CSIR Advanced Agriculture and Food

Report 1

Analysis for Yolanda Farming Pecan nut Butter

by

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Title:	Nutritional Analysis for Pecan nut Butter
Keywords:	Pecan nut Butter
Objective:	To determine the nutritional, microbial and stability of the product
Methodology:	The pecan nut butter is an already formulated and ready to eat product. The nutritional content and safety of the product was evaluated.
Conclusions:	Nutrient content was analysed and showed that the product is comparable to products that are already in the market. The product is safe for consumption and does not contain pathogenic bacteria such as Salmonella and Listeria.
Limitations or Risks:	None
Contract Context:	This document is the result of a research funded by DARRLD

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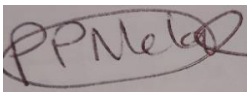
By	Pumeza Melane		29 May 2023
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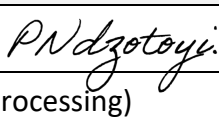
By	Ms Phatheka Ndzotoyi		30 June 2023
Designation	Research Group Leader (Agroprocessing)		

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1 Summary

The overall aim of the project was to contribute to improved access to markets of food products produced by small enterprises.

The main objective of the current project was to evaluate the nutritional quality, microbial quality, as well as the shelf stability of Yolanda's pecan butter. The pecan butter product was high in energy content (3089 kJ/100g), fat content (72.7 g/ 100g) and potassium content (500 mg/100 g). It was low in sugar and sodium.

The pecan butter is microbiologically safe, as it does not contain any pathogenic bacteria like Salmonella. The overall microbial counts are within the acceptable levels of ready-to-eat products (10^4)..

2 Background

Yolanda Farming is a small enterprise based in Gauteng in the Vaal region. The enterprise manufactures pecan butter at a small scale, in their farm premises. Pecan is one of the oldest nut crops that occur naturally in northern USA. The name “pecan” originates from the Algonquin Indian word “pacaan”, which include the walnut and hickory, and is used to describe “nuts that need to be cracked by a rock” (Venkatachalam, 2004). The pecan is a tree nut in the hickory family with a crunchy texture and sweet flavor. Pecans have a sweet, nutty, buttery flavor, and can be eaten as a snack, fresh (raw) or roasted. They can be used whole, chopped, or ground in baked goods and are often placed on top of cookies, pies, and cakes as decoration. They are also an excellent addition to ice cream, either mixed in or as a garnish.

Plant foods, such as nuts are seen as an important part of a healthy diet. Tree nuts have a wide range of health benefits, which include reducing the risk for coronary heart disease, hypertension, type II diabetes and obesity (O’Neil et al., 2010).

Yolanda farming produces pecan butter in their farm in the Vaal. The enterprise needs assistance with nutrient analysis of the product as well as the microbial quality and shelf life of the product.

3. Objective

The objectives of the study are as follows:

- To determine the nutritional content of Yolanda's pecan nut butter
- To determine microbial quality and shelf stability of the pecan nut butter

4. Methodology

Sample delivery

The small businesses were requested to bring in 12 samples for the different types of analysis that will be conducted. The pecan nut butter samples, packaged in glass bottles were delivered at CSIR by Yolanda from Yolanda Farms. There were 7 samples that were delivered. The samples were prepared for analysis and for shelf-life evaluation. The pecan nut butter was analysed for nutritional content, microbial quality, and shelf stability for 2 weeks as there were no more samples for further analysis.

4.1 Nutritional analysis

The nutrient content of the bottled pecan nut butter was determined in triplicate using standard nutrient analysis methods.

The moisture content was determined according to the AOAC method (1990). Exactly 2 g of each of the samples was weighed into clean, dry pre-weighed crucibles. The samples were dried in a hot-air drying oven at 105°C for 3h. The dried samples were transferred into a desiccator and allowed to cool to a constant weight. The dried sample weights were recorded and the difference in weight was calculated as a percentage of the original sample.

The total ash was determined according to the Association of Official Analytical Chemists (AOAC) method (1980). Ash content was determined gravimetrically by igniting the sample in a furnace at 550˚C for 5 hours.

Crude protein analysis (total N) was conducted according to the AOAC (1990) method as described by Sader et al (2004), using the LECO FP 528 Nitrogen analyser (LECO Corporation, St. Joseph, MI 49085). The LECO Nitrogen analyser uses the Dumas combustion method, where organic nitrogen is converted to nitrogen gas. The nitrogen in the sample was converted to % protein using a factor 6.25.

Mineral content was determined by accurately weighing 3 g sample, and ashing in a porcelain crucible at 550 ºC. The ash was dissolved in HNO3/HCl/H2O (1:2:3) and heated on a hot plate. Deionized water was added, and the crucible content transferred to a 100 mL volumetric flask by filtration and volume made up. The mineral solution was analysed for the elements by atomic absorption spectroscopy using the Varian Spectra atomic absorption spectrophotometer (Varian Australia Pty Ltd, Mulgrave, Victoria).

The fat content of the pickled pecan nut butter was determined using Soxhlet extraction method as described by Enyisi et al (2014). The fatty acid profile was determined using gas chromatography after derivatisation of the fatty acids to methyl esters.

The Crude fibre (total dietary fibre) was determined gravimetrically after chemical digestion and solubilization of other materials using 1.25% sodium hydroxide and 1.25% sulphuric

acid (Official Methods of Analysis, Assoc. Off. Anal. Chem., 1984). The fibre residue weight was then corrected for ash content after ignition.

The carbohydrate content of the samples was calculated as weight by difference between 100 and the summation of other proximate parameters as follows:

Carbohydrate content = 100 – (Moisture + Fat + Protein + Ash + Fibre)

The vitamin analysis was outsourced to an accredited food testing laboratory.

4.2 Microbial quality analysis

The microbial quality of the pecan nut butter samples was analysed in triplicate. The microbial analysis methods are described by Khanom et al (2016). The samples were aseptically homogenized in normal sterile saline, and serial dilutions prepared using the saline solution. The total bacterial count was determined using nutrient agar, followed by incubation at 37 ^{o}C for 18 to 24 hours. The presence or absence of *Staphylococcus aureus* was determined using Mannitol Salt Agar (MSA), while total Enterobacteriaceae was enumerated using Violet Red Bile Salt Glucose agar (VRBG), followed by incubation at 37 ^{o}C for 24 hours. The yeast and moulds were enumerated using Potato dextrose agar (PDA) and Malt Extract Agar, and the plates were incubated at 25 ^{o}C for 48 to 72 hours. The enumeration of pathogenic bacteria, Salmonella and Listeria was done at accredited labs. The presence or absence of salmonella was determined using brilliant green agar plates, while Listeria selective medium (Oxoid) was used to detect Listeria. The methods are described by Gast and Beard (1992) and Public Health England publication (2018) for *Salmonella* spp and *Listeria* spp respectively.

4.3 Shelf-life evaluation

The shelf life of pecan nut butter was supposed to be determined over a 6-week study, but due to insufficient number of samples, the accelerated shelf life was conducted for 2 weeks. The samples were assessed for microbial quality at predetermined intervals.

5. Results and Discussion

5.1 Nutritional results – Yolanda Pecan nut butter

The nutritional content of Yolanda's pecan butter is shown in Table 1. The results show that the pecan nut butter has proven to be a rich source of energy, potassium, calcium, and magnesium. Potassium helps heartbeat stay regular as well as moving nutrients into cells and waste products out of cells. Pecan nuts which are the main ingredients of the product, are known as good source of calcium, magnesium, and potassium, which help lower blood pressure. The product has protein of (11.7g/100 g) and high fat content of 72g/100g. The fat content is made up of different types of fat, one being of monosaturated fats. Monosaturated fatty acids are healthy fat andeating foods with monounsaturated fat instead of foods high in saturated fats can help lower levels of bad Low Density Lipoproteins (LDL) and cholesterol, also Omega 6 fatty acids help increase protective cholesterol.

Pecan nuts are naturally sweet, and the pecan butter is low in sugar, which proves that the product doesn't have added sugar, it is also low in sodium. The pecan butter is low in iron and has presence of Vitamin C and Vitamin B6.

Table 1: Nutritional Content for Yolanda's Pecan nut Butter

Tests	**Results**	**Units**
Moisture	3.45	g/100g
Energy	3089	kJ/100g
Carbohydrates	4.36	g/100g
Protein	11.7	g/100g
Total Dietary Fiber (TDF)	15.8	g/100g
Fructose	<0.50	g/100g
Galactose	<0.50	g/100g
Glucose	<0.50	g/100g
Sucrose	3.53	g/100g
Maltose	<0.50	g/100g

Tests	Results	Units
Lactose	<0.50	g/100g
Total Sugars	3.53	g/100g
Total Ash	2.51	g/100g
Total fat	72.7	g/100g
Saturated fatty acids	6.36	g/100g
Monounsaturated fatty acids	46.6	g/100g
Polyunsaturated fatty acids	19.8	g/100g
Trans fatty acids	<0.10	g/100g
Omega 3 fatty acids	0.894	g/100g
Omega 6 fatty acid	18.9	g/100g
Sodium (Na)	<5.00	mg/100g
Calcium (Ca)	42.4	mg/100g
Magnesium (Mg)	141	mg/100g
Potassium (K)	500	mg/100g
Iron (Fe)	<5.0	mg/100g
Vitamin B6	2.3	mg/kg
Vitamin C	28	mg/kg

5.2 Microbial Quality of Yolanda's pecan butter

The microbial quality of the Yolanda's pecan butter is shown in Table 2. According to the results, the Pecan Butter is acceptable and safe for human consumption as it does not contain any pathogens such as Salmonella. The microbial activity is at an acceptable range/standard.

Table 2: Microbial quality of Yolanda's Pecan Butter

Test	Results	Units
Escherichia coli	No growth	/25g
Enterobacteriaceae	No growth	cfu/g
Salmonella	Absent	/25g
Total Microbial Activity	50	cfu/g

5.3 Shelf life for Yolanda's Pecan Butter

The accelerated shelf-life studies were meant to be for 6 weeks, but due to Yolanda Farming not being able to provide all required samples, shelf life was conducted for 2 weeks. Below is a table that shows shelf-life results. The results of the two batches of pecan butter are shown in Table 3. The results show that the product has no high Total Plate Count, high total plate count could cause spoilage. The product is safe as there was no Salmonella detected. Enterobacteriaceae Count was found to be 10 cfu/g, which is acceptable, this indicates that the environment where the pecan butter is being produced is hygienic and that there is no post process contamination. When processing and handling the product, the enterprise needs to ensure that they follow good hygienic processes and to be able to avoid contamination.

Table 3: Shelf-life studies for Peanut Butter

Test	Month 1	Month 2
E.coli Count	No growth	No growth

Test	Month 1	Month 2
Salmonella spp. Detection	Absent	Absent
Enterobacteriaceae Count	10	No growth
Total Microbial Activity	50	10

5.4 Comparison of Yolanda's pecan butter to nut butters in the market

In South Africa pecan nut butter is not well known or popular as peanut butter. For comparison reasons, in Table 4 we are comparing Yolanda's pecan butter to peanut butter and cashew nut butter from Woolworths. The results below are per 100 g serving. Pecan butter is higher in calories and in fat. In addition, pecan butter has low levels of protein. Compared to the peanut butter and cashew butter. The criteria that sets Yolanda's pecan butter apart is its low concentration of carbohydrates and low in sodium. Looking at these nut butters, there is no one size fits all or healthier option than the other, it depends on what one is looking for. Yolanda's pecan butter is naturally sweet with no added sugar compared to the Woolworths peanut butter. Woolworths might have added sugar to peanut butter to make it taste better and makes it more appealing to their consumers especially kids.

Table 4: Comparison of Peanut butter

Nutrient	Yolanda Pecan Butter per 100 g	Woolworths Cashew nut Butter per 100 g	Woolworths Smooth Peanut Butter per 100 g
Energy	3089 kJ	2539 kJ	2502 kJ
Carbohydrates	4.36 g	17 g	17 g
Protein	11.7 g	20 g	24 g
Sugar	3.53 g	4.1 g	12.4 g
Fat	72.7 g	51.8 g	46.8 g
Fibre	15.8 g	7.7 g	8.3 g

Nutrient	Yolanda Pecan Butter per 100 g	Woolworths Cashew nut Butter per 100 g	Woolworths Smooth Peanut Butter per 100 g
Sodium	<5 mg	34 mg	239 mg

6. Conclusion and Recommendations

Pecan butter is not well known in South Africa, there is a gap in the market for Yolanda's pecan nut butter. The product has proven to be safe for consumption. It is comparable to other different nut butters available in the market. Yolanda's pecan nut butter is a source of potassium and relatively low in carbohydrates.

Yolanda 's pecan nut butter is a source of protein, Omega 6, Potassium and Magnesium. The nutritional results and microbial studies have proven that the product is ready to be marketed and sold in the big retailers, as it is currently being sold from home and flea markets. It has a long and stable shelf life but need to practise good quality processing methods and hygiene.

7. References

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