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Development and quality evaluation of pumpkin seeds and flaxseeds powder incorporated biscuits

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Abstract
Pumpkin seed and flax seed were processed into powder and used to substitute wheat flour as composite powder in production of biscuits. Biscuits were prepared from different blends of refined wheat flour, pumpkin seed powder and flax seed powder in the respective ratios of 100:0:0, 90:5:5, 80:10:10 and 70:15:15 and 60:20:20, 50:25:25. The biscuits were analysed for their physical properties, proximate and sensory properties. The data indicates that 30percent (70:15:15, Trial-3) powder incorporated biscuit had better physical and sensory properties (colour, appearance, texture, taste etc.). The incorporated biscuits prepared by flax seed powder and pumpkin seed powder are more nutritious than control biscuit. The study showed that value added biscuits can be produced using pumpkin seed powder and flax seed powder to enrich biscuits that is capable of increasing the protein and fiber contents which can help in ameliorating protein malnutrition.

Keywords: flaxseed, pumpkinseed, wheat flour and biscuits, nutritional characteristics, sensory analysis

1. Introduction
Today's consumers are conscious of their diet, and many prefer eating healthy foods. Biscuits represent a fast growing segment of food in India because of consumer demands for convenient and nutritious food products. The consumers demand has increased for the quality food products with taste, safety, convenience and nutrition. Thus nutrition has emerged as an added dimension in the chain of food product development Biscuits are a popular food stuff consumed by a wide range of population due to their varied taste, long shelf life and relatively low cost [1, 2]. Because of competition in the market and increased demand for healthy, natural and functional products, attempts are being made to improve the nutritive value of biscuits and functionality by modifying their nutritive composition. Such effects are very often achieved by increasing the ratio of whole grain raw materials other than wheat or different types of dietary fibres in basic recipes with the attempt to increase biscuits protein and mineral content for quality and availability or increase dietary fibre content.In many studies, authors postulated that Whole grains contains the phytochemicals including phenolics, carotenoids, vitamin E, lignans, β-glucan, inulin, resistant starch, sterols, and phytates, may provide desirable health benefits beyond basic nutrition to reduce the risk of chronic diseases [3].

Flaxseed (Linum usitatissimum) are a rich source of micronutrients, dietary fiber, manganese, vitamins, and the essential fatty acid Alpha Linolenic Acid, also known as ALA or omega-3 fatty acid. It is considered as one of the oldest fiber crop in the world known to have been cultivated in ancient Egypt and China. Canada is the largest producer of flaxseed in the world, representing about 40 per cent of world production. When combined, China, United States and India account for another 40 per cent of world production [4]. Flaxseed is one of the richest vegetarian sources of alpha-linolenic acid (omega-3 fatty acid) and soluble mucilage. It is small, flat, oval, brown or fawn or yellow coloured, glossy in appearance with mucilaginous taste and oil nature [5, 6]. The flaxseed is also an excellent source (about 28%) of dietary fiber. About two third of the total fiber in flaxseed is insoluble which increase the bulk indigestive system, thus aids in digestion and prevent constipation. These properties of fiber provide great protection against cancers. Whereas, remaining fiber portion of the flaxseed is soluble having the ability to lower cholesterol levels in the body [7]. The soluble fibers also optimize the blood sugar concentrations. The high amounts of lignans, soluble fiber, and alpha-linolenic acid, along with other phytochemicals found in flaxseed, offer many health benefits. The protein and soluble fiber known as flaxseeds mucilage have been shown to have cholestrolemic, hypolipidemic, and atherogenic effects, as well as to have positive effects on blood glucose metabolism [8, 9].

Pumpkin seed (Cucurbita pepo) has received considerable attention in recent years because of the nutritional and health protective values of the seeds. The seed is an excellent source of protein and also has pharmacological activities such as anti-diabetic, antifungal, antibacterial, anti-inflammation activities and antioxidant effects [10]. Besides, the pumpkin is economical and a nutrient dense source, the pumpkin seed

flour fortified complementary food mix is economical, with highly acceptable sensory qualities and a rich nutritive value, quoted that, pumpkin seeds offer a nutritious, sweet, somewhat soft and chewy snack or food additive [11, 12]. They also have omega 3 & omega 6 fatty acids needed for hormone balance, brain function and skin health. Tryptophan present in these seeds aids in milk production in lactating mothers and used to reduce postpartum swelling of the hands and feet. Hence Pumpkin seeds serve as a good nutritious snack and helps in promoting good health. Pumpkin seeds have one of the highest levels of Antioxidants of any nut, seed or food [13]. The present study entitled "Development and quality evaluation of pumpkin seed and flax seed powder incorporated Biscuits" was carried out with the following objectives

1. To manufacture biscuits incorporated with flax seed and pumpkin Seed Powder.
2. To conduct proximate analysis of raw flaxseeds and pumpkin seeds powder
3. To study the effect of pumpkin seed and flax seed powder incorporation on the
4. Physicochemical and nutritional quality characteristics of biscuits.
5. To study the Sensory analysis of developed biscuits.

2. Materials and Methods

Refined wheat flour, flax seed powder, pumpkin seed powder, fat, sugar and baking powder, ammonium bi carbonate, salt, used for biscuit making were purchased from local market in Hyderabad, Telangana. All the chemicals/ reagents used were of analytical grade.

2.1 Preparation of flax seed powder and pumpkin seed powder

The cleaned flax seed and pumpkin seed were sorted and roasted until it changed to light brown colour. The roasted flax seed and pumpkin seed were ground in a domestic grinder (Philips). The flax seed and pumpkin seed powder were sieved through a 100-150 mesh sieve. The samples were kept in airtight container during its storage period.

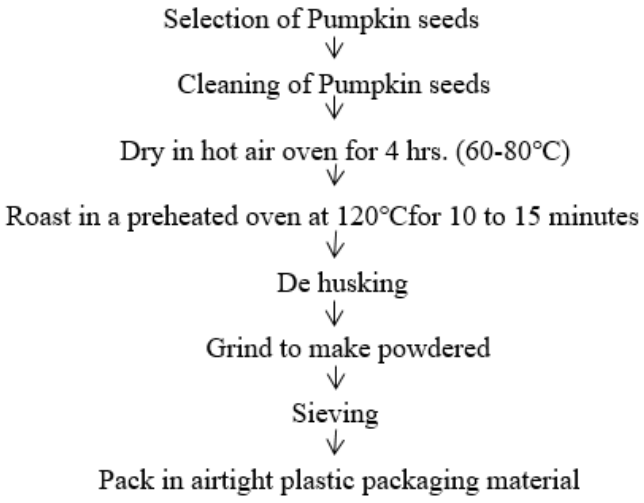

Fig 1: Preparation of pumpkin seed powder

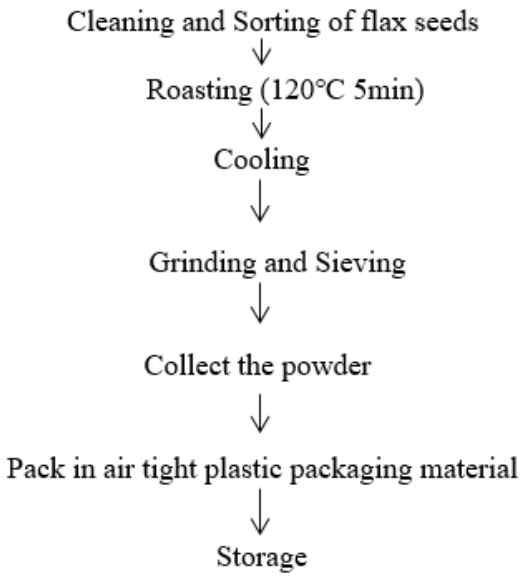

Fig 2: Preparation of flax seed powder

2.2 Product Development

Biscuit samples were prepared using creamy method for making biscuit dough. The ingredients (g) used in preparation of biscuits were flour blends 100g, fat 15, sugar 30, baking powder 1, salt 0.6, ammonium bicarbonate 1.5 and water to make dough softer. Biscuits were prepared from different blends of refined wheat flour, flax seed powder and pumpkin seed powder in the respective ratios of 100:0:0, 90:5:5, 80:10:10, 70: 15:15, 60: 20: 20 and 50:25:25. Refined wheat flour biscuits were considered as control. Biscuit dough was prepared in a Hobart Mixer and sheeted and rolled out into thin sheet of uniform thickness and cut into desired shape using mould. The cut pieces were placed over a perforated tray and transferred into a baking oven at 180-200°C for 10 - 15 min. The well baked biscuits were cooled.

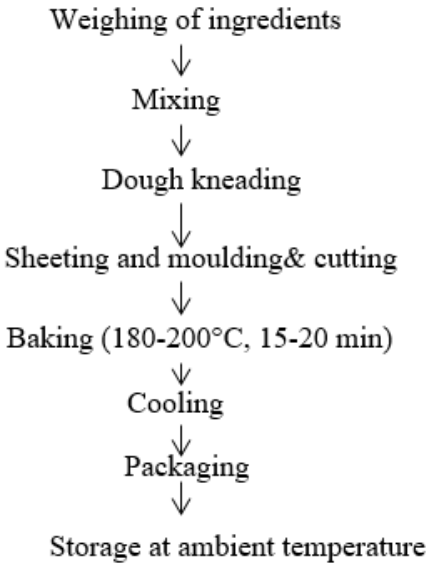

Fig 3: Flow chart for production of biscuits

3. Physical characteristics of developed biscuit

Biscuits were analyzed for diameter, thickness, spread ratio following the procedures described by AACC, 2000 [14]. The diameter (D) was determined by placing six biscuits horizontally (edge to edge) and rotated at 90° angle for reading. It was measured using the vernier caliper. Thickness (T) of the biscuits was also measured with a vernier caliper in triplicate. Means were recorded. Biscuits spread ratio was calculated as D / T. Weights were determined using a digital top loading balance (CE- 410I, Camry Emperors, China).

3.1 Chemical Composition of Developed Biscuit

3.1.1 Moisture Content

It was determined using procedure described by AOAC, (1990) was used. The moisture content of each sample was determined by weighing 5 g of the sample into a petri dish.
The sample was then dried to constant weight at 105°C [15].
Moisture content = Weight of can –weight of empty can×100/ Weight of sample

3.1.2 Protein content determination

Analysis of protein content was done using the Kjeldah method as described by AOAC, 1990 [16].

3.1.3 Fat content determination

Extraction of fat was performed by the Soxhlet method in automatic fat extraction unit called soxhlet apparatus using diethyl ether [18].

3.1.4 Ash content determination

10g of the samples was weighed and placed inside muffle furnace with temperature adjusted to between 550±15°C and was heated for 6hours or more to burn off all the nutrients and fibre present to obtain a white ash in hot plate. Ash Content in percentage was calculated thus (AOAC, 1984) [17].

% Ash = Ash weight x 100/ Weight of sample

3.1.5 Estimation of crude fibre

Crude fibre of the sample was estimated by using moisture and fat free samples and expressed as g/100g of the sample. (AOAC, 1990) [15].
The carbohydrate content was calculated by difference between 100 and total sum of the percentage of moisture, protein, fat, fibre and ash while the energy values were calculated using Atwater formula.

3.1.6 Calorific value

The calorific value (Kcal/100 g) of biscuits was calculated by summing up the products of multiplication of percent protein, fat and carbohydrate present in biscuits by 4, 9 and 4, respectively.

3.2 Sensory characteristics of biscuits

The sensory evaluation of prepared different biscuits samples were carried out a 10 member trained panel comprised of postgraduate students and academic staff members of the faculty who had some previous experience in sensory evaluation. The panel members were requested in measuring the terms identifying sensory characteristics and in use of the score. Judgment were made through rating products on a 9 points Hedonic Scale with corresponding descriptive terms ranging from 9 ‘like extremely to 1 ‘dislike extremely’ [19]. The parameters evaluated are such as colour, crispiness, taste, texture, flavour and overall acceptability were determined.

4. Result and Discussion

4.1 Proximate composition of wheat flour and flax seed powder and pumpkin seed powder

The chemical compositions of wheat flour and FSP and PSP used for biscuits preparation are shown in Table 1. Pumpkin seed powder was found to have high protein, fiber, and ash content in comparison with wheat flour and flax seed powder.

Table 1: Proximate composition of wheat flour and flax seed powder and pumpkin seed powder

Nutrients	Wheat flour	FSP	PSP
Moisture (%)	11.18	4.53	4.82
Protein (%)	13.10	20.0	25.85
Fat (%)	0.86	41.0	38.01
Ash (%)	0.62	3.47	4.11

Note: FSP-Flax seed powder, PSP-Pumpkin seed powder

4.2 Physical characteristics of biscuits

The physical characteristics of the biscuits prepared with pumpkin seed and flaxseed powder is given in Table 1.The Weight of biscuits decreasing slightly, Compared to control biscuits t. The diameter of the biscuits increased from 4.51cm to 5.01cm with increase in the level of incorporation of pumpkin seed and flax seed powder. The results showed that diameter in T5 sample had the maximum diameter (5.01cm), followed by T3and T4 (4.82cm), while minimum diameter was observed in T1 (4.50cm). However, biscuit thickness decreased from 0.64cm to 0.59cm with increase in the level of incorporation of pumpkinseed and flax seed powder. The results showed that T1 sample had maximum thickness (0.62cm) followed by T2 (0.61cm) while minimum thickness was observed in T3, T4 and T5samples and control sample. The spread ratio of biscuits increased from 7.04 to 8.49 with increase in the level of incorporation of pumpkin seed and flax seed powder. Narayan (1991) [20] reported that the spread ratio of biscuits increased with increasing level of soy flour. Joel Ndife (2010) [21] observation showed that the width of the cookies samples A (0%), B (20%), C (30%) and D (50%) increased as a result of the level of soy-flour substitution. The reverse was observed for the thickness of the cookies. Sample a (whole wheat cookies) had the highest value of 4.80mm. The spread factor is an indicator of biscuit and cookie quality.

Table 2: physical parameters of developed biscuits

Treatments	Weight (g)	Diameter (cm)	Thickness (cm)	Spread ratio(D/T)
C	8.6 ±0.1	4.51±0.5	0.64±0.9	7.04
T1	7.8±2.1	4.50±0.4	0.62±1.1	7.25
T2	8.2±1.4	4.61±0.2	0.61±0.6	7.55
T3	8.5±1.3	4.69±0.1	0.59±0.3	7.84
T4	7.7±0.6	4.82±0.8	0.57±1.5	8.45
T5	7.0±0.8	5.01±0.4	0.59±1.1	8.49

Note

C-Control sample

T1-Biscuits prepared by incorporated 10% of flaxseed and pumpkin seed powder

T2 .Biscuits prepared by incorporated 20% of flaxseed and pumpkinseed powder

T3 - Biscuits prepared by incorporated 30% of flaxseed and pumpkinseed powder

T4- Biscuits prepared by incorporated 40% of flaxseed and pumpkinseed powder

T5- Biscuits prepared by incorporated 50% of flaxseed and pumpkinseed powder

Table 3: Nutritional quality characteristics of biscuits

Nutrients	C	T1	T2	T3	T4	T5
Moisture (%)	2.52	2.61	2.72	2.68	2.70	2.88
Protein (%)	8.89	13.19	13.36	13.99	14.00	14.19
Fat (%)	13.98	15.09	15.56	16.98	16.72	17.01
Ash (%)	0.35	0.71	0.70	0.72	0.77	0.79
Crude fiber	0.15	0.92	0.98	1.12	1.42	1.58
CHO (%)	74.11	67.48	67.68	64.51	64.39	63.64
Energy	457.82	462.72	464.20	466.82	464.52	464.41
(k cal						

The chemical composition of the biscuit samples are presented in Table 3. The moisture content of the biscuit samples ranged from 2.52-2.88% with the control sample having the lowest value. The protein content of biscuits increasing levels of PSP and FSP. It ranged from 8.89 to 14.10% with the control sample(c) having the lowest value, while the sample (T5) with 50% powder inclusion having the highest value (14.10%). The fat content of biscuits ranging from 13.98 and 17.01%. Results indicated that as the level of flax seed powder and pumpkin seed powder inclusion increased, the protein, fibre and fat content also increased. This was in consonance with the findings of Akubor (2003) [22] who observed increase in protein, fat, fibre and ash contents when supplemented with soya bean flour for biscuit production. The carbohydrate content of biscuits decreased from 74.11% to 63.64%, with the highest value in the control sample and the lowest value in sample T5 (50% wheat flour; 25% of FSP 25% PSP powder). Results also indicated that Energy values of the developed biscuits increased as the levels of inclusion increased compared to the control sample. This might probably be due to the increases in protein and fat contents. Flaxseed fibre, both soluble and insoluble is considered to reduce the blood glucose and cholesterol levels. Moreover, flaxseed is one of the best source of lignan which has the ability to bind estrogen receptors in the body and act as anti-carcinogenic agent and helps to avoid prostrate, breast and endometrial cancers. Pumpkin seeds are a good source of calories, proteins, carotenoids, minerals, fiber and phytosterols which contribute in regulating cholesterol. They also have omega 3 & omega 6 fatty acids needed for hormone balance, brain function and skin health. Tryptophan present in these seeds aids in milk production in lactating mothers and used to reduce postpartum swelling of the hands and feet. Hence Pumpkin seeds serve as a good nutritious snack and helps in promoting good health [13]

Table 4: Sensory analysis data

Treatments	Color	Texture	Taste	Flavor	Overall acceptability
C	8.30	7.51	7.52	7.41	7.90
T1	7.69	7.82	7.31	6.90	7.89
T2	7.56	7.94	7.04	7.15	7.83
T3	7.83	7.91	7.72	7.69	7.92
T4	7.18	7.07	7.19	7.01	7.01
T5	6.56	6.61	6.54	6.69	6.76

C- Control sample. T1-10%(5%+5%) of flaxseed and pumpkin seed powder, T2 .20% (10%+10%)of flaxseed and pumpkinseed powder, T3 - 30% (15%+15%)of flaxseed and pumpkinseed powder,T4- 40% (20%+20%)of flaxseed and pumpkinseed powder, T5- 50% (25% +25%) of flaxseed and pumpkinseed powder.

Sensory Analysis

Colour: The colour of the sample control and trail T3 biscuit was highest with a score of 8.30 and 7.83 as compared to other biscuits.

Flavour: The flavour for sample T3 was highest with a score of 7.69 due to optimum content of both flax seed powder and

pumpkin seed powder.

Taste: The taste of sample T3 was highest with a score of 7.72 as compared to other biscuits.

Texture: The score for texture was highest for the sample T2 with a score of 7.94 as compared to other biscuits to

Overall Acceptability: The overall acceptability of trail T3 was highest as compared to other biscuits with a score of 7.92.

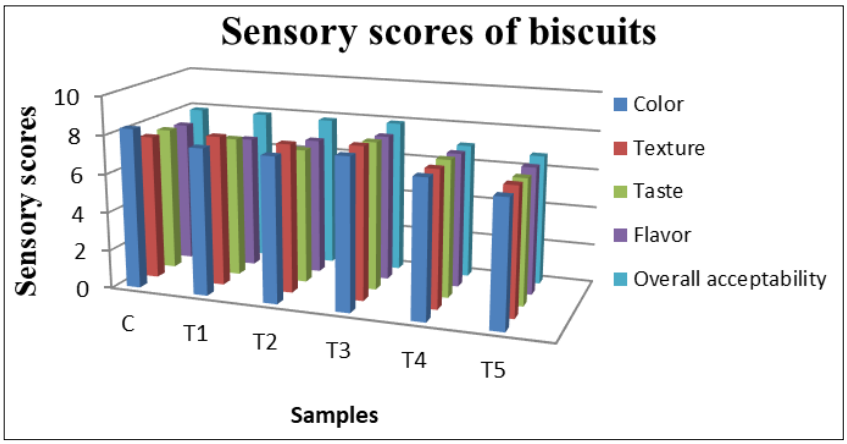

Fig 4: sensory analysis of different formulations

5. Conclusion

This research finally lead to the formulation of healthy biscuits incorporated with pumpkin seed powder and flax seed powder ingredients. The fibre and protein content level improved in the biscuits with the increase in the proportion of FSP and PSP. On the basis of sensory quality, biscuit when incorporated with blends 30%(15% flax seed powder and 15% pumpkin seed powder,Trail-3) resulted in better quality. It can be use as a vehicle for protein and fibre and omega 3 fatty acid fortification and other nutritional improvement. So, it is advice to include this biscuit in daily routine diet for health benefit.

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