

## Elaboration and sensory evaluation of pecan nut butter (*Carya Illinoensis K*) suitable for people with chronic diseases

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### ABSTRACT

The objective of the present work was to elaborate two butters with pecan nut (*Carya Illinoensis K*), suitable for people with chronic degenerative diseases and with cardio vascular risk. Because are these diseases are one of the leading causes of death in the world. The pecan nut (*Carya Illinoensis K*) is a food rich in monounsaturated fatty acids (MUFAs) such as oleic acid and polyunsaturated fatty acids (PUFAs) such as linoleic acid, which have been shown to be effective in lowering LDL cholesterol levels. A sensorial test was also carried out to see the grade level of this product, finding that it was well accepted by potential consumers. The parameters that most influenced the choice and acceptability of butter were the appearance and consistency.

**Keywords:** butter, chronic diseases, nut, pecan, sensory -

### I. INTRODUCTION

Actually, high interest exists in consuming foods that contribute to maintaining a healthy state, as well as preventing degenerative diseases [1]. Among this type of food are nuts, which are nutritious, tasty, convenient, and easy snack that contribute to a healthy lifestyle. They are typically consumed as whole nuts (either raw or roasted or salted) or used as ingredients in a variety of processed foods, especially in spreads, bakery, and confectionary products, among others [2], [3]. Epidemiologic studies have consistently demonstrated beneficial effects of nut consumption on coronary heart disease (CHD) morbidity and mortality in different population groups [3], [4], [5], [6]. There is speculation that the cholesterol lowering effect associated with nut consumption arises primarily from the fatty acid composition of nuts but may be caused by some other component [4], [5]. Generally, nut oils are rich in monounsaturated fatty acids, predominantly oleic acid, but contain much lower amounts of polyunsaturated fatty acids, predominantly linoleic acid, and small amounts of saturated lipids [3], [4], [5], [6], [7].

The pecan nut (*Carya Illinoensis K*) possesses a series of functional properties that make it a good alternative for an adequate nutrition. The pecan had a high content of proteins (12%) and fatty acids, approximately 63% of these fatty acids are monounsaturated (mainly oleic) and 27% are polyunsaturated fatty acids (mainly linoleic and

linolenic) [3], [8], [9]. Besides, the oxidative stress is common in chronic degenerative disease, and it has been assumed that dietary antioxidants may have protective effect, of this nut; the pecans (*Carya Illinoensis K*) have one of the highest contents of antioxidants [6], [10].

The consumption of nuts in natural form is limited. Children and elderly people cannot easily open the nuts and consume them [2]. Another problem after processing and before consumption of nuts is their storage and handling which influence the quality of the product, and there are many reports about presence of mycotoxins, especially aflatoxin in nuts [2], [11].

Development of new products such as butter of nut and using suitable packaging materials can reduce the risk of losses of product due to contamination to mycotoxins. Development of butter of nut would potentially increase the food uses of nuts and introduce consumers to a healthier food [2]. The term "nut butter" refers to products that contains at least 90% nut ingredients [2], and have a variety of uses, and the most common use is in sandwich preparation. Other uses include as toppings for edible crackers or as dips for vegetable pieces [2], [10].

The overall quality of nut butter is related to the quality of nut paste which is used as the main ingredient. The quality of nut paste is influenced by raw kernel quality, processing conditions such as roasting temperature and time, and storage conditions [13]. Efforts have been made to improve the flavor and texture of nut spreads by addition of

moist ingredients such as honey or several types of flavorings [2].

Finally, the most important characteristic of nut butter is spreadability, it is of utmost importance that the product should have a soft texture and be easily spreadable to avoid tearing the bread or crumbling the crackers. The aim of the present work was to evaluate the sensory characteristics of two pecan nut (*Carya Illinoensis K*) butters suitable for people with chronic diseases.

## II. MATERIAL AND METHODS

### 2.1 Manufacture of nut butters

Pecan nuts (*Carya Illinoensis K var Pawnee*) were purchased from a farm in the municipality of Zaragoza, Coahuila, Mexico. Two nut butters, of nut pecan were made, using the same formulation. For each 100 g of pecan nut, 1.35 g of sea salt and 2 g of sucralose were used. The ingredients were mixed and liquefied until they acquired a viscous consistency. They were packaged and stored at 5 ° C until use. One sample was pre-warmed at 135 ° C for 25 min until it takes on a golden color, this were the toasted sample. And the other sample was not pre-warmed and these were unroasted sample.

### 2.2 Nutritional analysis of nut butters

A nutritional analysis of the samples was carried out in which total fat, total sugars, dietary fiber, protein and sodium were determined using the AOAC methodology [14]. In addition, the percentages of calcium, iron and vitamins A and C were determined through established nutritional tables [15], [16].

### 2.3 Sensory analysis of nut butters

Sensory analysis of two nut butters of pecan nut (*Carya Illinoensis K*) was performed by un-trained panel composed of 50 panelists. The distribution in age was in range between 17-42 years old, and the distribution in female and male was 60 and 40% respectively.

The evaluation was conducted in the Bromatology Laboratory of the School of Health

Sciences, of the Universidad Autónoma de Coahuila, México. The conditions of the sensory room were 25 °C of temperature and white light illumination. A hedonic scale was used from 1 to 7. Being 1 dislike very much and 7 like very much and 3 was the rejection point. The attributes of appearance, color pleasant, consistency, smell nut, pleasant smell, nut taste, sweet taste, salt content, pleasant taste and general taste were evaluated.

### 2.3 Experimental Design

For the analysis of the nutritional analysis of nut butters of pecan nut (*Carya Illinoensis K*), a multiple comparison test of Tukey HSD (p=0.5) was used. Sensory analysis data were analyzed using a Kruskhal-Wallis test. Duncan test was applied to compare sums of ranks and principal component analysis (p=0.05). Data analysis was carried out using Statgraphics Centurion XV software version 16.1.15 Statpoint Technologies, Inc. Warrenton, Virginia

## III. RESULTS AND DISCUSSION

### 3.1 Analysis of nutritional content

Two nut butters (*Carya Illinoensis K*) were evaluated, nutritionally evaluated, without found significant differences between them (p=0.05). It was determined that for each 30 g of pecan nut butter, the product has energy value of 223.2 Cal, equivalent to 933.8 kJ, this energy was obtained of: 23.3 g of total fat, 4.32 g of carbohydrates and 3 g of protein (Table 1) [8], [9], [16].

The resulting product had a high number of calories, and most of these were fat. However, it is important to remember that although traditionally the nut it was considered as unhealthy due their high fat content, recent epidemiologic and numerous clinical studies, have provide evidence that frequent nut consumption is associated with favorable plasm lipids profiles [3], [5], [17], [18]. It has been shown that 30 g serving of nuts, it helps to reduce total cholesterol and LDL cholesterol, [5] the consumption of nut fatty acids can decrease cardiovascular risk [5], [17].

Nutritional facts	200 g	Portion 30 g (2 Teaspoons)
<b>Energy</b>	1488 Cal / 6225.7 kJ	223,2 Cal / 933.8 kJ
<b>Total fat</b>	155,55	23.3
<b>Total carbohydrates</b>	28,8 g	4.32 g
<b>Dietary fiber</b>	20 g	3 g
<b>Protein</b>	20 g	3 g
<b>Glucose</b>	8 g	1.2 g
<b>Sodium</b>	1.1 g	55 mg
<b>Sucralose</b>	1g	15 mg
<b>Cholesterol</b>	0 mg	0 mg
<b>Iron</b>	28 %*	4.2 %*

<b>Calcium</b>	14 %*	2.1 %*
<b>Vitamin C</b>	2 %*	.3 %*
<b>Vitamin A</b>	2 %*	.3 %*

**Table 1.** Nutritional facts of pecan unroasted butter nut (*Carya Illinoensis K var Pawnee*)

\* Based on a diet of 2000 Calories

The product is low in sugars so it is also suitable for diabetic patients. It can be consumed as part of the breakfast or as a snack for athletes who need to replenish energy and protein after intense exercise, or for those people who need to gain weight for some reason [18].

### 3.2 Sensory analysis of pecan nut butter

The sensory analysis data of the two pecan nut (*Carya Illinoensis K*) butters elaborated in the present project are shown in table 2. Both toasted and unroasted samples had an equal acceptance in the general taste ( $p=0.05$ ) of the judges. However, the two samples showed significant differences ( $p=0.05$ ) in some of the evaluated parameters, such as appearance, pleasant color, consistency, nut smell, pleasant smell and nutty taste. The unroasted pecan nut, had the highest acceptance in those parameters. This was chosen as the most attractive in the parameters of appearance and consistency because toasted nut butter had a slightly viscous appearance and consistency that which did not please the judges. This changes in consistency also coincided with

what was reported for soy-butter where it was found, that the roasted altered the viscosity and texture significantly [19], this are because the moisture content of nuts was reduced [2], [20]. This was very important because, the consistency and texture are of the sensory properties of foods that play a major role in consumer appeal, buying decisions and eventual consumption. It was found to be the single most dominant attribute of consumer preference of foods [2], [21]. The appearance was influenced for several factors between these the color, and this is another important attribute used by consumers to judge the acceptability of food products [22]

As for the parameters of smell and nutty taste these were affected by the action of heat, as in many cases in which conventional heat treatment is used. Changes in the taste were because in the case of roasted nuts, the volatile profiles are highly complex and are composed of compounds arising not only from lipid oxidation, but also from Maillard reaction, Strecker degradation, and caramelization of sugars [2], [23], and these combinations influenced the judges selection.

Sample	Tukey analysis HSD 0.05				
	Appearance	Pleasant	Consistency	Nut smell	Pleasant smell
<b>Toast</b>	4.20b	4.86b	4.58b	4.7b	4.96b
<b>Unroasted</b>	5.38a	5.62a	5.26a	5.64a	6.16a
Sample	Tukey analysis HSD 0.05				
	Nut taste	Sweet taste	Salt content	Pleasant taste	General taste
<b>Toast</b>	4.82b	4.0a	4.12a	4.52a	4.68a
<b>Unroasted</b>	5.56a	4.0a	4.24a	4.5a	4.96a

**Table 2.** Analysis of means by the Tukey test HSD  $p=0.05$  of sensory characteristics of two pecan (*Carya Illinoensis K var Pawnee*) nut butters.

The principal component analysis (PC) for toasted and unroasted pecan nut butters samples (Table 3) shows that 75% of the variation is explained by the principal components PC1, PC2 and PC3; the PC1 was influenced by attributes of consistency, pleasant smell, nutty taste, pleasant

taste and general taste, the PC2 by sweet taste and salt content and PC3 by appearance, pleasant color and consistency to the palate (Table 4).

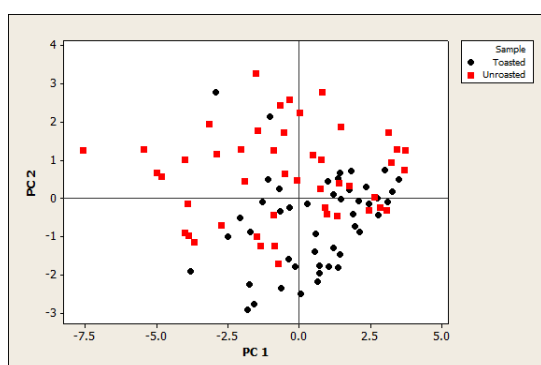
Number	Eigen value	Proportion	Accumulated
1	5.54	0.50	0.50
2	1.78	0.16	0.67
3	0.91	0.08	0.75
4	0.68	0.06	0.81
5	0.60	0.06	0.86
6	0.39	0.04	0.90
7	0.34	0.03	0.93
8	0.28	0.03	0.96

**Table 3.** Values of sensory analysis of two pecan (*Carya Illinoensis K var Pawnee*) nut butters

Variable	PC1	PC2	PC3
Appearance	0.283	-0.303	0.365
Pleasant color	0.267	-0.331	0.376
Consistency	0.314	-0.231	0.357
Smell nut	0.265	-0.424	-0.47
Pleasant smell	0.305	-0.35	-0.375
Nut taste	0.349	0.06	-0.257
Sweet taste	0.29	0.304	-0.211
Salt content	0.239	0.318	-0.05
Pleasant taste	0.351	0.3	-0.089
General taste	0.351	0.291	0.072

**Table 4.** First three principal components of the sensory analysis of pecan nut butters (*Carya Illinoensis K var Pawnee*)

By plotting (Figure 1) the results of the first major component against the second, there is no defined trend as to which were the best samples for the consumer, which is a positive aspect because it means that both samples had approximately the same acceptance and can be used according to the taste of the consumer, with similar beneficial health effects. This is consistent with the Tukey test of the general taste parameter.



**Figure 1.** Comparison of the first major component versus the second major component in sensory analysis of samples of pecan (*Carya Illinoensis K var Pawnee*) nut butters

#### IV. CONCLUSIONS

The two nut butters of pecan (*Carya Illinoensis K*), roasted and unroasted, were well accepted by consumers. The parameters that most influenced the choice and acceptability of butter were the appearance and consistency. The toasting process significantly affected the consistency of the butter since it altered the viscosity and texture by reducing the moisture content of nuts and changed the color, smell and taste of the product.

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