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Aruthra Devi
PG Scholar, College of Food and Dairy Technology, Tamil Nadu Veterinary and Animal Sciences University, Chennai, Tamil Nadu, India

Rita Narayanan
Professor, Department of Food Processing Technology, College of Food and Dairy Technology, Tamil Nadu Veterinary and Animal Sciences University, Chennai, Tamil Nadu, India

Samuel Masilamoni Ronald
Professor, Department of Veterinary Microbiology, Madras Veterinary College, Chennai, Tamil Nadu, India

Manikkavasagan
Assistant Professor, Department of Food Safety and Quality Assurance, College of Food and Dairy Technology, Tamil Nadu Veterinary and Animal Sciences University, Chennai, Tamil Nadu, India

Corresponding Author:
Aruthra Devi
PG Scholar, College of Food and Dairy Technology, Tamil Nadu Veterinary and Animal Sciences University, Chennai, Tamil Nadu, India

Optimization and development of fat spread from pumpkin seeds

Aruthra Devi, Rita Narayanan, Samuel Masilamoni Ronald and Manikkavasagan

Abstract
Nowadays bread symbolizes as one among the primary food. The utility of bread to societies in the old and new world has significantly evolved. Usually butter based spreads are been in use but they are highly criticized for their high fat content. The consumer trend has moved from high fat content food to low or reduced fat foods. In the present study a low fat spread using Pumpkin seeds, Olive oil, Whey powder, Whey protein concentrate, Sodium tri poly phosphate (Emulsifying salt), Garlic and salt, which can have a good keeping quality for a sufficient period of time, was developed. Experiments were conducted for optimization of the product with different proportions of the major ingredients viz Pumpkin seeds, Olive oil and Whey protein Concentrate. The organoleptic evaluation was conducted for optimization of the product. The yield of the product was approximately to be 96.5%.

Keywords: Low fat spread, spread, pumpkin seed, whey powder, whey protein concentrate

Introduction
Nowadays a trend has been switched to new types of spreads especially with lower fat content. Fat spread is a product in the form of water in oil emulsions and a low fat spread normally contain 39-40 percent fat content. Hence can be claimed as half of the fat percentage of butter or margarine. The development of low fat spreads originated during II world war due to the shortages in fat (Keogh *et al.,* 1988) [7]. The low fat spread is in its infancy stage in India. Spreads with fat content 40-60 percent are called as 'reduced fat spreads', products with fat content less than 40 percent are known as 'low fat spreads', product containing 5-15 percent fat and less than 5 percent fat known as 'very low fat spreads' and the spreads with extremely low fat content are sometimes called 'ultra-low-fat spreads' (Dostalova, 2003) [5]. According to CAC (2004) [3], Low-fat dairy spreads containing 39-41 percent fat are sometimes termed as half-fat butter' while those in which caloric reduction is 33 percent are termed as 'reduced calorie spreads'.

Nuts and seeds are considered as the repository of polyphenolic flavonoid, antioxidants such as carotenes, lutein etc which are claimed to be health benefiting compounds. These compounds are found to offer defense mechanism against degenerative nerve disease, Attention Deficit Hyperactivity Disorder (ADHD), cancers, heart diseases and viral infections. Oil seeds and nuts are rich in protein and fat and hence they are a good source of energy. Many of the oil seeds contain all the important omega-3 essential fatty acids such as linolenic acid etc (Kaur and Maruf, 2018) [6]. Pumpkin (*Cucurbita* sp.) seeds are generally considered as agro-industrial wastes and are discarded. Nowadays due to the discovery of the richness of protein, fibres, polyunsaturated fatty acids, minerals in the seeds of pumpkin, they are considered as a valuable source in food industry. The plentiful flat, oval seeds have peculiar flavor with nutty taste which are roasted and salted for consumption in some parts of Europe, USA, Canada and China as snack food. The total unsaturated fatty acid content of the seeds ranges from 73-81 percent of the total fatty acids present. In some parts of the world, the pumpkin seeds are anticipated to avoid kidney stones, prevent osteoporosis, promote ocular health, nourish skin etc (Patel, 2013) [11]. According to Rezig *et al*., 2012 [15], the pumpkin (*Cucurbita maxima*) seeds expressed seed moisture as 8.46 percent on dry weight basis whereas contents of proteins, fibre, ash, fat, and total sugars established at 33.92%, 21.97%, 3.97%, 31.57%, and 0.11% respectively.

Whey is one of the major by products of dairy industry. It contains nearly about 50 percent of total solids present in milk.

As per FAO (2004), world dried whey production is about 2.038 million tonnes. In India the whey production is estimated to about 4.8 million tons (Aneja, *et al*., 2002) [2]. Whey solids are known for their high nutritional content with added functional properties such as emulsification, gelation, therma stability etc. Nowadays, whey protein concentrate are increasingly used in development of many food products replacing traditional food additives such as milk powder, egg albumin based foods, ice cream, etc and also in Indian traditional products such as khoa. Incorporation of whey solids in infant and dietetic foods are in its infancy stage (Kumar, 2015) [8].

Olive oil is obtained from the olive (*Olea europaea*; family Oleaceae), a Mediterranean Basin based traditional tree crop and are produced by grinding and extracting the olives fruit by mechanical or chemical means. Olive oil is mainly composed of the mixed triglyceride esters of oleic acid and palmitic squalene (up to 0.7%) and sterols (about 0.2% phytosterol and tocopherols) (Kumar, 2015) [8]. Olive oil is a functional food, has a high level of monounsaturated fatty acids (MUFA), and also contains multiple minor components with many biological properties. Most of the cardioprotective effects of olive oil with respect to the Mediterranean diet have been attributed due to its high MUFA content (Covas *et al*., 2006) [4].

Sodium tripolyphosphate has also used as an emulsifying salt and as a food preservative. The reason is that it maintains the moisture level of certain foods for extended period of time and creates a shield against microorganisms. As the low-fat dairy spreads contain about 30-60% moisture, excessive free water may lead to poor body and consistency and plasticity defects (Prajapati, 1988) [12].

A low fat spread was prepared using sodium caseinate without the addition of salt and it results in the instability of the spread and was partly in an o/w form. The viscosity of aqueous phase was also lower at 5ºC. Sodium chloride plays a significant role in increasing the viscosity of the spread containing casein. Flavour acceptability of the spread can generally be improved by addition of 0.75-1.25% common salt (NaCl) (Tossavainen *et al.*, 1996) [17].

In conjunction with texture or mouth-feel, flavor is the most important aspect that influences the consumer's acceptability of any food. As a low-fat dairy spread is a blend of different dairy /non-dairy ingredients, it may or may not have the desired flavor. It is thus essential that external flavorings are added to develop or impart the desired flavor (Raj, 2013) [13]. Flavoring systems plays a vital role in the manufacturing of food. Flavorings can also be an important part in nutritional role, particularly in foods that are not very flavorful, by providing the needed appeal (Löliger, 2000) [10]. *Allium sativum* usually known as garlic is a species in the family *Alliaceae*. The genus includes the onion, shallot, leek and chive. Garlic has been used from long back for both culinary and medicinal purposes. It has a characteristic pungent spicy flavor that mellows and sweetens considerably with cooking (Aka and Pilau, 2010) [1].

Materials and Methods

Materials

The pumpkin seeds are procured from the local market of Chennai, Tamilnadu. The Whey powder is purchased from EnNutrica, Dindigul farm product private limited, Dindigul District,Tamilnadu. The Whey Protein Concentrate 80% by UTH Beverage Factory Pvt.Ltd, Pune and Olive oil produced by Aceities El Malaga, Spain were procured from the local market, Chennai, Tamilnadu. All the chemicals used in the preparation of different reagents were of analytical grade (AR) and were procured from standard approved companies.

Methods

The modified method of Kumar P, 2015 [8] is taken for the preparation of low fat spread. The figure1 illustrates the processing steps applied in the current study of the preparation of the low fat pumpkin seed spread. The raw pumpkin seeds procured were roasted to decrease the surface moisture. Taking the quantity of pumpkin seed as base the other ingredients were weighed. Predetermined quantity of roasted pumpkin seeds, salt and roasted garlic were ground to flour consistency. Standardized quantities of whey powder (WP), whey protein concentrate (WPC), Sodium Tri Poly Phosphate (STPP) were added to the pumpkin seed flour during further grinding to get lump formation. Once lumps are formed, Olive oil to a standardized level was blended to get the desired spreadablity. The content was then pasteurized at 75 °C for 15minutes. The prepared low fat spread was packed in 100ml polystyrene tubs and stored at refrigerated temperature.

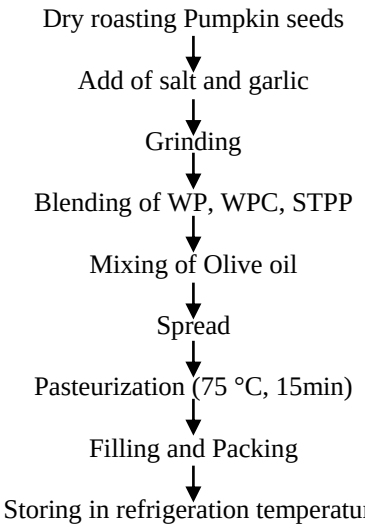

Fig 1: Schematic diagram of the manufacturing of low fat spread

Optimization of Salt and Garlic content

Three trials were done for the optimization of the salt and garlic contents. The treatments are as shown in the Table1 given below.

Table 1: Treatments for the optimization of the salt and garlic content in the low fat spread

Ingredients	Treatments		
	SG1	SG2	SG3
Pumpkin Seeds	100	100	100
Salt	1	2	3
Garlic	1	2	3

Optimization of Olive oil content

Trials with 10, 15, 20 and 25 percent of olive oil were done for optimizing the olive oil percentage in the low fat spread based on the sensory analysis. The treatments for optimizing are given below.

Table 2: Treatments for the optimization of the olive oil in the low fat spread

Ingredients	Treatments			
	O1	O2	O3	O4
Pumpkin Seed	100	100	100	100
Olive Oil	10	15	20	25
Salt	2	2	2	2
Garlic	2	2	2	2

Standardization of the ingredients of the Low fat spread

Based on the results from the optimization of salt, garlic and olive oil percentages three final trials were done for the standardization of the ingredients for the development of the product. The trials were given below and were standardized based on the sensory scores.

Table 3: Standardization of the ingredients for the development of the low fat spread

Ingredients	T1	T2	T3
Pumpkin Seed	100	100	100
Olive Oil	10	20	30
Whey powder	2	2	2
Whey protein Conc	15	15	15
Salt	2	2	2
Garlic	2	2	2
Sodium TripolyPhosphate	0.3	0.3	0.3

Sensory evaluation method

The Sensory evaluation was carried out by a trained panel of judges selected from the staff members of College of Food and Dairy Technology, Chennai as per the method of "9" point hedonic scale of Larmond (1977) [9]. Sensory evaluation provides a complete analysis of the various properties of food that is perceived by human senses. This is an important method for evaluating new products that are developed. The sensory evaluation is done by using a score card and a panel of members evaluates the products. The low fat nutraceutical blended spread was evaluated for different sensorial attributes such as Colour and Appearance, Body & Texture, Spreadability, Taste, Mouthfeel and Overall acceptability. The results were rated on points as 9: Like extremely, 8:Like very much, 7: Like moderately, 6:Like slightly, 5: Neither like nor dislike, 4:Dislike slightly, 3:Dislike moderately, 2: Dislike very much, 1: Dislike extremely. The low fat spread was served along with a slice of bread for the evaluation of spreadability of the product followed by mastication of the sample for evaluation of the remaining parameters. Prior to the test, the panel members were briefed about the questionnaire and instructed to visually evaluate the product acceptability for colour and appearance followed by mastication of a test sample. Water was provided in between the samples.

Statistical Analysis

The Statistical analysis was done for the data obtained as per the standard procedure of Snedecor and Cochran (1980) [16]. Results were expressed as mean ± Standard Error.

Results

Optimization of the Salt and Garlic content in the low fat spread

Table 4 and Figure 2 shows the respective mean ± SE sensory values for the trials done for optimizing the salt and garlic content in the low fat spread through sensory evaluation using 9 point hedonic scale.

Statistical analysis showed highly significant difference in overall acceptability between the treatments. From the Table4 and figure 2 it was concluded that SG2 was considered to be the ideal composition of salt and garlic content in the low fat spread.

Table 4: Optimization of the Salt and Garlic content based on sensory attributes in the low fat spread

Sample	Parameters			
	Colour & Appearance	Flavour	Taste	Overall Acceptability
SG1	$6.000^{NS} \pm 0.378$	$5.625^{b} \pm 0.183$	$5.750^{a} \pm 0.313$	$5.762^{b} \pm 0.185$
SG2	$6.000^{NS} \pm 0.378$	$8.000^{c} \pm 0.267$	$8.125^{b} \pm 0.226$	$7.350^{c} \pm 0.128$
SG3	$6.000^{NS} \pm 0.378$	$4.375^{a} \pm 0.183$	$4.625^{a} \pm 0.263$	$4.950^{a} \pm 0.143$

Means bearing various superscripts in the same column differs highly significantly ($P \leq 0.01$)
Small case shows significant difference between treatments

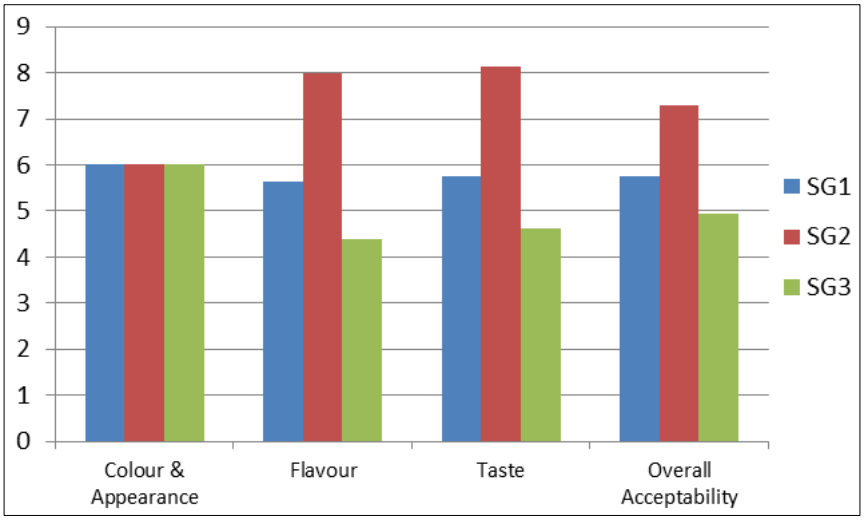

Fig 2: Optimization of the Salt and Garlic content based on sensory attributes in the low fat spread.

From the table 4 and Figure 2 it is evident that the salt and garlic content have increased the flavour and taste attributes and the overall acceptability of the low fat spread which is accordance with the research findings of Prajapati, 1988 [12] where the addition of flavour to the low fat spread increased the flavour, taste and the overall acceptability of the product. And it is also noted that the salt content ranging from 1.5-2.0 percent gives the good taste to the product and higher levels of salt decreases the overall acceptability of the product which is revealed by the current study.

Optimization of the Olive oil content in the low fat spread

Table 5 and Figure 3 shows the respective mean ± SE sensory values for the trials done for optimizing the Olive oil content in the low fat spread through sensory evaluation using 9 point hedonic scale.

Statistical analysis showed highly significant difference in overall acceptability between the treatments. From the Table5 and figure 3 it was concluded that O3 was considered to be the ideal percentage of olive oil content in the low fat spread.

Table 5: Optimization of the Olive oil content based on the sensory attributes in the low fat spread

Treatments	Parameters		
	Body & Texture	Spread ability	Overall Acceptability
O1	3.800 ^{a}±0.200	2.200 ^{a}±0.916	3.000 ^{a}±0.447
O2	4.200 ^{b}±0.200	3.600 ^{a}±0.244	3.900 ^{a}±0.187
O3	8.400 ^{d}±2.449	8.400 ^{c}±0.244	8.400 ^{c}±0.244
O4	5.800 ^{c}±0.374	5.400 ^{b}±0.244	5.600 ^{b}±0.291

Means bearing various superscripts in the same column differs highly significantly (P≤ 0.01)
Small case shows significant difference between treatments

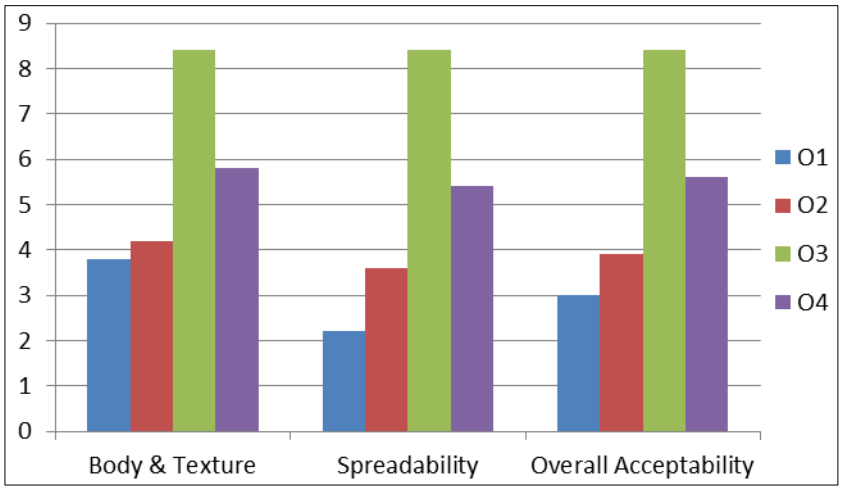

Fig 5: Optimization of the Olive oil content based on the sensory attributes in the low fat spread.

The present results were in agreement with the fat content of Prajapati, 1988 [12] who prepared the low fat spread. In their study, they observed that higher level of fat in the spread increases the softness and spreadability. In order to have the fat content of the low fat spread between 20 -40 percent, we have chose O3 as an optimum level.

Standardization of the ingredients of the Low fat spread

Table 6 and Figure 4 shows the respective mean ± SE sensory values for the trials done for the standardization of the ingredients for the preparation of the low fat spread through sensory evaluation using 9 point hedonic scale.

Statistical analysis showed highly significant difference in overall acceptability between the treatments. From the Table 6 and figure 4, it was concluded that Sample B was considered to be the ideal ingredients ratio for the preparation of the low fat spread.

Table 6: Standardization of the ingredients for the preparation of the Low fat spread based on the sensory attributes

Treatment	Parameters					
	Colour	Body &Texture	Spreadability	Taste	Flavour	Overall Acceptability
T1	6.333^{NS}± 0.333	5.555^{a}±0.376	4.666^{a} ±0.288	5.777^{NS}±0.433	5.777^{NS}±0.222	5.622^{a}±0.281
T2	7.777 ^{NS}±0.464	7.666^{b}±0.372	7.333^{b} ±0.500	7.00 ^{NS} ± 0.522	6.777^{NS} ± 0.468	7.311^{b} ±0.393
T3	7.222^{NS} ±0.464	6.555^{a}±0.376	5.888^{a} ±0.309	6.625^{NS}±0.595	6.375^{NS} ± 0.263	6.488^{a} ±0.352

Means bearing various superscripts in the same column differs highly significantly (P≤ 0.01)
Small case shows significant difference between treatments

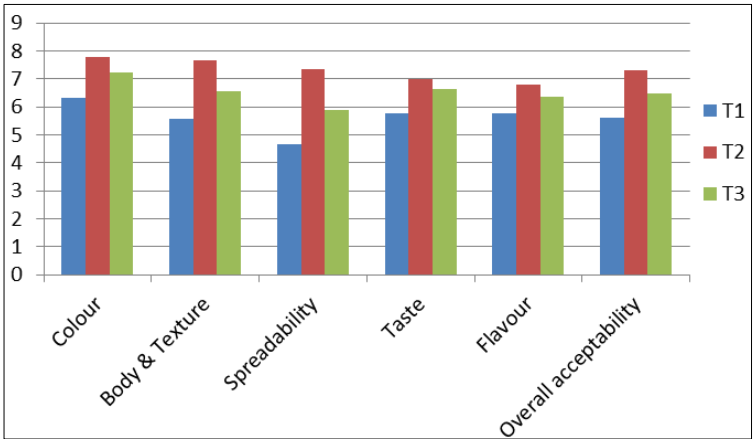

Fig 4: Standardization of the ingredients for the preparation of the Low fat spread based on the sensory attributes

Fig 5: Standardized low fat pumpkin seed spread

Conclusion

Nuts and oilseeds are a power house of essential nutrients which provides the quintessential nutrients. They also provides a wide range of health benefits which includes lowered serum lipid levels, prevention of diseases like coronary heart disease and attention deficit hyperactivity disorder (ADHD), juvenile diabetes and maintenance of lean body. It also provides micronutrients essential for growth (Kaur and Maruf, 2018) [6]. The results of the present study reveals that the product containing 20 percent Olive oil, salt and garlic of 2 percent each with pumpkin seeds, whey powder, whey protein concentrate was acceptable and the product contains 26.6% fat content by which this can be claimed as low fat spread as the result of fat content of the final product ranges between 20 to 40 percent as per the literatures given. The developed product could be a healthier alternative when compared to other spread products like jam, marmalades, butter, chocolate spreads as they are rich in fat and sugar contents than the low fat spread from pumpkin seeds.

References

1. Aka LO, Pilau NN. The effects of garlic (*Alium sativum*) on taste responses and relative organ weights in rats. Sokoto Journal of Veterinary Sciences. 2010; 8(1&2).
2. Aneja RP, Mathur BN, Chandan RC, Banerjee AK. Technology of Indian milk products: handbook on process technology modernization for professionals, entrepreneurs and scientists. Dairy India Yearbook, 2002.
3. CAC. Codex Alimentarius Commission proposed draft revised standards for dairy spreads, 2004. http://www.codexalimentarius.com.net
4. Covas MI, Ruiz-Gutiérrez V, De La Torre R, Kafatos A, Lamuela-Raventós RM, Osada J *et al*. Minor components of olive oil: evidence to date of health benefits in humans. Nutrition Reviews. 2006; 64(4):S20-S30.
5. Dostalova J. Low fat spreads. In Encylopedia Food Science Nutrition ed., B. Caballero, L C. Toruco and P M Fingler (Eds), Academic Press, NY. 2003; 62nd:3617-3622.
6. Kaur D, Maruf A. Development and analysis of multi-nut spread for children aged between 7-9 years. Development. 2018; 3(2).
7. Keogh MK, Quigley T, Connolly JF, Phelan JA. Anhydrous Milk Fat: 4. Low-Fat Spreads. Irish Journal of Food Science and Technology. 1988, 53-75.
8. Kumar P. Process Optimization for the Preparation of Chocolate Spread Incorporating Whey Protein Concentrate, Cocoa Powder, Olive Oil and Butterfat Using Response Surface Methodology. Journal of food processing and preservation. 2015; 39(6):745-757.
9. Larmand E. Lab. Method of sensory evaluation of food. Pub. Canada, Deptt. Agric. Ottawa, 1977.
10. Löliger J. Function and importance of glutamate for savory foods. The Journal of nutrition. 2000; 130(4):915S-920S.
11. Patel S. Pumpkin (Cucurbita sp.) seeds as nutraceutic: A review on status quo and scopes. Mediterranean Journal of Nutrition and Metabolism. 2013; 6(3):183-189.
12. Prajapati PS. Technology of low-fat spread manufacture (Doctoral dissertation, NDRI, Karnal), 1988.
13. Raj KA. Development of technology for reduced fat chhana based dairy spread with improved functional attributes. (Doctoral dissertation, NDRI, Karnal), 2013.
14. Ranganna S. Handbook of Analysis and Quality Control for Fruit and Vegetable products, Tata McGraw-Hill Education publications. ISBN: 0074518518. 1986, 105.
15. Rezig L, Chouaibi M, Msaada K, Hamdi S. Chemical composition and profile characterisation of pumpkin (*Cucurbita maxima*) seed oil. Industrial Crops and Products. 2012; 37(1):82-87.
16. Snedecor GW, Cochran WG. Statistical methods. Ames: Lowa State University Press. 7th edition, 1980.
17. Tossavainen O, Pyykkönen P, Vastamäki P, Huotari H. Effect of milk protein products on the stability of a model low-fat spread. International Dairy Journal. 1996; 6(2):171-184.