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Study on the utilization of "pumpkin seed" for the production of spread

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Abstract
Pumpkin seed spread is a great nut-free spread for allergic people and packed with nutrients. The study was undertaken with the objective to utilize this lesser known nutrition-rich seed flour for superior quality spread production and their analysis. Dehulled pumpkin seed was used for making spread and compared with peanut butter in terms of composition. Penetrometer study was carried out to determine hardness of spread. Spread was analyzed for proximate composition (according to AOAC method), antioxidant content, oxidative stability, microbiological aspect and sensory evaluation. Penetration study shows that the spread is soft, remains good in quality and its spread ability is within 7 days. Pumpkin seed spread contains less amount of fat (24.8g/100g) and high amount of protein (31.48g/100g) than peanut butter. So it can be concluded that pumpkin seed spread is More Healthy than peanut butter. This product can be used along with biscuits and bread.

Keywords: dehulled pumpkin seed, seed flour, spread

Introduction

A spread is a kind of food product that is semi-solid and can be spread, generally with a knife, onto food items such as bread or crackers. Spread food products are prepared in a paste, syrup or liquid form. Spreads are added to food for enhancing the flavour or texture of the food, which may be considered bland without it. Global food spread market has been segmented into five types, namely Honey, chocolate-based spread, fruit-based spreads, nut and seed-based spreads and others. This study has been carried out with the objective of Preparation of pumpkin seed spread simulating peanut butter with almost similar kind of physical and nutritional property from de-hulled pumpkin seed powder.

The popularity of food spreads can be attributed to their prevalence in traditional breakfast, in Europe and North America. In recent years, the spread market has developed further, with the launch of new innovative flavours. According to the current trend, consumers prefer premium quality products that do not contain artificial ingredients. The global market for food spread is dominated by Europe followed by North America and Asia Pacific. In recent years, Americans have become intrigued with non-peanut spreads due to a rise in peanut allergies and a quest for protein. Thus, seed butters, some of which stay far away from any type of nut, are becoming more popular. Many people with food allergies tolerate pumpkin seeds well. Today, nuts and seeds continue to be enjoyed world-wide in a variety of ways, as recipe ingredients, spreads, snacks, and as a delicacy(King *et al*. 2008)[1]Additionally, nut/seed butters also contain generous amounts of phytochemicals that may be protective against colon, prostate and breast cancer (Mangels 2001) [2]

Pumpkin seed spread is a good replacement to other nut/seed butter recipes, in many cases. It is a creamy blend of pumpkin seeds. It is made by smoothly processing pumpkin seeds, just as any other nut or seed like peanut butter. Pumpkin seeds (*pepita*) are edible kernels of fruit pumpkin. The seeds are semi-flat, featuring a typical ovoid shape with a conical tip. Inside its kernels feature olive-green colour, sweet, buttery in texture and nutty in flavor and have a white outer hull. Pepita is enjoyed as a snack, added in desserts and in savory dishes. The seeds are also concentrated sources of many health-benefiting vitamins, minerals and antioxidants. The seeds of plants affiliated to the family of Cucurbitaceae produce a number of proteins and peptides. Pumpkin seeds are rich not only in proteins but are also a rich source of antioxidants, vitamins such as carotenoids and tocopherols and minerals, while being low in fat and calories (Amin and Thakur 2013) [3]Pumpkin seeds could be utilized successfully as a good source of edible protein (320g/kg) and oil (450g/kg) for human consumption, as well as animal food; at the same time, it minimizes waste pollution (E1-Soukkary 2001) [4] Due to tryptophan, an amino acid, Pumpkin seeds have even been shown to improve sleep. Containing high levels of minerals such as magnesium, phosphorus, manganese, iron, copper, zinc and vitamin E and K, it is a great source for boosting the immune system. (Radocaj *et al*. 2011) [5] Optimized spread formulation from dehulled pumpkin seed oil press-cake. Different studies have been carried out in the utilization of whey protein concentrate in processed cheese spread. Cheese solids were partially replaced by whey protein concentrate solids (Suneeta Pinto *et al* 2007) [6] During the last few years the popularity for the plant based butters (nut and seed butters), has increased considerably. Earlier, peanut butter was the only alternative to the dairy

butter, but over the years, owing to development in the technologies and also the consumer awareness about the plant based butters, development of large varieties of butters with different nuts and seeds has taken place. These are very good sources of protein, fiber, essential fatty acids and other nutrients (Kalyani Gorrepati *et al*. 2015) [7] Food spreads are used in various conventional breakfast items and this has led to their steady growth. The rising health consciousness among consumers has given way to new low calorie spreads.

Materials and Methods

Raw materials

Pumpkin seeds, honey and salt were obtained from the local market.

All the other chemicals, reagents and solvents used in the study were of analytical grade and obtained from Merck Pvt. Ltd**.** Distilled water was used in all the experiments throughout the study.

Composition of Spread

- Dehulled pumpkin seed powder - 80 gm
- Honey-20 ml
- Water-2 ml
- Monoglyceride-0.2 gm
- Sodium benzoate-0.1 gm.

Preparation of dehulled pumpkin seed flour

Pumpkin seeds were collected from the nearby market, cleaned and sundried. The seeds were dehulled manually and ground to a powder by a domestic grinder.

Preparation of dehulled pumpkin seed spread

Dehulled pumpkin seed flour was finely pulverized into flour. Flour (containing 31 % oil) along with other ingredients like honey, salt, mono glyceride (emulsifier), sodium benzoate (preservative), potable water (3%) were homogenized to make a spread with the help of a homogeniser (Remi Motor, RQ 122)

Analysis of spread

Physical Methods

Penetration study of spreads

The firmness of the spreads were determined by a penetrometer (Stanhope-Seta Surrey, England) using the cone-form penetration body with an apical angle of 45^{0}C and a weight of 72.5g. The depth of penetration was measured at 5s at a product temperature of 25^{0}C.

Color Measurement

The color of biscuit samples was assessed using a Konica Minolta color reader CR 10 (Japan) using an aperture of 1.2 cm diameter. In the Minolta colorimeter, the color of a sample is represented by the three color parameters: L, a and b which were recorded for each sample. The L value gives a measure of the product lightness from 100 for perfect white to 0 for blacks as the eye would see it. The redness/greenness is denoted by values (ranging from negative values on the red side to the positive values on green side) and yellowness/blueness are denoted likewise ranging from negative to positive b values. Color is one of the physical properties often used by food customers and manufacturers to qualitatively assess the quality of feed and food materials.

Antioxidant Properties

Antioxidant properties of the product in terms of radical scavenging activity and carotenoid content were determined by following methods.

Radical Scavenging Assay by 1, 1-Diphenyl-2-Picrylhydrazyl (DPPH)

Radical scavenging activity was carried out by slight modification of the method proposed by (Shetty *et al* 1995) [8]

Carotenoid estimation

Carotenoid content was measured according to the method described by (Minguez *et al*. 1991) [9]

Chemical Methods

Proximate Composition

The analysis of the samples for carbohydrate, crude fiber, moisture and ash content were carried out in triplicate using the standard method of Association of Official Analytical Chemists (AOAC 2005)[10] Protein was estimated by following the method of Lowry.

Determination of Fat content Of Spreads

Fat content of spread was determined by the Soxhlet method. 50g of the samples were placed into a cellulose paper cone and extracted using n-hexane in a Soxhlet extractor for 8 hours. The n-Hexane was distilled off and finally removed completely by applying vacuum. The weight of the recovered oil was measured.

Determination of Acid Value

The acid value is determined by directly titrating the material in an alcoholic medium with aqueous sodium or potassium hydroxide solution.

Determination of Peroxide Value

The PV of the oil was measured by the acetic acid-chloroform method (AOCS Cd 8-53 1997) [11] to determine primary lipid oxidation products.

Microbiological Analysis

The total microbial loads of the samples were enumerated in freshly prepared zero and 7 days of cold storage at 100^{0}C as described by (APHA, 2005) [12]. Microbiological quality of samples made were evaluated by enumerating total viable organisms which include total aerobic count of bacteria, E.coli, total coliforms, yeast and molds. 10 gm of samples were homogenized using CM 101 CYCLO MIXER (REMI) vortex stirrer with 90 ml sterile saline (0.85% NaCl) to obtain a 10-1 dilution. Further, tenfold serial dilutions were made using the same diluents till a dilution of 10-8 was obtained. The spread plate technique was used to assess the microbial population. Aliquat (0.1 ml) of suitable dilution was spread plated in duplicates onto prepared, sterile and dried petri dishes of suitable media for the enumeration of different organisms. Plate count agar was used for total viable count, potato dextrose agar was used for the presence of yeasts and moulds and EMB was used for the presence of E.Coli. After inoculating, the plates were agitated, allowed to solidify, incubated and inverted in an incubator at 37^{0}C for 48 hours +/- 2 for total viable counts at 25^{0}C for 3-5 days for yeasts and moulds and 24 hrs for E.Coli. The number of colonies were counted on the plates taking into

consideration the dilution factor, expressed as $\log_{10}$ cfu/ml. Presence of E.Coli was confirmed by the appearance of metallic shin. Microbiological examinations were carried out at 1st and 7rh day of intervals.

Sensory Evaluation

The spread samples were kept at 100^0C until evaluation. Sensory evaluation of the product is measured by using a 9 point hedonic scale. Characteristic evaluation included odor, taste, texture and overall acceptability.

Results and discussion

Physical Methods

Color measurement

The color of a sample is represented by the three color parameters: L, $^+$a and $^+$b. Here, the L value decreases which indicates the darkness of sample.$^+$a and $^+$b values are also low, indicating greenness and blueness of the sample respectively. Color readings are shown in table 1.

Table 1: Color measurement

Sample	Color values		
	L	$^+$a	$^+$b
Dehulled pumpkin seed spread	26 ± 0.25	1.23 ± 0.02	5.06 ± 0.01

[L=Lightness or darkness, $^+$a =Redness or greenness, $^+$b=yellowness or blueness] Data is expressed in mean ±S.D.

Penetration study

After preparing the sample, penetration study was carried out to measure the hardness of spread. Table 2 shows that the first penetration reading is 194.5 (1/10 th mm). After 7 days penetration reading was increased to 212.5 (1/10 th mm). The product becomes More Soft if penetration reading is increased resulting in good quality, but after 14 days the reading was decreased. Finally it can be said that spread remains good in quality and retains its spread ability upto 7 days.

Table 2: Penetration study to measure hardness of spread

Sample	Penetrometer reading (at room temperature)		
	1st penetration reading(1/10 th mm)	After 7 days (1/10th mm)	After 14 days(1/10th mm)
Dehulled pumpkin seed spread	194.5	212.5	170

Chemical Methods

Antioxidant determination

Carotenoid content of pumpkin seed spread is high, resulting in its good antioxidant capacity and the value of radical scavenging activity of spread is within marginal level. Values are shown in table 3.

Table 3: Antioxidant determination

Sample	Value of DPPH-free radical scavenging capacity (%)	Carotenoid content(ppm)
Dehulled pumpkin seed spread	22.42±0.29	42.36 ±0.04

Data is expressed in mean ±S.D.

Comparison Study about the Proximate Composition of Pumpkin Seed Spread and Peanut Butter

In Table 4, the proximate composition of defatted pumpkin seed spread is compared with peanut butter. Table 4 shows that pumpkin seed spread contains a lesser amount of fat (24.8g/100g) and higher amount of protein (31.48g/100g) than peanut butter. It also contains a higher amount of carbohydrate than peanut butter. Finally, it can be concluded that pumpkin seed spread is More Healthy than peanut butter due to its more protein content and less fat content.

Table 4: Comparative proximate composition of the spread and peanut butter

Component analyze	Concentration in spread (g/100g)	Concentration in peanut butter (g/100g)
Moisture	9.2±0.02	2±0.25
Ash	2.6±0.05	1±0.26
Carbohydrate	30.12±0.00	19±0.25
Dietary fiber	2.8±0.12	3±0.06
Fat	24.8±0.1	50±0.15
Protein	31.48±0.01	25±0.25
Energy(kcal)	462.07±0.01	588±0.25

Data is expressed in mean ±S.D.

Oxidative Stability

Measurement of oxidative stability of pumpkin seed oil for preparation of dehulled pumpkin seed spread is shown in Table 5. Peroxide value 2meq/kg of oil indicates that the spread is marginally acceptable and acid value 0.5 indicated good quality of pumpkin seed oil.

Table 5: Oxidative stability of pumpkin seed oil

	Peroxide value(meq/kg of oil)	Acid value
Pumpkin seed oil	2±0.5	0.5±0.15

Data is expressed in mean± S.D.

Sensory Evaluation of Pumpkin Seed Spread

The spread was very unique and versatile both in taste and in terms of flavor. It was very much accepted by the panel members who tasted it. It has a very sweet aroma that is liked and appreciated by all who tasted it. It also had a smooth texture and spread ability. This product can be taken along with biscuits and bread. Table 6 shows the sensory evaluation of spread**.**

Table 6: Sensory evaluation of spread

Sample	Taste	Appearance	Odor	Texture	Overall acceptability
Spread	6.16±0.02	7.16±0.01	8.00±0.76	7.83±0.01	7.83±0.01

Data is expressed in mean± S.D.

Microbiological Analysis of Spread

The microbial populations of spreads made from pumpkin seed flour was evaluated at zero day and after seven days of storage at 10º C. The result shows that total aerobic bacteria and fungi (yeasts and mould) were not detected in the freshly prepared samples while in the samples after seven days of storage at 10º C, the total plate count (total aerobic

bacteria) and the fungal count (yeasts and mould) were in the narrow range of 1-1.4×10^{+3} cfu/g and 1.4-2.2×10^{+3} cfu/g respectively**.** Health Protection Agency Guidelines for Assessing the Microbiological Safety of Ready-to-Eat foods states that in case of Butter or Butter-like products the colony count less than 10^5 (cfu/g) is considered as satisfactory.

The result exhibits that the microbial counts of the pumpkin seed spreads (Total plate count, fungal count) are within the acceptable range at zero day and after seven days of storage at 10º C. Also E.Coli was absent in the spread samples as no metallic shine was observed. Table 7 shows the microbiological analysis of spread.

Table 7: Microbiological analysis of pumpkin seed spread

Sample	Total plate count (TPC)	Potato dextrose agar (PDA)
Dehulled pumpkin seed spread	1×10^{+3} CFU/g	4×10^{+3} CFU/g

Previous study was carried out that possibility of the production of functional low-fat spread of hull-less pumpkin seed flour from rheological and textural aspect. Oil seed cakes are an alternative to manufacturing low-fat spreads in terms of cost-effectiveness as well as for increased protein content.The presented results demonstrate that possibility of producing low-fat functional spread based on hull-less pumpkin seed flour, and a new form of utilization of this raw material(Ivana Nikolic *et al* 2014) [13]

Our study shows that spread made from dehulled pumpkin seed contains lesser amount of fat (24.8g/100g) and higher amount of protein (31.48g/100g) than peanut butter. So it can be said that pumpkin seed spread is More Healthy than peanut butter due to its more protein content and less fat content and it also has good spreadability.

Conclusions

Pumpkin seeds are highly nutritious and packed with powerful antioxidants. Eating them can help solve dietary deficiencies and may protect against various health problems. In fact, pumpkin seeds have been shown to improve heart health, blood sugar levels, fertility and sleep quality. In addition, their rich nutrient content may provide other health benefits, such as improved energy, mood and immune function. In the presented study, dehulled pumpkin seeds were used for making pumpkin seed spread which has a unique natural flavor. It may be concluded from the above findings that the spread which is made from pumpkin seed is rich in nutrients, especially protein and less fat content. Spread is also enriched with carotenoid. It also had a smooth texture and very good spread ability. It is a healthy breakfast choice along with toast and sandwiches. It can also be mixed into smoothies and healthy parfaits. These food choices are popular among different age groups. Pumpkin seeds even have very low instances of allergic reactions, so it makes up for a good alternative to peanut butter.

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