Development of gluten free low calories Pancake

Dissertation Report

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CERTIFICATE

This is certify that "Sandeep Kaur" Registration (11713702) M.Sc Dissertation entitled, "**Development of gluten free low calories Pancake**", Under my guidance and supervision. To the best of my knowledge, the present work is the result of her original investigation and study. No part of pre- dissertation has ever been submitted for any other purpose at any university.

The project report is appropriate for the submission and the partial fulfillment of the conditions for the evaluation leading to the award of Master of Food science and Technology.

Date: 14 MAY 2018

signature of supervisor

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DECLARATION

I hereby declare that the work presented in the entitled, "Development of gluten free low calories   Pancake", my own and original the work has been carried out by me at school of Agriculture, lovely Professional University, Punjab, (India). Under the guidance of "Dr. sawinder kaur", Head of the Department (Food Technology) school of Agriculture, Lovely Professional University, Punjab (India). For the award of the degree of Master of Food Science Technology**.**

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I certified that the above statement made by the student is correct to the best of my knowledge and belief**.**

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CONTENT

Introduction

Black rice

Black rice has two major crop primarily consumed in southeast Asia japan and. U.S.A and which primarily consumed in india.They are many special cultivars rice of India that color pigment. Black rice good source of several amino acids. Black rice contain high amount of dietary fibre and mineral content. It natural source of natural pigments compound protective against oxidative damage (Sheh et al.,2008).Black rice contain abundant active compound such as unsaturated fatty acid, vitamins (Wei et al.,2006). Anthocyanin and dietary fibre supplementation effective in reducing stress and may risk of cardiovascular diseases and cancer with inflammatory antioxidant and chemo protective properties (Park et al.,2008). Color rice has reported as potent source of antioxidants as encourages as viable sources of antioxidants for function were made before the beneficial effect of pigment rice emerged (Chaudhary 2003).Most of the rice crop Grown and consumed throughout the world have the white pericarp , but some varieties produce grains with brown, red, purple or black pericap (Jeng et al.,2008). The black rice contain consist of 75%-80%starch,12% water,only7% protein with a full of complement amino acid. Its protein highly digestible and excellent biological value and protein efficiency ratio owing to presence concentration lysine mineral like calcium, magnesium and phosphorus are present along with iron, copper, zinc and manganese (Oka et al., 2012**).** Asia thai glutinous black rice varities known as black stick rice or kao niow dahm commonly available through out the world market. Morever non glutinous Thai black rice varieties has also been exported and finding higher popularity and demand higher prices in Asian rice market nowadays (Yuwadio et al., 2007). Black rice has number of nutritional **a**dvantages over common rich such as higher content of protein, vitamins and mineral although the latter varies with cultivar and production location. Anthocyanins pigments have been reported to highly effective reducing cholesterol level in the human body, inhibitory effect if extract pigment rice bran vitro allergic reaction were determined by (Nam et al., 2007). Effects of peonidin, cyaniding 3- glycoside major athocyanins extracted from black rice also extracted inhibitory effect of cell invasion on various cancer cells (Chen et al., 2006). Black rice has relatively free radical scavenging and antioxidant effect and is important source of natural antioxidant development (Wei et al.,

2006). Black rice can be classified as non glutinous rice (also called non waxy or sweet rice) based on the amlyose content of the grains (Belitz et al., 2009).

PANCAKE

Pancake is another popular wheat based product that can be reformulated be non wheat and gluten free. Pancake are traditionally shallow fried pancakes made in the round shape (Jindal et al., 2004). Pancake are starch based product prepared by pouring batter on to hot solid surface until solid (Amal and Djamel, 2018).Conventional wheat pancake have studied been extensively on processing conditions for the improvement texture of flavor Seguchi 1990,1939 (Seguchi.et.al.1998). Rice flour has a potential to be wheat rice flour substitute in pancakes. Rice is naturally gluten free and contains protein that are known's to be nutritious (Helm and Burks 1996).   A pancake is a thin flat prepared from a batter and cooked on a hot griddle of frying pan. Pancake exist in several variations in the many different cuisines around the world. The griddle method of cooking is older than oven baking pancakes are ancient food (Hoflander 2007). Stevia based pancake while sugar was added in the control. In people with strong genetic factor, environmental factors such as excessive in take food acts as predicating agents. This sugar along with sweetening qualities have also be contributing calories which lead to obesity (Agarwal et al., 2009).Batter based wheat product such as cake, ice cream cones, pancake are consumed globally and are important sources of energy, carbohydrates. A batter made by mixing dry flours prepared using the standard which called 1 cup of all ingredients such as water, milk or pourable viscous flow obtained. In the united state pancake or griddle cake are commonly served as breakfast. Pancake provide effective modal of batter based product because its batter is fried or cooked on a hot griddle (Morris and Rose, 1996).package food product comprising single containers serving said pancake mixes, as well as method of preparing pancake also   provided (Clark et al). The pancake described is preferably 100% whole grain flour and free from preservatives and or artificial coloring. Pancake is a popular breakfast item, Battered based product is popular due to their crispy texture more desirable color and flavor. The quality is batter coated products is influenced by the

rheological properties of the batter material and changes in their properties associated with their transition liquid to solid state (Xue and Ngadi).Pancake consumed in Ageria are a product of family preparation. It consumed on occasions and on holidays. The term pancake referred to many preparations cooked traditionally in other countries of the world (Amal and Djamel 2018).

Review literature

The effect of heat treatment of wheat flour on pancake springiness was studied by Seguchi in 1990. Pancakes baked with heat-treated wheat flour increased in springiness (recovery from compression) and decreased in gumminess. BrabenderAmyl graph tests of heat-treated also showed the first viscosity-increase of the flour water slurries started allowed temperatures when duration of the heat-treatment was increased. The property changes brought about by heat-treatment arc consistent with properties of chlorinated wheat flour. Material – commercially milled U.S western white patent flour with protein and ash content of 7.6 percent and 0.35 percent, respectively was used. sample heat by electric air oven used. Heat treatment of wheat flours improves they desirable characterstic of springiness and decreases gumminess in pancake made from those flours.

The use of chhana and paneer whey in the preparation of pancake was studied by Jindal, 2004. Six samples of chhana and paneer at different ratio substituted different whey to water ratio 0:100, 20:80, 40:60, 60:40,80:20,100:0. Whey substitute also be improved fat, total solid, protein and ash of pancake. Sensory evaluation showed pancake mixed with chhana highest with respect to appearance, body, and texture, flavor and taste and overall acceptability. The substitution of 80:20 was found to be best a samples. All the components those are present in the whey, there was decrease moisture content and chhana, paneer to improve nutritional value. At the same time it will help to control the pollution problem caused by the disposal product. Ingredient wheat flour 25g, sugar 15g, whey+water 60 ml used. Organoleptic analysis, chemical analysis, statistical analyses were determined.

Shih et al., in 2005 conducted the studies on physicochemical properties of gluten free pancake from rice and sweet potato flour. The incorporation of sweet potato flours in the formulation of pancakes was found to improve the physicochemical properties of product. Rice sweet potato pancake at 20-40 percent sweet potato flour incorporation, show a flow behavior more like that of traditional wheat batter and was more useful for pancake preparation. Textural properties such as hardness, chewiness and cohesiveness were

improved and become more comparable with those of the wheat pancake control. Protein content, dietary fibre, total carbohydrate and calories differed very little for all pancake.

The relationship of pancake springiness and interaction between of wheat flour component caused by dry heating was studied by Miki and Masaharu, 2006. Dry heated wheat flour in a fractionated water soluble, gluten starch and tailings fractions by an acetic acid fractionation technique. It has been experimentally shows that heating of wheat affects the texture of food made with flour. Heating of wheat between 60 and 100 degree c is reported to be determined loaf volume. Mixograph test for used for hydrophobicity of the wheat flour by drying heating. With gradual increase in the duration time at each temperature recovery of prime starch fraction decreased while the tailing fraction increased. The water soluble and gluten fraction did not change, which is indicated by the fact that interaction between the prime starch and tailing fractions occurred for these treatment.

The effect of substituting sugar with artificial sweeteners on the texture and palatability of pancake studied by Waldron, 2013. The effect of replacing sugar with stevia and splenda in pancake were examined the study. Subjectively the texture and texture of pancake were evaluated using a 9 point hedonic scale and a structured rating rate scale. Objectively texture and color were examined using a texture analyzer and a hunter colorimeter. The use of alternative sweetners reduces the calorie content of food and that can be useful in accommodating for diabetic needs. Stevia composed of steviol with glycosides, is heat resistant, pH resistant and not fermentable. It should have little to no effect cooking. Splenda mainly composed of surcalose with dextrose and maltodextrin, is heat resistant. So cooking should also have effect on it. To test how stevia and splenda affect pancake quality compared to using regular sugar, stevia blend and granulated sugar splenda completely substitute sugar in the experimental groups. Sugar was added in the control. Each variation was cooked in the same way with the same cooking material. Product texture was measured using a texture analyzer and sensory analysis, color was measured colorimeter, test evaluated using hedonic scale. The result by replacing aritifical sweetner, the calories content and glycemix index decreased.

The effect of hazelnut Flour on the texture and palatability of banana pancakes was studied by Miki and Masaharu, 2006. Hazelnut flour icorporation in pancake is a easy way to increase the nutrition content otherwise nutritionally dense food in an attempt to decrease the risk of certain diseases. The problem is finding balance between flour with gluten forming protein and hazelnut flour to order to produce a product with desirable texture and palatability with the proposed health benefits. To determine the correct ratio, independent and depended variables were used and measured with several test. The texture analyzer was used to determine the force required to compress pancake. Line spread apparatus were used to show the hazelnut flour affected the viscosity pancake batter. The purpose of the experiment determines the ratio of flour with gluten forming protein to hazelnut to produce a pancake with most desirable texture and palatability. Result finding 50% of the all the purpose flour could be replaced with hazelnut flour

Nutritional evaluation of value added product using potato Flour studied by Kaur et al., 2015. Pancake were developed by using potato flour and evaluated on sensory parameters using nine point hedonic scale. Accepted level of potato flour in the developed products was 20- 25 percent. Higher acceptability score was obtained to pancake addition with potato flour. Micronutrient content increased with incorporation potato flour. The developed value added product using potato flour could recommended for malnourished children, pregnant and lactating mother under supplementary feeding program run by government and non government agencies. Method- mix besan 50g, potato flour 50g, red chili, salt, coriander leaves. Add water 70 ml and mix well. Heat the oil on non sticky tawa. Pour the mixture and spread with spatula. Cook the sides till brown color.

Lu et al., 2017 investigated the changes level of phenolic during pancake preparation. The concentration and distribution of phenloic acid varies the type of wheat flour,(whole wheat and refined wheat and cultivar soft and hard). Phenolic acids are widely distributed in grains and are present in high concentration in whole wheat products.
In this paper evaluated the application of simple ultraviolet and infra red spectral fingerprints to classify flour batter and pancake. All samples extract and analyzed in four

replicates. Principle component analysis of NIR spectral data 4900 to 5900 cm^{-1} showed clear separation between flour, batter, pancake and UV spectral data be 250 and 350 nm separated two into cluster well refined and whole wheat samples. Conclusions show concentration of phenolic acid was higher in all whole wheat flour samples that refined wheat samples.

Physicochemical properties of pancake enriched with freeze dried date pomace powder was observed by Amal and Djamul 2018. Pancake was prepared after incorporation of 20,30, and 40% of freeze dried date pomace powder. The use of fruit and vegetables by product as natural food addtitives has recently been suggested, due to their high content of polypheonls, carotenoids, dietary fiber or other bioactive compound. Date is a energetic fruit. The pancake formula was adapted from the recipe of Shih et.al. (2006).

Problem background

People now days are so busy to their work due to which they do not get proper balance diet food for the proper growth and maintenance of the nutrition and body. The lack of proper nutrition and balance diet food, people are facing so many health problems like heart diseases, diabetes, and cancer. Black rice is special because it is highly nutritious. . It possesses a unique antioxidant called anthocyanin, which is capable of lowering the risk of heart attack by preventing plaque buildup in arteries. Fried products, especially wheat flour processed products, are consumed all over the world. However, there is little information available regarding the effect of black rice on the physicochemical, antioxidant, and sensory quality characteristics of bakery products.

An attempt will be made through this study to incorporate the health benefits of black rice in pancakes in order to improve the nutritional content.
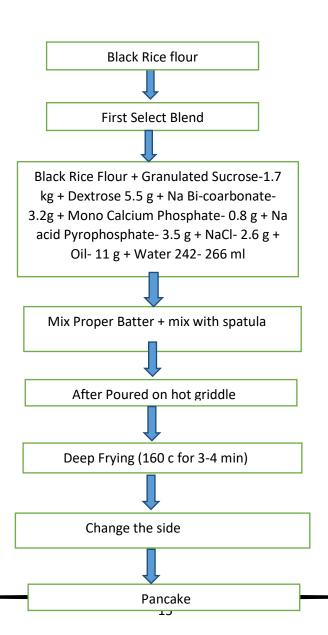
OBJECTIVE

1. Standardization of pancake batter using black rice flour.
2. Effect black rice flour Incorporation on physicochemical and functional properties of Pancake.
3. Comparative Analysis of fried and baked product.

Methodology

Development of pancake using black rice

Selection of blend

White Rice	Black rice
100	0
25	75
50	50
75	25
0	100

Black Rice flour

↓

First Select Blend

↓

Black Rice Flour + Granulated Sucrose-1.7 kg + Dextrose 5.5 g + Na Bi-coarbonate-3.2g + Mono Calcium Phosphate- 0.8 g + Na acid Pyrophosphate- 3.5 g + NaCl- 2.6 g + Oil- 11 g + Water 242- 266 ml

↓

Mix Proper Batter + mix with spatula

↓

After Poured on hot griddle

↓

Deep Frying (160 c for 3-4 min)

↓

Change the side

↓

Pancake

Moisture Content

Moisture determination by standard official method. This involved drying to a constant weight 100 degree c and calculating moisture loss in weight of the dried samples. The crucible was washed thoroughly and dried in oven 100 degree c for 30 min after allow to cool inside desicators. After cooling they weighed using balance and their various weighs recorded as W1. Then 2.0 g of the finely ground samples were put into the crucible and weighs to get W2. After sample plus crucible were placed inside the oven and fried 100 degree c for 4 hrs, cooled and weighed at the same temperature for 30 min until constant weight were obtained to get W3.Then the moisture content was calculated from% Moisture=(W2-W3)/(W2-W1) multiply 100 where w1= initial weight empty crucible,w2=weight crucible + sample before drying and w3= final weight of crucible+ sample after drying (Oka et al.,2012).

Fat Method:

Total fat in the sample was determined using Sechelt extraction for 4 hrs. Starting with methanol and ethanol, respectively. About 250 ml clean boiling flasks were dried in an oven at 105 – 110 0C for about 30 min and cooled in desiccators. Approximately, 2.0 g of samples were weighed accurately into labeled thimbles. The dried boiling flasks were weighed correspondingly and filled with about 300 ml of petroleum ether (boiling point 40 -60 0C). The extraction thimbles were plugged tightly with cotton wool. After that, the Sechelt apparatus was assembled and allowed to reflux for 6 hrs. The thimble was removed with care and petroleum ether collected from the top container and drained into another container for re-use. After that, the flask was dried at 105 – 110 0C for 1 hour when it was almost free of petroleum ether. After drying, it was cooled in desiccators and weighed. Then, % fat in the rice sample was computed using the formula below: % fat = Weight of fat x 100 Weight of sample (Oka et al.,2012)

Protein

The crude protein content of the rice samples was determined using the Microkjeldahl method which involved protein digestion and distillation. a. Protein Digestion: About 2.0 g of the rice sample was weighed into a Kjeldahl flask and 4 tablets of Kjeldahl Catalyst were added. This was followed up with the addition of 1.0 g copper Sulphate and a speck of selenium catalyst into the mixture, and 25 ml concentrated sulphuric acid was introduced. The whole mixture was subjected to heating in the fume cupboard. The heating was done gently at first and increased with occasional shaking till the solution assumed a green color. The temperature of digester was above 420℃ for about 30min. The solution was cooled and black particles showing at the neck of the flask were washed down with distilled water. The solution was re-heated gently at first until the green color disappeared Then, it was allowed to cool. After cooling, the digest was transferred into a 250 ml volumetric flask with several washings and made up to the mark with distilled water and then distilled using Markham distillation apparatus.

% carbohydrate = 100 – (% moisture + %crude fiber + % protein + % lipid + %ash) (Oko et al.,2012)

Ash Method:

Total ash of the rice sample was determined by Furnace Incineration described by AOAC based on the vaporization of water and volatiles with burning organic substances in the presence of oxygen in the air to CO_2 at a temperature of 600 0 C (dry ashing). About 1.0 g of finely ground dried sample was weighed into a 277 tarred porcelain crucible and incinerated at 600 0 C for 6 hr in an ashing muffle furnace until ash was obtained. The ash was cooled in a dessicator and reweighed. The % ash content in the rice sample was calculated as:

%Ash=Weight of ash/weight of original sample (Oko et, al. 2012

Carbohydrate

Total Carbohydrate was calculated as (Protein + fat +moisture Ash) (SHIH et a.,l 2005)

Flowability & Pourabilty

Development of gadgets for determining flow ability and pour ability was developed for the measurement of flow ability of the batter on a slanted surface and by employing. The pour ability of the batter was determined as per the set up along with both instruments worked on the principle of gravity induced flow which simulated the movement batter and pouring into hot oil for frying

$$\text{pourability} = = \frac{\text{Distance of the graduated marks}}{\text{Time required to flow between two graduated marks}}$$

The angle of inclination of the gadget used to measure flow ability was 45°. The gadget was made of perplex or acrylic (poly methyl methacrylate) sheets of thickness 3 mm. A fixed volume of batter (70 ml) was poured manually to measure flow ability by using a beaker of diameter 37 mm after touching the top part of the slanted surface.(Chakkaravarthi. et. al 2017)

$$\text{Flowability} = \frac{1}{\text{Time required to flow on 30cm of inclined surface}}$$

Viscosiy

A Brookfield viscometer Used. The spindle speed was set to 2 rpm and spindle no.6 was used all the experiments. The experiment was run room temperature.(Aghamohammadi.et.al.2016).

pH

A 0.5g sample was mixed with 20 ml of distilled water and vortex mixes with 20 ml of distilled water and vortex mixer for 3 min. The mixture was held room temperature for 1 hr to separate the solid and liquid. After centrifugation of the liquid for 3 min at 3,050xg, the pH supernatant was measured (Abdel- Moemin AR.2016).

Acidity

5 gram sample was diluted 10 ml sample of batter was diluted in 10 ml water and titrated against 0.1 normality NaoH as calculated (S., et al.,2015).

$$\frac{\text{Titrate value} \times \text{Normailty of alkali} \times \text{volume made up} \times \text{millequivalent weight of acetic acid}}{\text{Volume of sample taken volume of sample taken} \times (\text{weight/volume of sample taken})} \times 100$$

Anthocyanins content

Determination of the total amount of anthocyanins (TAC) was done using the reported spectrophotometric method. Anthocyanins were extracted with acidified methanol (methanol and 1 M HCl, 85:15, v/v) with a solvent to sample ratio of 1:10. Absorbance was measured after centrifugation at 525 nm against a reagent blank. Cyaniding 3-glucoside-chloride was used as standard pigment, and TAC was expressed as mg cyaniding 3-glucoside equivalent per 100 g flour (Sompong et al.,2008).

Total phenolic content

The TPC of extracts was determined using the Folin–Ciocalteu reagent. Extract was added to 600 of freshly diluted 10-fold Folin–Ciocalteu reagent. Nine hundred and sixty micro liters of sodium carbonate solution (75 g/l) was added to the mixture after 2 min reaction time. The absorbance of the resulting blue color was measured at 760 nm against a blank after 5 min of reaction at 50 C. Ferulic acid was used as standard and TPC was expressed as mg ferulic acid (FA) equivalent per 100 g flour (Oko et al.,2012).

Total   Flavonoids

Weight of sample, macerated with 80% ethanol. Take 0.25 ml of extract in the test tube, add 1.25 ml distilled water. Add 0.75 ml 5%   Na nitrate, Allow to stand for 5 min,. add 0.15ml ALCL3 10%. Let it stand for 6 min, add 0.5 ml of 1 N NaoH, add 0.275 ml   distilled water.The total flavonoids content was measured at 510 nm using a quercetain standard curve as described by (Kim.et.al.2003).The result were expressed in milligrams QUE per 100 dry sample (Suzme et al., 2014).

Antioxidants property

Each rice flour (1.5 g) was weighed accurately and extracted at room temperature with 85% aqueous methanol under agitation using a magnetic stirrer for 30 min. The mixtures were centrifuged at 2500g for 10 min and the supernatants were collected. The residues were re-extracted twice under the same conditions, resulting finally in 50 ml crude extract. All extracts were used as they were after centrifugation to determine TPC and antioxidant capacity (OKo et al.,2012).

Standardization of process parameters for deep fried and shallow fried Pancake

- **Sensory Evaluation**
- **Moisture content**
- **Proximate**
- **Total phenol**
- **Flavonoids**
- **Anthocyanin**
- **Antioxidants**

Deep frying

A deep fryer with a strainer was used for frying experiments. The heating was control using probe .The oil bath filled to a depth of 4.5 cm with 1.4l of Wesson vegetable oil, heated at 190 c for 2 hrs. Before use. The products were fried with flipping from side to side about 30 sec until they were golden brown on the outside   and the core and the temp were reached 99-101 c.

The product   was drained on the strainer for 0.5 hrs. Before being tested moisture and other frying. Oil absorption and moisture – oil absorption was determined after frying. Frying finishing and then oil was drained off for 30 sec (Visser.et.al.2006)

Oil uptake calculation-percent of oil uptake calculation by subtracting the initial percent oil content of the mixture of the ingredients from the final percent of oil of the dried product. The moisture was subtracted from the total weight of the sample resulting in oil content on dry basis weight basis. The calculation was

$$\% \text{ oil uptake} = [O_f/(w_f - M_t) - O_i / (W_i - M_i)] * 100$$

Where Of, Wf, and Mf where the total oil content , total weight, and moisture weight,
  (F. Shih & K. Daigle 2003)

EXPECTED OUTCOME

It is expected outcome that pancake with high nutrients value**,** low calories gluten free will be obtained .Black Rice flour enhanced nutritional quality of pancakes .The pancake will be source of traditional food, In which can incorporate in the diet of the people suffering in obesity and people suffering from gluten allergies. Formulation of low calorie pancake develops for health based and low calories product.

Reference

1. Shih, F. F., Truong, V. D., & Daigle, K. W. (2006). Physicochemical properties of gluten-free pancake from rice and sweet potato flours. *Journal of food quality*, *29*(1), 97-107. Shih, S., & Daigle, K. (2002).

2. Preparation and characterization of low oil uptake rice cake donuts. *Cereal chemistry*, *79*(5), 745.

3. Funami, T., Funami, M., Tawada, T., & Nakao, Y. (1999). Decreasing Oil Uptake of Doughnuts during Deep-fat Frying Using Curdlan. *Journal of Food Science*, *64*(5), 883-888.

4. Zhang, M. W., Guo, B. J., Zhang, R. F., Chi, J. W., Wei, Z. C., Xu, Z. H., ... & Tang, X. J. (2006). Separation, purification and identification of antioxidant compositions in black rice. *Agricultural Sciences in China*, *5*(6), 431-440.

5. Hiemori, M., Koh, E., & Mitchell, A. E. (2009). Influence of cooking on anthocyanins in black rice (Oryza sativa L. japonica var. SBR). *Journal of agricultural and food chemistry*, *57*(5), 1908-1914.

6. Chakkaravarthi, A., Kumar, H. P., & Bhattacharya, S. (2013). Jilebi 2: Flowability, pourability and pH of batter as affected by fermentation. *Journal of food science and technology*, *50*(2), 293-300.

7. Kitisin, T., Saewan, N., & Luplertlop, N. (2015). Potential anti-inflammatory and anti-oxidative properties of Thai colored-rice extracts. *Plant Omics*, *8*(1), 69.

8. Park, Y. S., Kim, S. J., & Chang, H. I. (2008). Isolation of anthocyanin from black rice (Heugjinjubyeo) and screening of its antioxidant activities. *Kor J Microbiol Biotechnology*, *36*(1), 55-60.

9. Sompong, R., Siebenhandl-Ehn, S., Linsberger-Martin, G., & Berghofer, E. (2011). Physicochemical and antioxidative properties of red and black rice varieties from Thailand, China and Sri Lanka. *Food Chemistry*, *124*(1), 132-140.

10. Agarwal, V., Kochhar, A., & Sachdeva, R. (2009). Sensory and Nutritional Evaluation of Sweet Cereal Products Prepared Using Stevia Powder for Diabetics. *Ethno-Med*, *3*, 93-8.

11. SEGUCHI, M. (1990). Effect of Heat-Treatment of Wheat Flour on Pancake Springiness. *Journal of food science*, *55*(3), 784-785.

12. Waldron, J., Reyes, R., & Legi, R. (2013). The Effect of Substituting Sugar with Artificial Sweeteners on the Texture and Palatability of Pancakes.

13. Steele, H., Strueh, L., & Kleine, S. The Effect of Hazelnut Flour on the Texture and Palatability of Banana Pancakes.

14. Oko, A. O., Ubi, B. E., Efisue, A. A., & Dambaba, N. (2012). Comparative analysis of the chemical nutrient composition of selected local and newly introduced rice varieties grown in Ebonyi State of Nigeria. *International Journal of Agriculture and Forestry*, *2*(2), 16-23.

15. Gupta, P., Shivhare, U. S., & Bawa, A. S. (2000). Studies on frying kinetics and quality of French fries. *Drying Technology*, *18*(1-2), 311-321.

16. Dulley, J. R., & Grieve, P. A. (1975). A simple technique for eliminating interference by detergents in the Lowry method of protein determination. *Analytical biochemistry*, *64*(1), 136-141.

17. BHIKHABHAI, C. (2014). *Development of dry mix for khoa jalebi preparation* (Doctoral dissertation, NDRI, Karnal).

18. Aliberto, E. S., Corbett, C. R., & McIntyre, R. S. (1985). *U.S. Patent No. 4,504,510*. Washington, DC: U.S. Patent and Trademark Office.

20 " Mau, J. L., Lee, C. C., Chen, Y. P., & Lin, S. D. (2017). Physicochemical, antioxidant and sensory characteristics of chiffon cake prepared with black rice as replacement for wheat flour. *LWT-Food Science and Technology*, *75*, 434-439.

20"Changes in the phenolic acids composition during pancake preparation: Whole and refined grain flour and processed food classification by UV and NIR spectral fingerprinting method—Proof of concept." *Journal of Food Composition and Analysis* 60 (2017): 10-16.

21 "Effect of Heat-Treatment of Wheat Flour on Pancake Springiness." *Journal of food science*55, no. 3 (1990): 784-785.Lu, Yingjian, AyazMemon, Patrick Fuerst, Alecia Kizonas, Craig Morris, and DevanandLuthria.

22 "Yemmireddy, V. K., S. Chintagari, and Y. C. Hung. "Physico-chemical Properties of Pancakes Made from an Instant Mix Containing Different Levels of Peanut

(Arachishypogaea) Flour." *Peanut Science* 40, no. 2 (2013): 142-148.SEGUCHI, MASAHARU.

23 "Jindal, A. R., M. Shoree, F. C. Shukla, and B. Singh. "Studies on the use of chhana and paneer whey in the preparation of puras (pancakes)." *International journal of dairy technology*57, no. 4 (2004): 221-225.

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