UTILIZATION OF FOAM MAT DRIED PUMPKIN POWDER AS SOURCE OF NUTRACEUTICALS CONTENT IN COOKIES

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Abstract
Foam mat drying retain the more nutritional quality than conventional drying methods. Pumpkin as well as foam mat dried pumpkin powder is the source of β-carotene which play an important role in prevention of many diseases. In present study foam mat dried pumpkin powder was produced under pre optimized foam mat drying condition and the produced pumpkin powder was used as a source of nutraceuticals in cookies making. Proximate analysis of the powder was done to determine the micronutrient contents in the form of the nutraceuticals in foam mat dried pumpkin powder. Foam mat dried pumpkin powder showed high fat content(27.3%), carbohydrate content (55.77%) and β-carotene(40mg/100gm).Ash, protein and fiber content of the cookies were 4.33,4.90 and 4.25% respectively. Moisture content of the foam mat dried pumpkin powder was 3.45%,which was very low.2.5,5 and 10% pumpkin powder was used for preparation of cookies in the form of replacement of wheat flour. Cookies made with 5% wheat flour replacement with foam mat dried pumpkin pumpkin powder was most acceptable on the basis of physical analysis and sensory evaluation. Physico chemical analysis of the cookies were done, which scored highest in the sensory evaluation. Moisture, protein, fat, ash percentage of the optimized cookies were 3.00,5.72,18.00and0.60% respectively. and β-carotene of the optimized cookies were 13.85mg/100gm

Keywords: Foam mat drying, Pumpkin powder, Proximate analysis, Cookie, Sensory analysis, Physico chemical analysis

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1.INTRODUCTION

The post harvest loss of fresh fruits and vegetables are estimated to be 20-30%. In order to prevent the losses, there is a need to preserve the commodities and process the commodities into various value added products. India is one of the largest producers of fruits and vegetables in the world and occupies a second position after China. India is the second largest producer of pumpkin after china. In India pumpkin is cultivated (3500000 MT annually) and used mainly for human consumption, but there is no industrial demand or market potential for pumpkin in India. Pumpkin (***Cucurbita moschata***) is one of the important cucurbitaceous vegetable grown all over India. Pumpkin is composed of *Cucurbita moschata, Cucurbita pepo, Cucurbita maxima, Cucurbita mixta, Cucurbita facifola* and *Telfairia occidental* [Caili et al.,2006]. Pumpkins are extensively grown in tropical and sub-tropical countries. *Cucurbita moschata, Cucurbita pepo* and *Cucurbita maxima* are the world wide commonly grown species of pumpkin [Kowsalya and Chandrasekhar,2003].

Pumpkin also called kashiphal or lal kadu occupies a prominent place among vegetables owing to its high productivity, nutritive value, good storability, long period of availability and better transport qualities. It is used both at mature and immature stages as a vegetable. Fresh pumpkins are very perishable and sensitive to microbial spoilage, even at refrigerated conditions. It can be consumed in variety of ways such as fresh or cooked vegetable, as well as being stored frozen or canned [Figueredo et al.,2000]. The vegetables are sweetish when fully mature and can be used

in preparing sweets, candy or fermented into beverages. They are rich in carotenes, minerals, vitamins, pectin and dietary fiber. The yellow-orange characteristic color of pumpkin is due to the presence of caroteniods. Caroteniods are the primary source of vitamin A for most of the people in the developing countries [Boileau et al., 1993] where vitamin A deficiency is still common [Chakarvarty, 2000]. It is believed that β-carotene has a protective role against cancer [Halter,1989] and coronary heart diseases [Fuller et al., 1992]. In India, these are mostly consumed in fresh vegetable preparations with the exception of their use in vegetable soups where pumpkin is added as thickening agent. Pumpkin has a vast scope for diversification and can be utilized in the production of processed products like jam, pickle, beverage, candy, bakery products and confectionary. Pumpkin can be processed into flour which has a longer shelf-life. Pumpkin flour is used because of its highly-desirable flavor, sweetness and deep yellow-orange color. It has been reported to be used to supplement cereal flours in bakery products like cakes, cookies, bread, for soups, sauces, instant noodle and spice as well as a natural coloring agent in pasta and flour mixes [Ptitchkina et al.,1998].

Nutraceuticals are food product that provides health as well as medical benefits; including the prevention and treatment of disease. Few nutraceuticals are being used as pharmaceutical and a number of other being used and purchased by the general public as self-medication. Such products may range from dietary supplements to genetically engineered foods, herbal products and processed foods. Carotenoids are the most common naturally occurring terpenoid pigmented nutraceuticals which can be used as pharmaceutical products as well as food products.

Bakery products like cakes, cookies, bread etc are very much liked by both young and old generation in rural and urban areas. So, an attempt was made to develop nutritious cookie named, LANGUE DE CHAT [Kinslee J.J.,2006] by blending whole wheat flour and pumpkin powder, along with other ingredients. Objective of the study was to develop cookies from foam mat dried pumpkin powder by partially replacing the wheat flower.

2. MATERIALS AND METHODS

2.1 Materials

Pumpkin was purchased from local market of Birati, West Bengal. Pumpkin pulp was foamed with glycerol monostearate and the foamed pumpkin pulp was dried at pre optimized foam mat drying condition[3% GMS and drying temperature 50^{o}C]. Commercial wheat flour , bakery fat, powdered sugar and eggs were purchased from the local market.

2.2 Preparation of Foam mat dried pumpkin Powder

Pumpkin washed with running raw water and peeled with a stainless steel knife. The flesh portions were pulped using a mixer grinder (Bajaj, India). The pulp was placed in a clean glass beaker and added water in the ratio of 1:2(pumpkin pulp : water) and then the mixture was treated with potassium meta bisulphite at 200 ppm to inhibit microbial and enzymatic activity and to retain the colour of the dried sample. Glycerol monostearate was used as a foaming agent. Pumpkin powder for cookies production ,was produced from pumpkin pulp which was foamed with 3% glycerol monostearate and dried at 50^{o}C in a tray dryer. The dried material was ground in a mixer grinder to get powdery form. After obtaining powder, the sample was further dried for some time to reduce the moisture percentage of the powder below 5%.

2.3 Proximate analysis of the powder

2.3.1 Ash

Two gram of powder was taken in a pre-weighed silica crucible and charred over the heater to make it smoke free. The crucible

along with the sample was ignited at 750°C for 4 hrs in muffle furnace. When muffle furnace was cooled, the crucible with ash was taken out, kept in desiccators to cool down, and weighed to a constant weight. The total ash content was determined on the basis of difference in weight of the silica crucible. The percent ash was calculated from the following formula.
Percentage of ash = (Weight of the ash/Weight of the sample)*100 (1)

2.3.2 Crude fat

Five gm of pumpkin powder was extracted with petroleum ether(60-80^{o}C) in Soxhlet extraction apparatus for 90 minutes(10 cycles). The ether extract was filtered in pre-weighed beakers, petroleum ether was evaporated completely from the beakers and the increase in weight of beaker represented the fat content [AOAC1995].
Weight of the sample = W (gm)
Weight of the empty beaker = W_1 (gm)
Weight of the empty beaker + fat content (ether extract) = W_2 (gm)
Percent fat weight = (W_2-W_1/W) *100 (2)

2.3.3 Crude fiber

Two gm fat free (defatted) powder was transferred to 500 ml beaker and 200 ml of 1.25% H_2SO_4 was added. Solutions was transferred into digestion apparatus and boiled for120 minutes. Filter the contents through a What man(grade1) filter paper. The residue was washed for free of acid using hot distilled water and then transferred to the digestion flask to which add 200 ml of 1.25% sodium hydroxide was added. The contents were digested for 120 minutes followed by filtration by What man filter paper and residue was made free of alkali using hot distilled water. The residue was transferred to crucible, weighed, dried in an oven overnight at 60°Cand then placed in the muffle-furnace at 750°C for 4 hrs. The loss in weight after ignition represents the crude fiber in the sample[AOAC 1995].

Percent of crude fiber = (Loss in weight/Weight of the sample)*100 (3)

2.3.4 Crude protein

Crude protein was estimated by using Micro-kjeldahl method, [AOAC 1995], using the factor 6.25 for converting nitrogen content into crude protein.

Procedure

Weighed sample (0.3gm) was digested with concentrated sulphuric acid (10ml) and digestion mixture (25gm) in Kjeldahl digestion tube. The contents were cooled and 20 ml of distill water was added with digestion sample. After distillation ammonium borate was collected through a condenser in a 250 ml conical flask containing 25 ml of 4.0% boric acid solution. The distillate was titrated with 0.1 N sulphuric acid. A blank sample was also run along with the samples.

%Nitrogen=(Volume of sample-Volume of blank)*14*100/Weight of sample taken*1000 (4)
Crude protein (%) = % Nitrogen*6.25 (5)

2.3.5 Carbohydrates

Amount of carbohydrates was calculated from the sum of moisture, crude protein, crude fat, ash and crude fiber and lastly subtracting it from 100 [AOAC 1995].

2.3.6 Total Sugar

Total sugar content of the powder was measured by titrimetric method using methylyn blue as an indicator. [AOAC 1995].

2.4 Preparation of cookies (LANGUE DE CHAT) with foam mat dried pumpkin powder

Cookie formula was selected with respect to 50 gram of wheat flower. Control was made by following formula which is showed in Table1.2.5%,5% and 10% pumpkin powder was added with the dough in the form of

replacement of wheat flour, while composition of other ingredients remain same . One control was also prepared in which no pumpkin powder was added.

Table1: Formula was used for processing of LANGUE DE CHAT (control)

Ingredients	Amount(gram)
Wheat Flour	50.00
Butter	13.00
Castor Sugar	40.38
Eggs	12.00

Flow chart of LANGUE DE CHAT processing(for control and powder added cookies)

Specific amount of wheat flour was weighted and placed into a container

↓

The butter was creamed with castor sugar

↓

Eggs were added to the creaming mixture and folded in the wheat flour.

↓

Pumpkin powder was added in the dough

↓

Formation of dough and cut the dough into round shapes and placed them on greased trays.

↓

Bake them at 180^{o}C into baking oven till golden brown colour was appeared.

↓

Cool them at room temperature and packed them into LDPE pouch.

2.5 Pictorial representation of pumpkin powder and cookies

The pictorial representation of the whole process was represented from Figure1-4.Figure1 is the packed pumpkin powder which was used at three different percentage in cookies making. Figure 2,3 and 4 represented the cookies which were made from 2.5,5 and 10% replacement of wheat flour with foam mat dried pumpkin powder as compared to the control(no powder was added).

Fig1: Pumpkin powder

Fig2: Control & 2.5%

Fig3: Control & 5.0%

Fig4: Control & 10.0%

2.6 Evaluation of Cookies

2.6.1Physical Measurements

Diameter of cookies were measured by laying cookies edge-to-edge with the help of a scale. The same set of cookies was rotated 90° and the diameter was re-measured. Thickness of cookies were measured by stacking six biscuits on top of one another and taking the average in millimeter. The spread ratio was calculated by dividing diameter by thickness . Volume of cookies were defined as the area of the cookie multiplied by thickness.
Volume = $\pi * W^2 * T/4$(cc) (6)

After calculating volume, density was obtained by ratio of weight of volume:
Density = Mass of sample/Volume of sample (gm/cc) (7).

2.6.2 Sensory Evaluation

Cookies incorporated with pumpkin powders were coded with different numbers and placed for sensory evaluation by an untrained panels of ten judges of different ages of food technology department. The panelists were asked to rate each sensory attribute using the control cookies as the basic for evaluation. Cookies were evaluated for color, texture,

flavor appearance and overall acceptability on a 9-point hedonic scale [Hooda and Jood,2005].

2.6.3 Physico chemical analysis of cookies

Moisture Content

Moisture content was determined according to the method described in AOAC [AOAC 1995].Best cookie with respect to sensory evolution was selected for moisture determination.

Ash, protein, carbohydrate and fat percentage of the cookies were also determined by AOAC methods.

3. RESULTS AND DISCUSSION

3.1 Characteristics of foam mat dried pumpkin powder

Fresh pumpkin must be higher in moisture and lower in fat, protein, ash, carbohydrate and crude fiber content than powder sample. During drying water was removed from the pumpkin pulp resulting increasing the concentration of nutraceuticals in powder sample. The results of proximate analysis, of foam mat dried pumpkin powder are presented in Table 2.The most important thing noticed in the powder was higher fat content in the powder,27.30% . Excess fat may be came from GMS(glycerol monostearate) and vegetable oil. β-carotene content in the powder was very high,40.00(mg/100gm).Ash presented in the powder was about 4.33%.The colour of the ash was bluish gray and no carbon particle was found in the ash. Crude fiber was 4.25% in the pumpkin powder which was much higher than raw pumpkin. The percentage of crude fiber was higher because pumpkin flour contains high insoluble dietary fiber which includes cellulose (40.4g /100g), hemicelluloses (4.3g/100g) and lignin (4.3g/100g) [Ptitchkina et al.,1998]. Though the fiber percentage is much higher in dried sample than raw sample. Protein percentage was 4.9 which was very low in amount. Total carbohydrate presented in pumpkin powder was55.77% and total sugar presented in the powder was 6.1% which was included in total carbohydrates.

Table 2: Proximate analysis of the pumpkin powder

Characteristics of the powder	Amount in pumpkin powder
Ash%	4.33
Crude Fat%	27.30
Crude Fiber%	4.25
Protein%	4.90
Carbohydrate%	55.77
Moisture%	3.45
Total Sugar%	6.10
β-carotene(mg/100gm)	40.00

3.2 Physical measurements of the cookies

The effect of replacement of wheat flour with 2.5, 5 and 10% foam mat dried pumpkin flour in cookies making were studied and the data of physical analysis of cookies were presented in Table 3. The weight of the cookies were increased with increasing concentration of the powder. The highest diameter(42.40 mm) was found in cookies which were made from 5%. replacement of wheat flour with pumpkin powder. Incorporation of 10% powder in cookies given lowest diameter value (39.60 mm). It was also clear that increasing the powder concentration in cookie preparations resulted the decrease in thickness of cookies when compared with 15.80 mm thickness for control. The higher thickness (17.10 mm) was recorded for cookies which were made from 2.5% flour replacement. The decrease in diameter and thickness of cookies with addition of 10% pumpkin powder may be due to dilution of gluten. Concerning to spread ratio, it was observed that replacing with 5% powder showed the highest value of spread ratio and volume,2.60 and 23.01 respectively. Cookies made from 5% powder showed the best result in all selected parameters. Cracking was found in cookies made with 2.5 and 10% replacement of wheat flour. Amount of force required to bite the cookies increased with concentration of pumpkin powder. When the concentration of powder was highest the hardness of the cookies also increased. Kulkarni and Joshi, 2012 reported the same things about pumpkin blended biscuits.

Table 3: Physical analysis of cookies

Type	Weight (gm)	Diameter (mm)	Thickness (mm)	Spread Ratio	Volume (cc)	Density (gm/cc)
Control	13.43	41.10	15.80	2.60	20.96	0.64
2.5%	13.50	40.00	17.10	2.34	21.48	0.63
5.0%	13.85	42.40	16.30	2.60	23.01	0.60
10.0%	16.16	39.60	15.80	2.51	19.46	0.83

3.3 Sensory evolution of the cookies

Sensory evolution studies were showed in Table 4**.** Colour, flavour, texture, appearance and overall acceptability were selected as sensory characteristics of the cookies. Colour of the cookies became more dark when the concentration of the powder was increased in the cookies. Cookies made from 5% powder achieved highest score in colour and flavour. Cookies became harder with increasing the concentration of the powder. Concerning to spread ratio, it was observed that cookies made with replacing 5% wheat flour got the highest value(7.25±0.25) when compared to the control(7.75±0.25).It was also observed that cookies with adding 5% powder achieved the highest score in appearance and overall acceptability. From Table 4 we can conclude that cookies made with 5% powder scored the best result among the other two types of cookies. Regarding to overall quality, it could be observed that cookies incorporated with 5% showed higher scores compared to other cookies.

Table 4: Sensory analysis of cookies

Sensory Attributes (Characteristics of the powder)	Sensory Score of four type of cookies			
	Control	2.5%	5%	10%
Colour	7.85±0.39	6.38±0.22	8.00±0.00	7.38±0.22
Flavour	7.82±0.22	6.87±0.54	8.00±0.00	7.25±0.25
Texture	7.75±0.25	7.00±0.00	7.25±0.25	7.12±0.22
Appearance	7.87±0.22	7.00±0.00	8.00±0.00	7.25±0.25
Overall Acceptability	7.63±0.41	7.00±0.00	7.87±0.22	7.38±0.41

3.4 Physico-chemical analysis of the cookies

Cookies made with 5% pumpkin powder were selected for the physico chemical analysis which was listed in Table 5. Moisture percentage of the cookies were 3% which was within the limits (3-5% is optimum for standard cookies).Ash percentage of the cookies were 0.6% .Colour of the ash was white and no carbon particle was found in the crucible. Fat percentage of the cookies were 18%.Protein percentage of the cookies were 5.72.Carbohydrate and total sugar percentage was 68.66 % and 20% respectively. β-carotene was absent in control sample but due to 5 % (w/w) replacement of refined wheat flour with pumpkin powder in the optimized cookies, the β-carotene content increased to 13.85 mg/100g. This is very important considering the increase in the vitamin A value of the product.

Table 5 : Physico chemical analysis of optimized cookies

Parameters	Amount
Moisture%	3.00
Ash%	0.60
Fat%	18.00
Protein%	5.72
Total Sugar%	20.00
Carbohydrate%	69.66
β-carotene(mg/100gm)	13.85

4. CONCLUSION

The foam mat dried pumpkin powder could be very well utilized to prepare the cookies. The foam mat dried pumpkin powder had very high nutraceutical value because of containing higher amount of β-carotene which is the source of vitamin A. Cookies made from 5% powder showed the best result in physical measurements and also given highest number by the sensory panelists when compared to the control. So, pumpkin powder enriched cookies can be an acceptable product with high nutraceuticals content.

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