In addition, the diet should provide macro and micronutrients that cover all nutritional needs, so all food groups should be taken: cereals, legumes, fruits, vegetables, eggs, meat, fish, and dairy products, being the balance the fundamental key, especially for diabetic patients.<sup>(13)</sup>

## CONCLUSIONS

It can be seen that people like fast food and that they are willing to eat healthy muffins, appreciating that a healthy product can help change eating habits. It is considered that the most difficult aspect in the treatment of diabetes is to maintain an adequate diet and that a high percentage of people are willing to maintain a healthy diet, so it is considered of utmost importance to raise awareness and elaborate healthy foods for people with diabetes and thus increase their nutritional possibilities.

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#### **CONFLICT OF INTEREST**

The authors declare that there is no conflict of interest.

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