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Development of nutritious spread and its storage study

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Abstract
Fruits and vegetable products have occupied unique place in the dietary practices of population. Fruits, nuts, and vegetables play a significant role in human nutrition, especially as sources of vitamins (C, A, B6, thiamine, niacin, E), minerals, protein and dietary fiber carbohydrate. Making fruit spreads is a good way to use fruits that are not suitable for canning whole or freezing. While all fruit spreads are jelled to some degree, each type has a different texture, flavor and color. Sweet potato's tubers have anti-diabetic, anti-oxidant and anti-proliferative properties due to the presence of valuable nutritional and mineral components. Consumption of red beet which is rich source of antioxidants can contribute to protection from age related diseases. Red beet contains antioxidant activity which can prevention of diseases like cancer, cardiovascular diseases. Guava is an excellent source of vitamin-C and abundant in dietary fiber, vitamin-A, pectin, phosphorus, calcium and potassium. Peanut seeds are a good source of protein, lipid and fatty acids for human nutrition. Peanut-containing foods have high consumer acceptance because of their unique roasted peanut flavour. The healthy and nutritious spread containing good source of Vit.C, protein, crude fiber, and mineral such as calcium, iron, magnesium, sodium etc. The nutritious spread has antioxidant capacity. Optimization of healthy and nutritious spread was carried out by variation of sweet potato, beet root, peanut, guava, sugar. The J (50:25:10:2.5:5) was selected as per 9 hedonic scale. Healthy and nutritious spread has a shelf life of 2 days at room temperature and 14 days at refrigerated temperature.

Keywords: Anti-diabetic, anti-oxidant, anti-proliferative, spread

1. Introduction
Many researchers discuss the nutritional value of margarine and other spreads largely around two components. These are the total amount of fat (saturated fat, trans-fat) as components of the formulation. It has been concluded by some researchers that the saturated fatty acids in triglycerides contribute to elevated blood cholesterol levels, which in turn has often been linked to cardiovascular diseases. It has been observed that firmer margarines contain more saturated fat. They have also indicated a strong link between earlier death and consumption of high amounts of trans-fats which had been common in many spread formulations not quite too long ago. Due to problems associated with consumption of such as cheeses and margarines, alternatives which can deliver the functionalities required in traditional spreads with less nutritional problems are being sought. Therefore, these healthy spread from sweet potato, beet root, guava and peanut will have source in protein, minerals, vitamin, and essential amino acid, similarly market spread like mayonnaise, cheese spread, butter spread, can be replace by the fruit spread thus the healthy spread will be nutritious source for all age people Owusu, A. A. (2012) [6].

Making fruit spreads is a good way to use fruits that are not suitable for canning whole or freezing. Sugar is used as a preservative in fruit spreads. While all fruit spreads are jelled to some degree, each type has a different texture, flavor and color. The individual characteristics of a fruit spread depend on the type of fruit used, how the spread is prepared, and the proportion of ingredients and the method of cooking the spread. Types of fruit spreads jam are made from crushed, chopped, or ground fruit, and sugar. Jams can be made with or without added pectin. Jam holds its shape, but is fewer firms that jelly. Jelly is made from fruit juice and sugar. Jelly is a semi-solid fruit spread that is clear and firm enough to hold its shape. Jellies can be made with or without added pectin. Conserves are similar to jams because they are made from a mixture of fruits, but they also contain nuts, raisins, and coconut. Conserves are made with sugar and can be made with or without added pectin. Marmalades are soft jellies with small pieces of fruit or peel evenly suspended in the clear jelly. Marmalades are usually made from citrus fruits and peels. Marmalades are made with sugar and can be made with or without added pectin.

Fruit butters are made from sweetened fruit pulp cooked with sugar and spices until thickened to a spreadable consistency. Butters can be made with or without added pectin (Wells-Moses, K, 2016) [12]. Sweet potato (*Ipomoea batatas* (L.) Lam.), known as a patata which is member of the Convolvulaceae or morning glory family, is grown for its enlarged storage roots sometimes the tender leaves and shoots are consumed as a green leafy vegetable. Recently, it became clear that the orange- fleshed sweet potato (OFSP) can play an important role in alleviating micronutrient deficiencies and since 1999 has been used in food-based approaches for this purpose. These micronutrient disorders are known to impact negatively on the growth and development of children and also to reduce resistance to disease in both children and adults. Micronutrient deficiencies, specifically vitamin A, iron and zinc, are public health problems in South Africa and elsewhere. The main nutritional material in sweet potato's tubers is carbohydrates (starches and simple sugars), protein, and fat and fat- soluble vitamins. (Laurie, 2004) [7]. Sweet potato's tubers have anti-diabetic, anti-oxidant and anti-proliferative properties due to the presence of valuable nutritional and mineral components. Furthermore, Ipomoea batatas tubers, which are steady item in the Americans' diet, appear to be very beneficial in the diet of diabetics and consumers with an insulin resistance, because they have a low glycemic index. Knowledge of the glycemic index (GI) diet for diabetes may help to predict their daily diet in order to control a blood glucose level. It encourages using them in the diet of diabetics. However, the knowledge about these species is not sufficient, especially on their nutritional values (Krochmal *et al*., 2014) [5]. Beetroot (Beta vulgaris) is botanically classified as an herbaceous biennial from Chenopodiaceae family and has several varieties with bulb colors ranging from yellow to red. Beetroots (Beta vulgaris) are rich in valuable, active compounds such as carotenoids, glycine betaine, saponins, betacyanines, folates, betanin, polyphenols and flavonoids. Therefore, beetroot ingestion can be considered a factor in cancer prevention. (Singh and Hathan, 2014) [10]. Consumption of red beet which is rich source of antioxidants can contribute to protection from age related diseases. According to Vinson, red beet is one of the most potent vegetables with respect to antioxidant activity. Betacyanins are a group of compounds exhibiting antioxidant and radical-scavenging activities. They also inhibit cervical ovarian and bladder cancer cells *in vitro.* Red beet also can be used as antioxidant reported that the ingestion of a single dose of red beet juice resulted in an increase of antioxidant compounds including betalains in urinary excretion. Betalains and other phenolic compounds presented in red beet decreases oxidative damage of lipids and improve antioxidant status in humans. Antioxidant activity in red beet is associated involvement of antioxidants in the scavenging of free radicals and consequently in the prevention of diseases like cancer, cardiovascular diseases. Antioxidant activity was also reported to enrich human low density lipoproteins by betalains which increase resistance to oxidation. According to Gentile, Tesoriere and Alessio (2004) [4] betalains exhibit anti- inflammatory effects, antiradical and antioxidant activity (Singh and Hathan, 2014) [10].

Psidium guajava L. belongs to family *Myrtaceae* which comprises approximately 150 species of trees and shrubs, many of which have edible fruits. It is commonly called as guava, "the poor man's fruit" or "apple of tropics". Guava is presently cultivated in most of the tropical and subtropical countries around the world. It is a small tree with many branches and produces many small to medium size fruits. The colour, size, flavour (tart to sweet) and characteristic musky odour vary between the genotypes The fruit is an excellent source of vitamin-C, which is up to 2000 mg per 100gm of fruit and abundant in dietary fiber (5–7%), vitamin-A, pectin, phosphorus, calcium and potassium. Red fleshed fruit contains 3 mg of carotene/100 g of fruit. The predominant nonvolatile organic compound of guava fruit includes citric, maleic, lactic, ascorbic and galacturonic acid. The storage aroma of fruit is attributed to carbonyl compounds. Its leaves have been used to treat many ailments including cough and pulmonary disease in Bolivia and Egypt. In Mexico guava leaves are extensively used to stop diarrhea and for the alleviation of gastrointestinal disorders, which is a common practice originally inherited from traditional Aztec medicine (H.P. Singh *et al.*, 2011) [3].

Groundnut or peanut (*Arachis hypogea)* is a plant which belongs to the family of plants called *Fabaceae*. Botanically, groundnut is a legume although it is widely identified as a nut and has similar nutrient profile with tree nuts. This annual plant is generally distributed in the tropical, sub-tropical and warm temperate areas and represents the second most important legume in the world based on total production after soybean. Peanuts make an important contribution to the diet in many countries. Peanut seeds are a good source of protein, lipid and fatty acids for human nutrition. Peanut-containing foods have high consumer acceptance because of their unique roasted peanut flavour. Peanuts are continually applied for the preparation of new and improved food products. A large proportion of peanut production in the world is destined to domestic foods such as peanut butter, snack products, confections and roasted peanut products. Peanut constitutes a major annual oilseed crop and a good source of protein containing high lysine content which makes it a good complement for cereal. (Afolabi *et al.*, 2018) [1].

2. Materials and Methods

The standardization of healthy and nutritious spread carried out in the Department of Technology, Shivaji University, Kolhapur Maharashtra state.

2.1 Selection of the raw material (sweet potato, beet root, guava peanut)

Fresh sweet potato, beet root, guava will purchase from vegetable market. Peanut will be purchase from reliable source.

2.2 Chemicals

Most of the chemicals used in this investigation were of analytical grade and were obtained from Food Technology Laboratory of Department of Technology, Shivaji University, Kolhapur.

2.3 Preparation of nutritious spread

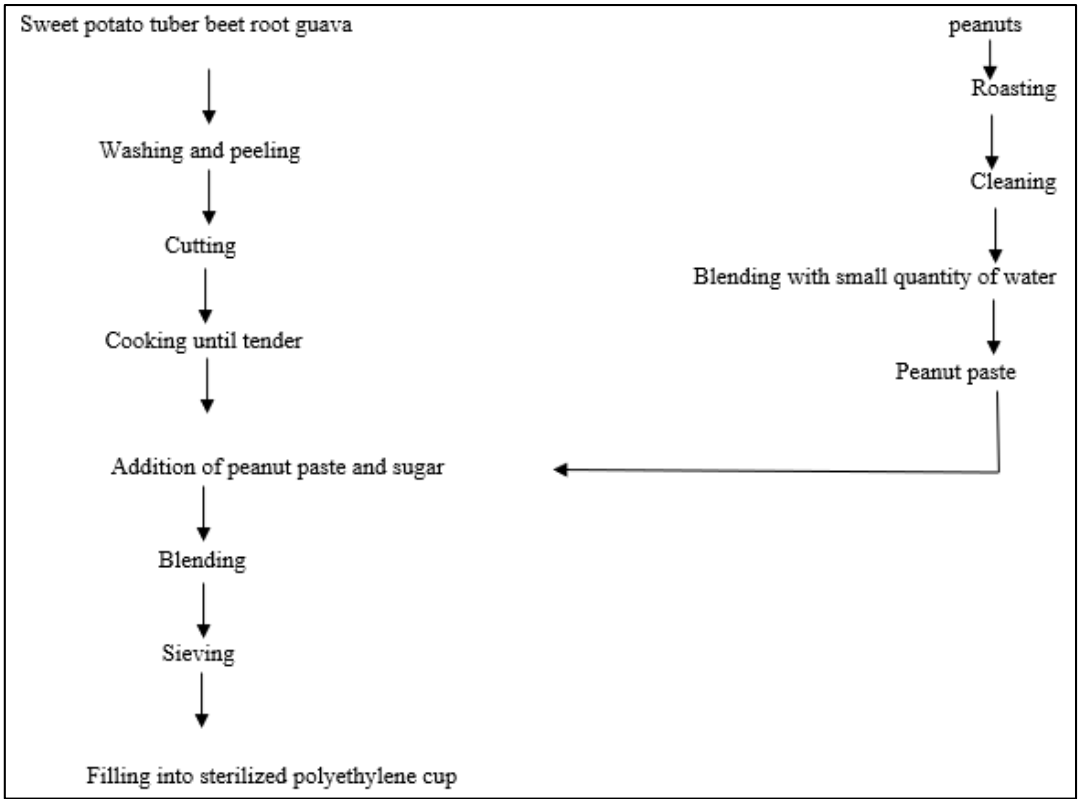

Fig 1: Preparation of nutritious spread

2.4 Optimization of nutritious spread

Table 1: Formulation of nutritious spread

Sample code	Sweet potato	Sugar	Beet root	Peanut	Guava
A	50	25	0	0	0
B	50	25	5	0	0
C	50	25	10	0	0
D	50	25	15	0	0
E	50	25	10	2.5	0
F	50	25	10	5	0
G	50	25	10	7.5	0
H	50	25	10	10	0
I	50	25	10	2.5	2.5
J	50	25	10	2.5	5
K	50	25	10	2.5	7.5

Optimization by formulation of sample with sweet potato, sugar, beet root, guava, and peanut is shown in above table 1. Among eleven samples, sample J (50:25:10:2.5:5) is selected as best as per the 9 point hedonic scale sensory evaluation.

2.5 Physical characteristics of sweet potato, beet root, guava, and peanut

2.5.1 Colour and shape

Colour and shape of the sweet potato, beet root, guava, and peanut were recorded by visual observation.

2.5.2 Size

The length and breadth of the randomly selected fresh sweet potato, beet root, guava, date and peanut were measured using vernier calliper (PIA International Ltd., model 1112-200) and expressed in terms of centimetres.

2.5.3 Weight

Fresh sweet potato, beet root, guava, date and peanut were weighed on an electronic balance. Average weight of ten fresh beetroot, sweet potato, guava was calculated and expressed in terms of grams (Shimadzu Ltd., Model ELB300).

2.6 Proximate analysis

potato beet root guava (fresh) peanut were analyzed for their proximate analysis such as moisture, fat, ash, fiber and protein, etc. contents following standard methods (Ranganna 1986) [10].

2.7 Chemical analysis

Chemical Analysis includes Moisture, Ash, Fat, Crude fibre, Carbohydrates and Protein ascorbic acid were estimated by standard methods (AOAC, 2000) [2].

2.8 GCMS analysis

GC analysis

Gas chromatography of resulted nutritious spread was done by means of Shimadzu instrument at the Shivaji University

operating in electron impact mode at 70 eV; helium (99.999%) was used as carrier gas at a constant flow of 1ml/min and an injection volume of 0.5 EI was employed (split ratio of10:1) injector temperature 250 °C; ion-source temperature 280 °C. The oven temperature was programmed from 110 °C (isothermal for 2 min), with an increase of 10 °C/min, to 200 °C, then 5 °C/min to 280 °C, ending with a 9 min. isothermal at 280 °C. Mass spectra were taken at 70 eV; a scan interval of 0.5 s and fragments from 40 to 550 Da. Singaravadivel, K. (2014) [9].

2.9 Analysis of bioactive compounds

2.9.1 Total Phenolic content

Total phenol content was determined using the calorimetric Folin–Ciocalteu method (Chavan *et al*., 2013) [3]. 0.2ml of diluted extracts were mixed with 1 ml of 1:10 diluted Folin–Ciocalteu reagent and reacted for 5 min. 0.8 ml of 7.5% sodium carbonate was added to the mixture, and incubated for 30 min in the dark at 27 ± 2 ◦C. Absorbance was measured at 765 nm on the spectrophotometer. Gallic acid was used as a standard. The standard graph was prepared by using gallic acid in the range with different concentrations gave a regression equation.

2.9.2 Determination of radical scavenging activity (antioxidant activity)

The nutritious spread was analyzed for free radical scavenging activity. The total antioxidant property of nutritious spread was determined by 2, 2-Diphenyl-1-picrylhydrazil radical (DPPH) in terms of % radical scavenging activity. DPPH solution (1 mg/ml) was made by dissolving DPPH in methanol. DPPH solution (100 µl) was diluted to 5 ml and absorbance was taken at 535 in UV-Spectrophotometer. The absorbance was taken as control absorbance. Further the extract (100µl) was made by dissolving required spread in methanol; then it was added with 100µl of 1mg/ml of DPPH solution. Then it was diluted to 5 ml by methanol then it was incubated at room temperature for 30 min. Then absorbance was measured at 535 nm in UV spectrophotometer. The absorbance was taken as sample absorbance. Following formula was used to calculate the antioxidant activity Ravichandran, K *et al.*, (2013) [7].

$$\% \text{ Antioxidant activity} = \frac{\text{Absorbance of controle Absorbance of sample}}{\text{Absorbance of controle}} \times 100$$

2.10 Sensory Evaluation of nutritious spread

Sensory, evaluation of nutritious spread was done by using nine-point hedonic scales by 15 semi-trained members, Ihediohanma & Adeboye (2014) [4].

2.11 Microbiological analysis

2.11.1 Total viable count

Total viable count was carried out using the pour plate method described by Harrigan and MacCance. 1ml aliquot from a suitable dilution was transferred aseptically into sterile petri dishes. To each dilution, 10-15 ml of melted and cooled (42 °C) nutrient/plate count agar was added. The inoculums were mixed with media and allowed to solidify. The plates were then incubated in an incubator at 37 °C for 48 hours to check yeast and mold by colony counter (Quebec colony counter) was used to count the viable colonies and the results were presented as Cfu/ml of blended health drink (Sulieman, 2013) [11].

2.12.2 Yeast and mold count

From suitable dilution of samples, 0.1 ml was aseptically transferred onto solidified Potato Dextrose Agar (PDA) medium containing 0.1 g chloramphenicol per liter of medium to inhibit bacterial growth. Samples were spread all over the plates using a sterile bent glass rod. The plates were then incubated at 26-28 °C for 48 hours. Colony forming units (cfu) were counted using a colony counter (Sulieman, 2013) [11].

3. Results and Discussion

3.1.1 Physical characteristics of sweet potato, beet root, guava, peanut.

Physical quality attributes are important in determining the consumer acceptability of product. The yield of product depends upon the quality of raw material which could be measured in terms of physical properties. Results with respect to physical properties are summarized in Table 1.

Table 1: Physical parameters of raw material

Parameters	Sweet potato	Beet root	Guava	Peanut
Colour	Purple	Reddish brown	Faint green	Light pinkish
Length(cm)	10-15	8.5-9.5	3-10	1-1.2
Width(cm)	4.1-10	7-10	5-8	0.5-08

3.1.2 Physicochemical properties of raw material

Table 2: Physicochemical properties of raw material

Parameter	Sweet potato	Beet root	Guava	Peanut
Moisture (%)	68.90±0.98	87.3999±0.01	79.45±0.04	7.99±0.15
Ash (%)	0.9972±0.01	1.3978±0.01	0.9070±0.02	2.68±0.05
Protein%	0.46±0.01	1.35±0.02	2.19±0.24	2.88±0.40
Fat (%)	1.6999±0.10	0.2997±0.01	2.05±0.10	38.10±0.47
Crude fiber (%)	0.9999±0.01	1.9±0.00	12.8998±0.10	2.69±0.06
Vit. C (mg/100ml)	2.4	4.8	80.4	-
Ca (mg/100ml.)	72.5	177.5	47.5	60
Fe (mg/100ml.)	0.047	0.888	BDL	BDL
Mg (mg/100ml.)	-	-	6.58	12.37
Zn (mg/100ml.)	0.1063	0.2481	0.1023	0.5614
K (mg/100ml.)	1250	2000	-	-
Na (mg/100ml.)	40	100	-	-
P (mg/100ml.)	-	-	6.65	6.65

Data are expressed as mean ± standard deviation of triplicate experiments

Table 2 showed that the analysis of the five samples such as sweet potato, beet root, dates, guava and peanut. The percentages of crude protein in sweet potato, beet root, dates, guava and peanut of values was 0.46%, 1.35%, 2.1%,28.88%, 2.19% respectively. Percentage of Ash in sweet potato, beet root, dates, guava and peanut is 0.9972%, 1.3978%, 2.18%, 0.9070% and 2.68% respectively.

3.2 Sensory evaluation of nutritious spread

In healthy and nutritious spread, appearance liking and overall liking among the 10samples prepared were not scored differently by the panelists. However, J sample received higher score, on taste, flavor, mouth feel, appearance and overall acceptability liking. Optimization by formulation of sample with sweet potato, sugar, beet root, guava, and peanut is shown in above table 7. Among eleven samples, sample J (50:25:10:2.5:5) is selected as best as per the 9 point hedonic scale sensory evaluation. As per above sensory evaluation chart Sample no J (50:25:10:2.5:5) is selected for further studies.

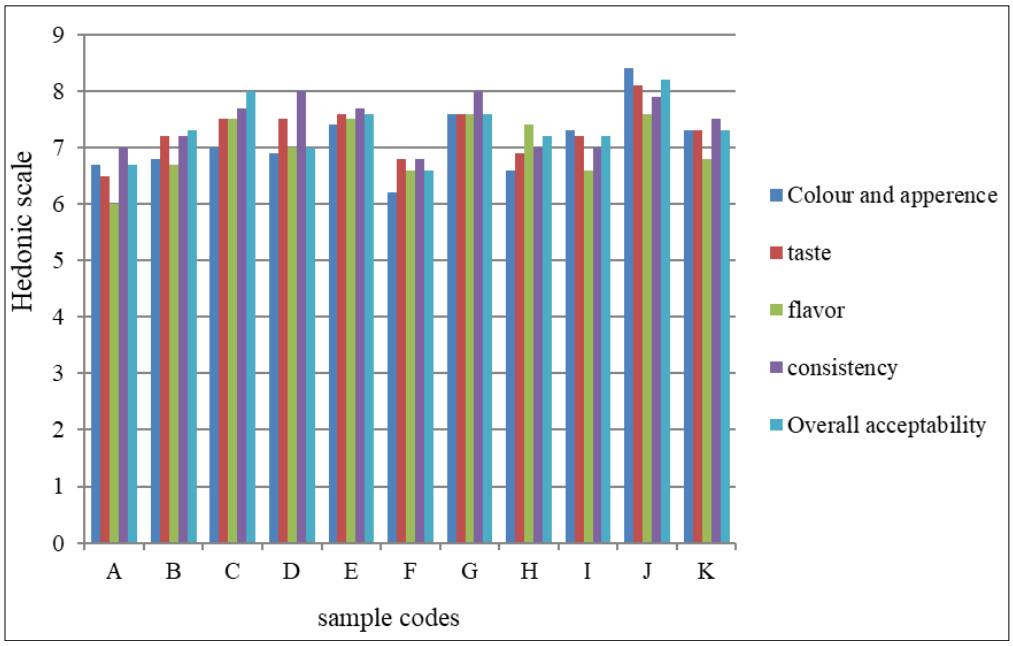

Fig 2: Sensory evaluation of healthy and nutritious spread

3.3Physiochemical Analysis of prepared nutritious spread

The fresh sweet potato, sugar, beet root, guava, and peanut were used for preparation of healthy and nutritious spread. The data regarding the physico-chemical composition of prepared nutritious spread was tabulated in table 3. On basis of the nutritional aspects and sensory analysis j sample was accepted and chemical analysis of this sample was done. Based on our preliminary study, J sample were no significant difference in moisture, fat, and carbohydrate but slightly increases the protein, ash and crude fiber content.

Table 3: Physiochemical Analysis of nutritious spread

Parameters	Healthy and nutritious spread
Moisture (%)	58.4
Titrable Acidity (%)	0.17
Total Solids (%)	41.6
Crude Fat (g)	2.9
Protein (g)	8.2
Fibre (%)	10.47
Ash (%)	2.3
Total Soluble Solids TSS (°B)	36
Carbohydrate (g)	86.6
Total energy(kcal)	405.3
Total Phenolic Content TPC (mg GAE/g)	24.8
Antioxidant(%RSA)	11.21
Flavonoids content	-
Vitamin C (mg/100g)	96
Calcium (mg/100ml)	14.8
Iron (mg/100ml)	16.95
magnesium(mg/100ml)	25.76
zinc(mg/100ml)	0.2765
sodium(mg/100ml)	17.8
potassium(mg/100ml)	27.2
phosphorous(mg/100ml)	3.2
pH	7.28

Table 3 gave the summary of the analysis of final optimized product sample. The percentage of protein in prepared nutritious spread is increased up to 8.2% than that of present in raw materials. The presence of ascorbic acid and phenolic content in prepared healthy and nutritious spread is indicated in above table. The healthy and nutritious spread has shown TPC up to 24.8 mg GAE/g. The acidity, pH, TSS content of healthy and nutritious spread was 0.17%, 7.28, 36^0 Brix respectively. The mineral contents of healthy and nutritious spread as calcium, iron, magnesium, sodium and potassium, phosphorous are 14.8mg/100ml, 16.95mg/100ml, 25.76mg/100ml, 17.8mg/100ml and 27.2mg/100ml, 3.2mg/100ml respectively. Hence healthy and nutritious spread is a good source of mineral content and can prove use full for mineral deficient people.

3.4 GCMS analysis of healthy and nutritious spread

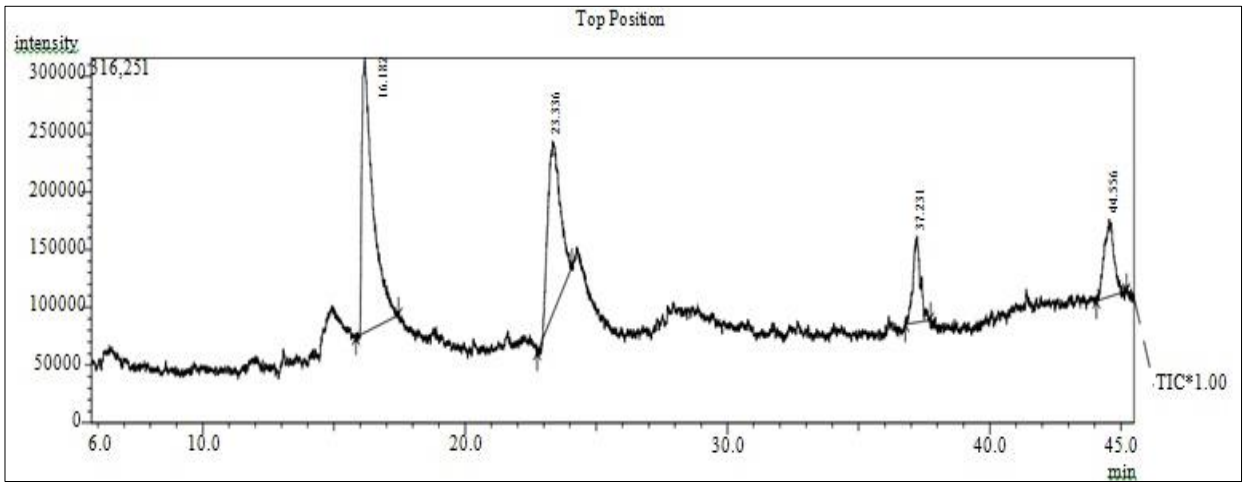

Fig 3: GCMS analysis of healthy and nutritious spread

3.5 GCMS analysis of healthy and nutritious spread

GCMS analysis of healthy and nutritious spread was done and results were shown in above graph the results show that 5-Hydroxymethylfurfural, 2-Formyl-9-[.beta.-d-ribofuranosyl] hypoxanth, was found present in healthy and nutritious spread**.** Antioxidant dl-.alpha.-Tocopherol beta.-Sitosterol found in nutritious spread

3.6 Sensory evaluation of nutritious spread during storage

Sensory evaluation of nutritious spread was done for the attributes namely colour, flavour, taste and consistency of nutritious spread prepared. Evaluation was done on the basis of 9 point hedonic scale. Sweet potato sugar blende is used as a control sample for sensory evaluation. The sensory evaluation of nutritious spread during storage was done for over 14 day's at refrigeration temperature and 2 days at room temperature. On the basis of sensory evaluation of initial product, microbial analysis and; nutritious spread is considered as best nutritious spread than others.

3.6.1 Sensorial Evaluation of prepared nutritious spread during storage period 28 °C

The sensory evaluation of selected sample of nutritious spread stored in Polypropylene cups at room temperature. From sensory score it was observed that as days is increasing sensory score is in decreasing pattern. Flavour and overall acceptability of fresh nutritious spread was excellent, while up till 2 days of storage it was satisfactory. The flavour became unsatisfactory after 3-4 days of storage. With the passage of time the flavour of the sample was degraded due to compositional changes in sample. As a result, the freshly prepared nutritious spread got higher score and overall acceptability that is 8.2 but after 3days there was change in taste, flavour and over all acceptability 4.3. At 3 day the overall acceptability was 4.3 this shows progressive deterioration and quality degradation of nutritious spread stored at room temperature. Thus, the nutritious spread quality is affected during storage by microbiological and physiological process.

3.6.2 Sensorial Evaluation of prepared healthy and nutritious spread during storage period 5 ºC

The sensory evaluation of selected sample of developed nutritious spread stored in Polypropylene cups at refrigeration temperature. From sensory score it was observed that as days is increasing sensory score is in decreasing pattern. Flavour and overall acceptability of fresh nutritious spread was excellent, while up to day 14th it was satisfactory. The flavour became unsatisfactory at day 16th. With the passage of time the flavour of the sample was degraded due to compositional changes in sample. As a result, the freshly prepared nutritious spread got higher score and overall acceptability that is 8.2 but after days 14th there was a change in taste, flavour and over all acceptability. At day 16th the overall acceptability was 4.1 this shows progressive deterioration and quality degradation of nutritious spread stored at refrigeration temperature. Thus the healthy and nutritious spread quality is affected during storage by microbiological and physiological properties.

3.7 Storage study of nutritious spread

Storage studies were carried out at room temperature (28±2 ºC) and refrigerator temperature (5 ºC) in polyethylene cup for 16days.

3.7.1 Effect of storage on nutritious spread at room temperature (28±2 ºC)

The effect of storage period on nutritional composition of nutritious spread at room temperature was observed. The nutritional parameter such as acidity, pH, TSS, compounds were determined during storage. Acidity of nutritious spread was 0.17 percent at day 0 and is continuously decreases during storage and at end it was 0.08 percent at day 3. TSS was increase in storage study.

3.7.2 Effect of storage on nutritious spread at refrigeration temperature (5 ºC)

The effect of storage temperature on nutritional composition nutritious spread at refrigerated temperature was observed. The nutritional parameter such as acidity, TSS, pH, were determine during storage. The acidity of healthy and nutritious spread was 0.17percent at day 0 and continuously decreases during storage and at end it was 0.13 percent at day 16th. TSS (^{0} Brix) goes on increasing during storage at refrigerated temperature

3.8 Microbial analysis of nutritious spread

As spread is made up from different raw material and it contains lot of nutrients so it is mandatory to check its microbial load during storage therefore study was carried out to check its bacterial, mold and yeast count on the interval of day 2.

3.8.1 Total plate count nutritious spread at room temperature (28±2 ºC)

Total plate count of nutritious spread was carried out at regular intervals of day1. Initially at zero days there was 4.0 $\times 10^3$/ml count as the nutritious spread were freshly prepared in clean environment. Total plate count of nutritious spread was within the limit up to 2 days but at 3rd day the total plate count was found to be $10.4x10^3$ which was above the acceptable limit. Hence we concluded that healthy and nutritious spread has a shelf life of 2 days. Total plate count of healthy and nutritious spread was within the limit up to 2 days but at 3rd day total plate count was more than that of acceptable limit and hence it was concluded that nutritious spread has a shelf life of 2 days at room temperature. The main reason for the spoilage of nutritious spread was it is a good source of carbohydrates and higher in moisture content. Total plate count (Cfu /ml) of fruits and vegetable product more than 10×10^3 Cfu/ml then the product is reported as unsafe according to food safety standards (2011).

3.8.2 Total plate count nutritious spread at refrigeration temperature (5 ºC)

Total plate count of nutritious spread was carried out at regular intervals of 2 days. Initially at zero days there was 4.0×10^3/ml count as the nutritious spread sample were freshly prepared in clean environment. Total plate count of nutritious spread was within the limit up to 14 days but at 16th day the total plate count was found to be $10.54x10^3$ which was above the acceptable limit. Hence it is concluded that nutritious spread has a shelf life of 14 days. Total plate count of nutritious spread was within the limit up to 14 days but at 16th day total plate count was more than that of acceptable limit and hence it was concluded that nutritious spread has a shelf life of 14 days at refrigerated temperature. Total plate count (Cfu /ml) of fruits and vegetable product more than 10×10^3 Cfu/ml then the product is reported as unsafe according to food safety standards (2011).

3.9 Yeast and mold count (Cfu /ml) of nutritious spread

3.9.1 Yeast and mold count (Cfu /ml) of nutritious spread at room temperature (28±2 ºC)

The yeast and mold count was carried out. Initially yeast and mold count of nutritious spread was carried out at regular intervals of 1day. Initially at zero days there was zero count as the healthy and nutritious spread were freshly prepared in clean environment. Yeast and mold count of nutritious spread was within the limit up to 2 day but at 3rd day the yeast and mold count was found to be $4.6x10^3$ which was above the acceptable limit. Yeast and mold count of nutritious spread was within the limit up to 2 day but at 3rd day yeast and mold count was more than that of acceptable limit and hence it was conclude that nutritious spread has a shelf life of 2 days at room temperature. Yeast and mold count (cfu /ml) of fruits and vegetable product more than $4x10^3$ /ml cfu/ml is reported as spoiled by food safety standards (2011).

3.9.2 Yeast and mold count (cfu /ml) of nutritious spread at refrigeration temperature (5^0 C)

Table 19 indicated yeast and mold count (Cfu /ml) of nutritious spread at refrigerated temperature. Yeast and mold count nutritious spread was carried out at regular intervals of 2 day. Initially at zero days there was zero count as the nutritious spread were freshly prepared in clean environment. Yeast and mold count of nutritious spread within the limit up to 14th day but at 16th day the yeast and mold count was found to be $4.98x10^3$ which was above the acceptable limit. Yeast and mold count of nutritious spread was within the limit up to 14 days but at 16th day yeast and mold count was more than that of acceptable limit and hence it was concluded nutritious spread has a shelf life of 14 days at refrigerated temperature. Yeast and mold count (cfu /ml) of fruits and vegetables product more than $4x10^3$/ml cfu/ml is reported as spoiled by food safety standards (2011).

4. Conclusion

Due to huge health benefits of sweet potato, beet root, peanut and guava it was used in spread so that it can be consumed by all age group peoples. By making of spread somewhat flavour and taste get changes. To increase taste of spread. Nutritious spread has good nutritive value. The sweet potato containing high amount of carbohydrate (starch & simple sugar) and anti-diabetic, antioxidant activity. Beet root rich in antioxidant. Guava is excellent source of vitamin C & pectin. Peanut is good source of protein.

Optimization of healthy and nutritious spread was carried out by variation of sweet potato, beet root, peanut, guava, sugar. The J (50:25:10:2.5:5) was selected as per 9 hedonic scale. Nutritional analysis of prepared healthy and nutritious spread was carried out. The healthy and nutritious spread containing good source of Vit. C, protein, crude fiber, and mineral such as calcium, iron, magnesium, sodium etc. Nutritious spread has a shelf life of 2 days at room temperature and 14 days at refrigerated temperature.

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