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Evaluation and development of healthy pancake premix from pseudocereals amaranth and buckwheat

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Abstract
The era of health conscious has influenced the food industry to introduced healthy foods. According to the demand of consumer's health, people now-a day's demand nutritious food with sufficient health benefits. The aim of this study was the development and standardization of healthy pancake premix. Healthy pancake premix was prepared comprising of ingredients buckwheat flour, amaranth flour, makhana flour, jaggery, milk powder, almond, baking powder. Healthy Pancake premix was packed in laminates and polypropylene. Pancake premix was analyzed for chemical parameters (moisture and crude fat) content for 21 days and sensory attributes during the storage period of 28 days. The moisture content was increased during storage period of 21 days whereas fat and ash content was decreased. Sensory evaluation was done by nine points hedonic scale method. However, sensory attributes were recorded throughout the storage interval of 28 days under ambient conditions. Thus, it was found that among all the treatments, the Treatment T_1 (30:15:10::BWF:AF:MF) packed in laminates was best in appearance, aroma, taste and texture among the other treatments.

Keywords: Premix, pancake, laminates, polypropylene, healthy, storage

Introduction
Ready-to-eat foods are those foods that do not require any additional cooking and generally are stored in refrigeration or at room temperature. Ready–to-eat foods provide the advantageous benefits of convenience, health and variety (Muktawat and Varma, 2013) [10]. Premix usually refers to a substance which is mixed in an early stage of manufacturing and distribution process.

Pancakes could be easily prepared from the premix by adding required quantity of fat or butter and water to the premix. Pancakes made from different instant mixes are consumed in different parts of the world with different regional names and are considered to be very popular wheat-based breakfast food items. Studies have been made on conventional wheat pancakes, extensively on the processing conditions for the improvement of texture and flavor Yemmireddy *et al*., 2013 [18]. Cereals are a staple food in almost all parts of the world and play an important role in the human nutrition. Rice, maize and wheat are three most widely grown cereal species, but there are several other important cereals like millet, sorghum, oat and barley, as well as the pseudocereals amaranth, quinoa, and buckwheat (Bender and Schonlechner, 2021) [2]. Recent years have witnessed that the pseudo cereals have attracted much interest because of their favorable characteristics (high dietry fiber, proteins, vitamins, minerals and essential amino acid content). Among the pseudocereals the most important are the buckwheat and amaranth with higher protein and mineral content than traditional cereals.

Buckwheat is a dicotyledonous plant, in the *Polygonaceae* family. *Fagopyrum esculentum* (common buckwheat) and *Fagopyrum tataricum* (tartary buckwheat) are the two main types of buckwheat species. Both are primarily grown in the temperate zones of the Northern hemisphere. Because of its similarity in use and chemical composition to cereals, buckwheat is often known a pseudo cereal (Linh *et al.*, 2014) [8]. Buckwheat seeds, flowers and tissues contain many nutraceutical compounds. It contains variety of dietary compounds, including proteins with essential compounds (which are deficient in staple foods) and high biological value phenolic compounds. The seed of buckwheat also contains phenols in the form of: flavonoids and flavones, plant sterols, fagopyrins, thiamine binding proteins, allergenic proteins and their derivatives, which have the healing properties for human beings. Whole buckwheat contains total of 55% starch, 12% protein, 4% lipid, 2% soluble carbohydrates, 7% total dietary fiber, 2% ash. Several gluten free pseudo cereals grains like: amaranth, quinoa and buckwheat, have an excellent nutrient profile for human consumption (Verma *et al.*, 2020) [16].

A major pseudocereal, amaranth which is an ancient plant belonging to the family (*amaranthaceae*) and is believed to be originated from central and southern America. Because of their significant starch, protein and lipid content amaranth seeds are considered promising raw materials for the production of flour, starch and protein (Sangeeta and Grewal, 2018) [12]. Amaranth has a higher protein content than most of cereals, i.e. (12% to 18%) with a higher content of lysine and an acceptable level of tryptophan and methionine, both of which are found in low concentration in cereal and legume grains. It has lipid content of 10 to 17% and relatively high amount of unsaturated fatty acids. It is also an excellent source of vitamins and minerals (Sindhu and Khatkar, 2016) [14]. Makhana (*Euryale Ferox salisb*) is an aquatic crop and is commonly known as Gorgon nut or Foxnut. Being the non-cereal food, Makhana is an ideal staple food of devotees during the religious fast. Makhana seeds are high in in magnesium, potassium and phosphorus and low in saturated fats, sodium and cholesterol. It contains proteins that is easily digestable, carbohydrates, total minerals, phosphorus and iron. These chemical constituents are extremely beneficial for human body and also provide rich source of nutrition. It is high in fiber and aids in constipation (Francis, 2018) [4]. Makhana can be stored in two forms i.e. seeds and popped makhana. Hence, popped makhana flour could be a useful alternative in development of nutritious food products (Kumar *et al.*, 2015) [7].

Jaggery is a traditional concentrated cane sugar consumed in Asia, Africa and some countries in America. Jaggery is rich in minerals mainly iron but it also has traces of other mineral salts. It activates digestive enzymes and speeding up digestion and smoothening the process, ultimately reducing strain on the intestines and the digestive tract. It effectively cleans the respiratory tracts, lungs, food pipe, stomach and intestines. Because of its nutritional and medicinal value, it is being highly recommended by health experts in food application too (Shrivastva *et al.*, 2016) [13]. The almond is an edible seed that grows on tree (*prunus dulcis*), also known as almond tree. Almonds are an excellent source of antioxidant which aid in the prevention of oxidative stress that can damage molecules in cells and contribute to ageing and diseases such as cancer and therefore antioxidants are primarily in the brown layer of the skin (Olatidoye *et al.*, 2011) [11]. Milk powder is a manufactured dairy product made by evaporating milk to dryness (Manzi *et al.*, 2013) [9]. Thus, knowledge gap for the use of pseudocereals in development of functional foods and nutritious pancake is limited. As a result, the study conducted for the preparation of healthy pancake premix is found to be of high in nutritive value and also contains the goodness of buckwheat flour, amaranth flour, foxnut and Jaggery.

Materials and Methods

Selection of ingredients and preparation of pancake premix: Popped makhana was procured from the local market and then grinded into fine powder or flour followed by sieving. The other ingredients such as buckwheat flour, amaranth flour, jaggery, milk powder, almond powder and baking powder were also procured from the local market. The various ingredients (buckwheat flour, amaranth flour, makhana flour, jaggery, milk powder, almond powder and baking powder) were weighed accurately. The pre-weighed ingredients were then packed in polypropylene and laminates and stored at ambient temperature.

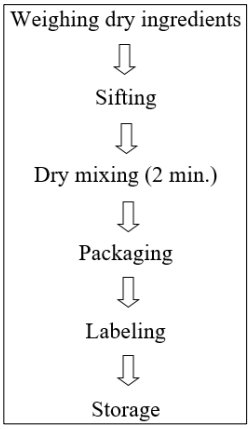

Fig 1: Flow sheet for the preparation of healthy pancake premix

Methodology for preparation of pancake from premix: To prepare pancake from premix measured quantity of water was added (95 ml) to form batter and stirred with a wire whisk for about two minutes. Over mixing was avoided. Finally, the batter was poured on the preheated griddle and the pancakes were cooked for about 1.5 minutes at 190^0C until the bubbles on the upper surface of the pancake was broken (as an indicator to the proper cooking) and turned to the other side and then again cooked for another 1.5 minutes at ambient temperature.

Table 1: Treatment details for the preparation of healthy pancake premix per 100g.

Treatment	Buckwheat Flour (%)	Amaranth Flour (%)	Makhana Flour (%)	Jaggery (%)	Almond Powder (%)	Baking Powder (%)	Milk Powder (%)
C_1	55	-	-	22	6	1	16
C_2	55	-	-	22	6	1	16
T_1	30	15	10	22	6	1	16
T_2	30	15	10	22	6	1	16

Control C_1= packed in laminates, Control C_2 = packed in polypropylene, T_1= packed in laminates, T_2= packed in polypropylene

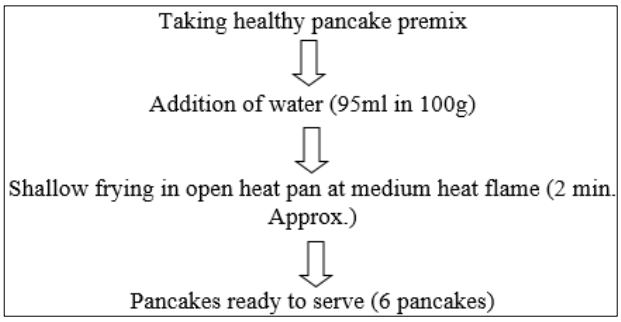

Fig 2: Flow sheet for the preparation of healthy pancake

Fig 3: Healthy pancake made from premix

Quality attributes

The developed samples were then evaluated for their chemical properties such as moisture content, crude fat. Also, sensory parameters were evaluated for samples and determined by the procedure as given below:

Moisture content

The moisture content was estimated by gravimetric method on dry basis. About 5g of sample was taken into previously weighed petridish. The dish was then kept in an electric hot air oven maintained at the temperature of 105°C for 2 hours. Then it was cooled in desiccator and weighed. The process of drying, cooling and weighing was repeated at 30 minutes interval until the difference between two consecutive weighing was less than 1 mg (AOAC, 2002) [1].

Formula used for determination of moisture content is given below:

$$\text{Moisture content (\%by weight)} = \frac{W_1\text{-}W_2}{W} \times 100$$

Where,

W = Weight in g of sample taken.

W_1 = Weight in g of the dish with the material before drying,

W_2 = Weight in g of the dish with the material after drying.

Crude fat

The fat content was determined by using Soxhlet extraction method. In this method moisture free 5g sample was taken in a ready- made thimble and oil was extracted in pre-weighed round bottom flask (cleaned, dried and weighed) using petroleum ether is SOCS plus for 2.5 to 3 hours. The flask was then dried in a hot air oven to evaporate petroleum ether and allowed to cool, after cooling the final weight of the flask was taken and used for the estimation of crude fat content of sample (AOAC, 2002) [1].

The following equation was used for estimation of crude fat content (%) in the sample:

$$\text{Crude fat \%-} \left(\frac{W_2 - W_1}{W} \right) \times 100$$

Where,

W = Weight of sample taken (g)

W_1= Weight of empty round bottom flask (g)

W_2= Wight of flask with fat (g)

Storage Study

The shelf -life of the healthy pancake premix was evaluated for chemical analysis for 21 days of storage period at room temperature. Various parameters were studied after regular interval of 7 days. The premix was packed in two types of packaging material i.e. laminates and polypropylene and the quality parameters of both the packaging material were evaluated.

Sensory Analysis

The organoleptic evaluation of healthy pancake premix was carried out for consumer acceptance and preference for the period of 28 days. Healthy pancake Premix was subjected to sensory analysis by hedonic scale method. The coded samples were given to semi-trained panel of 10 members and the product was evaluated after a uniform interval of 7 days for appearance, taste, texture and overall acceptability. The panelists were asked to rank the product according to their liking (Srilakshmi, 1999) [15].

Statistical analysis

The obtained results were statistically analysed using completely randomised design (CRD) and CRD factorial for interpretation via analysis of variance (Gomez and Gomez, 1984) [5].

Results and Discussion

Chemical analyses

Moisture content

From the Fig.4, it was observed that at zero day the moisture content in samples C_1 and C_2 was 7.49 percent followed by T_1 and T_2 i.e. (7.90%). After 21 days of storage period, an increase in the moisture content was observed and the highest moisture content was found to be (8.12%) in sample T_2 which was packed in polypropylene followed by sample T_1 in laminate, C_2 in polypropylene and C_1 in laminate i.e. (8.05%), (7.77%) and (7.63%) respectively. The increase in the moisture content during storage period is due to hygroscopic nature of product. Similar findings were reported by (Jothi *et al.*, 2014) [6] that moisture content increases due to various level of water holding capacity of different flours while studying the effect of gluten free flours on physico- chemical properties of cracker biscuits. It was concluded that samples (C_2 and T_2) packed in polypropylene gained more moisture content as compared to ($C_1$and T_1) which were packed in laminates. It may be due to poor barrier properties of polypropylene.

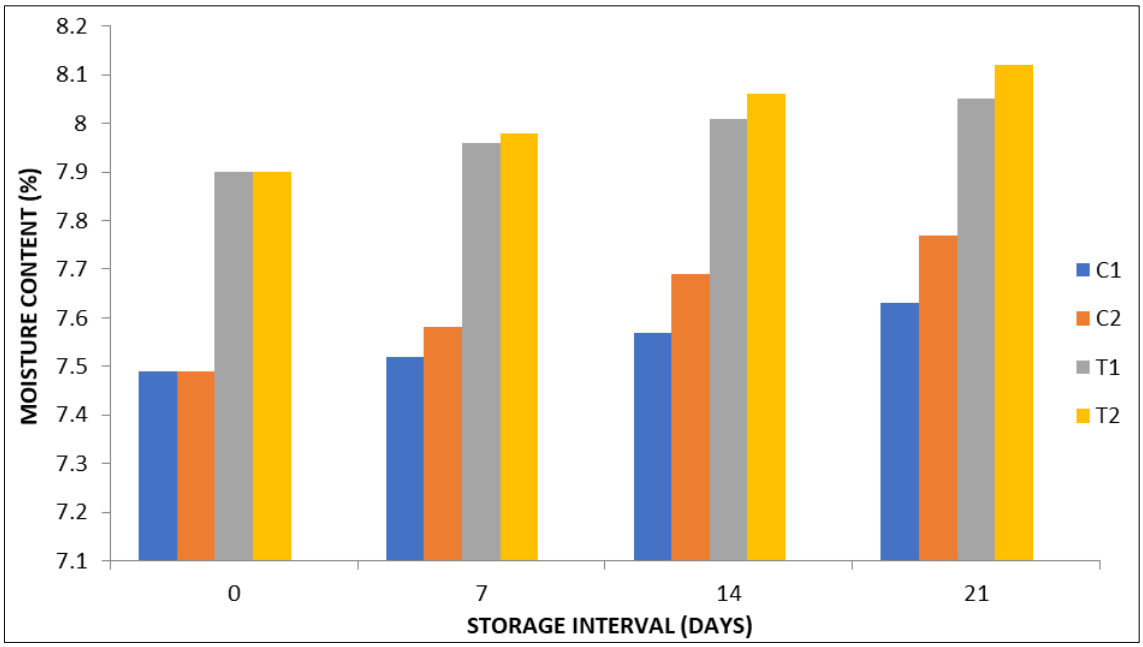

Fig 4: Graphical representation of effect of storage period on moisture content (%) of healthy pancake premix packed in laminates and polypropylene.

Crude Fat

From the table 2, it was observed that at zero day, the fat content in samples C_1 and C_2 of premix was (7.54%) and (7.52%) respectively, followed by samples T_1 and T_2 i.e. (7.18%) and (7.35%). After 21 days of storage period, a decrease in the fat content was observed among all the samples. The highest fat content was found in sample C_1 i.e. (4.53%) followed by samples C_2 i.e. (4.42%), T_1 i.e. (4.41%) and was found to be lowest in T_2 i.e. (4.38%). These results are corresponds with the findings by (Wronkowska and Soral, 2008) [17] that fat content may decrease with the increased concentration of buckwheat flour in gluten-free formulations. It was also found that samples (C_2 and T_2) packed in polypropylene showed less decrease in fat content more as compared to samples (C_1 and T_1) packed in laminates.

Table 2: Effect of storage period on crude fat content (%) of healthy pancake premix stored at room temperature.

Treatment	Crude Fat (%)				Mean
	Storage period (month)				
	0	7	14	21	
C_1 (55::BWF)	7.54	6.54	5.51	4.53	6.03
C_2 (55::BWF)	7.52	6.54	5.51	4.42	5.99
T_1 (30:15:10:BWF:AF:MF)	7.18	6.19	5.25	4.41	5.76
T_2 (30:15:10: BWF:AF:MF)	7.35	6.38	5.37	4.38	5.87
Mean	7.39	6.41	5.41	4.43	

BWF: Buckwheat Flour AF: Amaranth Flour MF: Makhana Flour

Effect	$CD_{(p=0.05)}$
Treatment	0.02
Storage	0.02
Treatment x Storage	0.04

Sensory analyses

The healthy pancake made from premix were subjected to sensory analysis for appearance, texture, taste and overall acceptability by hedonic test method. Sensory analysis during storage study was done regularly at interval of 7 days.

Overall acceptability

The results indicated in Fig.5, showed that all the treatments had appreciable rating for overall acceptability. Mean scores for the overall acceptability of all the treatments was found to decrease with advancing in the storage period. However, the mean score for treatment T1 (30:15:10::BWF:AF:MF) recorded to be highest i.e. 9.0 among all the treatments at 0 day and it was found to decrease to 8.5 after 28 days of storage period followed by treatment T2 (30:15:10::BWF:AF:MF), C1(55::BWF) and C2(55::BWF). It was found that all the treatments of healthy pancake premix were acceptable on 0 day. But after 28 days of storage period, T1 (30:15:10::BWF:AF:MF) was observed to be more acceptable among all the treatments. The treatment T1(30:15:10::BWF:AF:MF) was found to be more acceptable because the proportion of buckwheat flour is lower than in the control treatments. Observations were reported by (Beitane *et al.*, 2014) [3] that buckwheat flour usually imparts bitterness and changes the colour of pancakes to darker, when buckwheat flour incorporation is increased. It was also concluded from sensory scores that premix packed in laminates has better scores than those in polypropylene. Thus, the observed sensory parameters of the healthy pancake premix were corroborated within the findings.

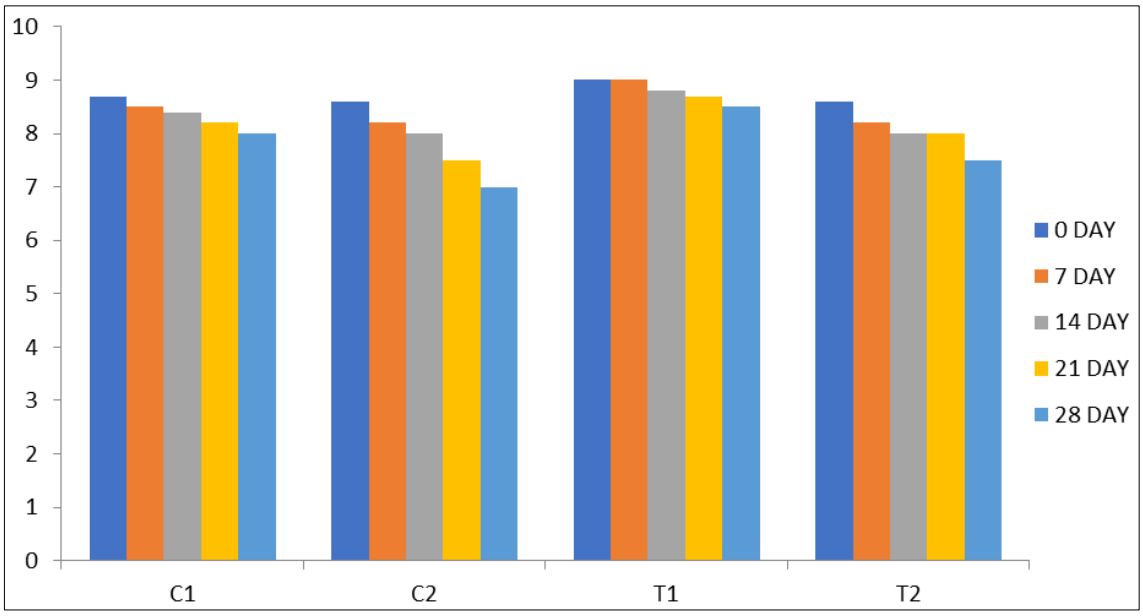

Fig 5: Effect of storage period on overall acceptability for different treatments.

Conclusion

A variety of gluten-free whole grains such as amaranth, buckwheat can be used in the gluten free formulations. These gluten free ingredients used possess high quality protein and abundance of fiber and mineral content. From the study, it is evident that for the preparation of an acceptable and nutritious pancake can be done by the incorporation of pseudocereals into the premix. On the parameters of sensory analyses, Treatment T_1(30:15:10::BWF:AF:MF) packed in laminate was accepted the most among the rest of the treatments and can be used in the development of pancake. However, availability of these products is still limited in the markets but more research is needed for exploiting the functionality of these gluten free cereals, which are nutritionally balanced.

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