Utilization of Black rice for the development of cold extruded products

Dissertation Report I

Submitted by

Shailly Khajuria

Registration No. 11718288

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Section – H1730

Under the Guidance of

Er. Sawinder Kaur

Head of the Department

School of Agriculture

Lovely Professional University, Punjab

CERTIFICATE

This is to certify that **Shailly Khajuria** (Registrations no.11718288) has personally completed M.Sc. Dissertation I entitled, "**UTILIZATION OF BLACK RICE FOR THE DEVELOPMENT OF COLD EXTRUDED PRODUCTS**", 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 condition for the evaluation leading to the award of Master of Food Technology.

Date: 14/may/2018

signature of supervisor

Er. Sawinder kaur
Head of the Department

School of Agriculture
Lovely Professional University, Punjab

DECLARATION

I hereby declare that the work presented in the dissertation I entitled, "**UTILIZATION OF BLACK RICE FOR THE DEVELOPMENT OF COLD EXTRUDED PRODUCT**", is 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 Er. Sawinder kaur, Head of the Department (Food Science and Technology) school of Agriculture, Lovely Professional University, Punjab ,India. for the award of the degree of Master of Food Science Technology**.**

Date: **Shailly Khajuria**

Place: Phagwara, Punjab (India) **Regd. 11718288**

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

Er. Sawinder Kaur
Head of the Department

(Food Technology and Nutrition)

School of Agriculture
Lovely Professional University, Punjab (India)

Content:

INTRODUCTION

Black rice has a number of nutritional compensation over general rice as it contains higher content of protein , dietary fiber,vitamins, minerals and natural anthocyanin compounds ,such as cyaniding 3-glucoside and peonidin 3- glucoside, which process anti-oxidative and anti-inflammatory activities (Hu et al.,2003). The black rice has newly gained detection in functional food class due to its health values (Suzuki et al., 2000).

Asia Thai glutinous black rice varieties known as Black sticky rice or kao niow dahm commonly available all through the world rice market. also ,non glutinous Thai black rice varieties has also been exported and finding higher fame and command higher prices in Asian rice market nowdays. Many studies have been reported that black rice include rich of anthocyanin and other polyphenolic compounds .Colored rice are reported as potent sources of antioxidants and encouragements as possible sources of antioxidants for useful foods were made (Yuwadio et al., 2007) of these, red rice gained fame in japan as a useful food because of its high polyphenols and anthocyanin content. Before of health beneficial effects of pigmented rice emerged, (chaudhary 2003) saw an upcoming demand of black rice as an organic food colouring agent which has been at least larger probable due to the increased production of black rice. Black rice has a number of nutritional advantages over common rice such as a higher content of protein, vitamins and minerals although the highly effective in rising cholesterol level in the human body inhibitory effects of extracts of pigmented rice bran on vitro allergic reaction were resolute by (Kohnam et al., 2007) Effects of peonidin, peonidin 3-gluco side and cyanidin 3- glucoside, major anthocyanins extracted from black rice also exerted an inhibitory effect of cell attack on various cancer cells (Chen et al., 2006).

Rice (Oryza sativa L.) is one of top food cropsin south East Asia and the main farming regions included South Asia,China ,korea, Thailand and Japan. Rice can be grade as non glutinous rice (also called non- waxy or sweet rice) based on the amylose content of the rice grains (Belitz et al., 2009).

Chakli is a common term for a selection of fried snacks that can be made using different mixture of ingredients .The main ingredient for all type of “chakli’’ is made in Western India under the name of Chakali, out of channa dal and solid as a packaged savoury (Ravi et al., 2011). Indian market is busy with various recipes for a particular snack, the taste and suitability of the same product also mixed for consumers. Sensory attributes ,color , flavor, texture and taste are the deciding factors in food acceptance (Anon., 2011) ,Since chakli is a traditional snack and is mostly prepared locally, and the chakli available in the market has different taste and acceptability (Sompong et al., 2011).

The Black rice grains consist of 75 – 80% starch, 12% water and only 7% protein with a full balance of amino acids. It’s protein is highly digestible with excellent biological value and protein efficiency ratio due to the presence of higher concentration of Lysine minerals like calcium, manganese*(Oko et al.,1990).*

In Thailand , black glutinous rice is known as Kha-Niao-Dam, large quantities are consumed as principle food product in daily meals in the north and northeasterm parts of the country.The black glutinous rice can be used either as total grains or as milled powder (Rosell and Gomez 2014).

REVIEW OF LITERATURE

Cold Extruded product

The suitability of raw and steamed cereal grains and also the effects of adding black gram flour and shortening along with cereal and millet flour.The quality for crisp eating of chakkli was measured by Kiya tape hardness tester for force needed to crush the pieces and organoleptic evaluation was also done. Bajra was found to give a highly crisp deep fried product While wheat and refined Wheat flour give extremely hard product, While maize, sorghum and rice comes in between. When grains were steamed for 30 min. the crispiness was improved. The addition of shortening reduced the hardness and addition of black gram dhal had a reverse effect although its increase the adhesion of the dough and improve its extrudibility (Narashimha et al., 1974).

Manorama and Rukmini 1992 Studied the acceptability and stability of crude palm oil (CPO) in a number of traditional food like murukku, suji, halwa, upma,and cake.The recipes were prepared in four oil , 1:1 blends of (CPO) and ground nut oil, crude palm oil, Ground nut oil and refined palmolein oil.The results showed that Murukku and Suji halwa were most suitable for crude palm incorporation.

Jayalakshmi and Neelakantan 1987 the acceptability of sorghum-Soya blends in south Indian dishes. Soya flour was incorporated with sorghum flour at 15 , 30 and 50 % and these blends were used for the preparation of methu pakoda, roti, upma, pattu, savai, laddu and murukku following the traditional cooking methods. It was found that soya flour could be incorporated with sorghum flour up to 50% level for making deep fat fried products like methu pakoda and murukku while for the preparation of pattu , laddu, sevai,upmav and roti , soya flour could be blended with sorghum flour only up to 30% level.

Chakli, was studied for the processing changeable which integrated ingredients , thermal treatment of flour and keeping quality . In addition functionality of raw material, proximate composition and sensory analysis were aqlso undertaken. Results revealed that thermal treatment affected the water and fat absorption capacity of flour. The proximate composition of prepared products were as follows moisture 3.0-4.3 %, proteins 8.2-9.8% , total ash 2.8-4.1 % and fat 17.1 – 19.0 %. Products prepared with thermally treated flours with added shortening rated higher in sensory quality scores in comparison with products prepared with untreated flours and without added shortening . The products prepared with different legumes could be stored up to weeks with only a marginal raise in free fatty acids (Geethalakshmi and Prakash , 2000).

The effect of incorporation of ragi flour at different levels (5, 15 and 25%) to “chakkli’’ for fat absorption ,sensory and storage parameters. Three sets of product were prepared using untreated, thermally treated and gelatinized ragi flour at different level. It was found that fat absorption by the control was 19%, ragi flour incorporation (5%) increase fat content to 24%, but on further increase of ragi flour (15 and 25%), it decrease to 19.7 and 18 % respectively, incorporation of gelatinized ragi flour (5%) has a significantly higher scores for texture , flavor and overall acceptability. There was a slight increase in storage days and increase was more in sample incorporated with higher level of ragi (Sebastian et al., 2005).

Chakali was developed as a savoury snack for obese people Chakli is a Maharashtrian delicacy food product that was developed from bhajni. The traditional recipe of bhajni i.e, fried chakali was modified in order to improve its fat and fiber content. Multigrain Baked chakali possessed oats in it which was fiber rich that helped in losing weight and avoid other disorder like CVD, Diabetes Mellitus and other risk factors. Is other ingredients like chilli flakes , sesame seeds, curry leaves showed their benefits in obesity. When baked chakali was compared with traditional fried chakali or bhaji it was adequate for obesity and more nutritious also as it possessed low fat and sodium and high mount of fiber in it (Saiyed and Sengupta .,2014).

Ready to - eat snack food chakali was prepared using sorghum, pearl millet and finger millet with defatted soy – flour and medium fat soy flour and medium fat soy flour. Nutritional analysis revealed that 20% soyabean incorporation in the form of defatted soya- flour and medium fat soy – flour enhanced the protein content up to 75 – 80% and 59 – 64 %, respectively compared to traditional product. Textural analysis showed that incorporation of finger millet with DFSF required higher bending strength (Sumedha Dwshpande and Krishna Jha 2014).

Singson et al., 2014, reported that the most common spice used in chakli recipes was cumin (52%) followed by chilli powder (40 %), asafetida (28%), turmeric (24 %) and ajwain (16 %). Spices were used singly or in combination. Cumin (20 %) and asafetida (2 %) were used singly, while in other recipes, spices were used in combination of two or more spice mix. This is well known fact that spices, and flavor and improves the taste. Similarly, in most of the Indian recipes it was observed that use of more spice and in different combination produces diversified recipes. Besides, it was observed that food additive like soda bicarbonate (4 %) was also used. The most common shortening used in preparation of chakli was butter (44 %), followed by oil (8 %) and ghee (6 %) Bhattacharya and Narasimha, 2008, suggested that textural quality of fried products is known to be influenced by use of shortening. It functions as lubricants as well as provides a crispier texture.

Recipe of the standardized chakli was as follow Sorghum – malted finger millet flour (50 %), rice flour mixture (20 %), washed Bengal gram, green gram, black gram pulse (30 %) and (50%).preparation was as follows firstly , cereal + pulse mix. (Sorghum – finger millet flour, rice flour, Bengal, green , black gram), salt , cumin seeds, oil and asafetida were mixed to develop a firm dough using warm water simultneously. The dough was allowed to rest for some time after that dough is filled in the chakli presser and Chakli were shaped and simultaneously fried in hot oil on low flame. After frying and chakli were allowed to cool down and kept in air tight containers for further analysis (Patekar et al., 2017).

Kodo millet is rich in phenolics, tannins and phytates which act as antioxidant. The beneficial role of millet based diet is to protect the body against oxidative stress and maintaining blood glucose level in Type II diabetes mellitus. The fiber content of kodo millet is very high. Kodo millet has around 11% protein and the nutritive value of protein has been found to be comparable of other small millets. As with other food grains, the nutritive value of kodo millet protein could be improved by supplementation with legume protein (A. Mohana vidhya et al.,2014).

PHYSICO-CHEMICAL CHANGES IN OIL/FAT USED AS FRYING MEDIA

The acid value and peroxide value of desi ghee, vanaspati, sunflower, mustard and groundnut oil and studied the quality of various heated fats/oils. The five fats/oils viz. sunflower oil, mustard oil, ground oil, vanaspati and deshi ghee were used to prepare wheat flour product namely chapatti, puree, parantha and Bengal gram dhal products namely boiled dhai,boiled and sauted dhal and deep fried dhai, Peroxide value and acid value of the fats extracted from wheat flour and Bengal gram dhal products had increased considerably, when prepared from various oil and fats, however they were still within the acceptable range. The values of leftover oil used for frying at household level were also within the acceptable limits, but there is a possibility of crossing these limits on prolonged cooling (Kaur et al., 1997).

The effect of frying conditions on the colour changes during deep fat frying of french fries. The hunter colour scale parameters redness, yellowness and lightness were used to estimate colour changes during frying as a function of the main process variable (oil temperature, oil type and sample thickness). The results showed that lower oil temperature up to 170 ˚C gave lighter less red and more yellow colour parameters which means more acceptable products, while the effect of replacement of refined cottonseed oil by hydrogenated oil is negligible. Thickness of French fries should also be considered as lower thickness resulted in lower lightness and higher temperature (Krsokida et al.,2001).

The influence of the degree of degradation of industrially refined and partially hydrogenated rapeseed oils (Liquid oil, liquid hydrogenated oil and solid hydrogenated oil) used as a frying medium on fat uptake and texture of frozen pre- fried french fries. Liquid hydrogenated rapeseed oil exhibited the best thermo- oxidative stability among the oil under investigation. The kind of oil influenced fat uptake and the texture of French fries. The lowest fast uptake was observed with French fries fried in solid oil. Fat absorption increased with increasing unsaturated fatty acids and decreasing saturated fatty fat frying acid content .The hardness of French fries increased with increasing content of saturated fatty acids and decreasing unsaturated fatty acid and trans isomer fatty acid content (Kita et al.,2005).

The dough based in wheat flour and yeast as leavening agent , which was deep –fat fried in sunflower oil at 180, 190 and 200˚C to produce donuts and monitored each 15 s of frying through the frying process, such as moisture and oil contents, bulk density, volume changes, crust colour, rheological including instrumental TPA, compression and penetration forces and thermalproperties: specific heat, thermal conductivity, and diffusivity these physical properties can be employed to predict or design deep –fat frying processes and equipment,control frying worked on frying condition on moisture and fat papads. Papads were prepared using 0 , 5 , 15 and 20 % soya flour with pilses and other ingredients. The products were analysed for proximate composition , studied the effects of processing time and tem. On the quality of soya papads. The moisture and fat content in the dried papads samples were found in the range of 10.10 to 10.33% and 1.06 to 5.35% respectively. A sharp increase in fat content was observed with the increase of soya flour in the papads (Rahman and Uddin 2008).

The important factors on porosity development, and to establish the relationships between porosity and oil uptake. Analysis was done for moisture and oil absorption. For cooling time, which started after 240 s of frying, the sample were washed in petroleum ether, absolute density refers to the density calculated on the basis of volume excluding the pores and inters particle spaces. The apparent density is based on the total volume including the pore. Then,the porosity changes were realated to oil uptake . Potatoes were cut into rectangular shapes and were fried at different oil temperature (140 , 155 , 170 , and 185℃)for periods ranging from 60 to 240 s. It was found that the oil uptake increased as the oil bath temperature decreased from 185 to 140˚C. potato Sr. changed with frying time , as crust thickness and absolute density increased , whereas apparent density decreased. The porosity increased during frying because of forceful water evaporation and pore formation and reches a maximum at the end of the frying period. However, during the cooling periods it starts to decreased as a result of the absorbed oil implanted in the pore spaces and collapse phenomenon (Ziaiifar et al., 2008).

The effect of drying time and frying time on the textural and sensory characteristics of popped rice to be used as an ingredient base for snack bars . The broken sticky rice was steam – cooked before drying at 65˚C for 2, 3 and 4 hr and was used for preparing popped rice by deep fat frying dried rice at 210˚C for 5, 10 and 15 seconds. The product quality was evaluated for moisture cont, water activity, colour, texture and sensory perceptions. The colour of the fried product obtained from cooked broken sticky rice dried for 2 hr. was significantly lighter than the dried for 3 and 4 hr. The hardness of product measured as peak compression force increased with increasing drying time. Sensory evaluation indicated that the product obtained from drying cooked sticky rice 3 hr. followed by deep fat frying for 10 sec. was the most acceptable (Phanitchareon et al., 2010).

FRYING TIME AND TEMPERATURE:

The effect of frying time and temperature on deep fried rice cracker. The experiments were conducted at the frying temperature of 200, 220, and 240˚C and frying time in the range of 20 – 140s. The oil uptake in fried rice crakers increased with increase in frying time but decrease with increase in frying temperature with increase in frying time and temperature, the texture of rice cracker become harder, the bulk density increased and the expansion ratio decrease (Maneerote et al., 2009).

The frying parameters on crispiness and sound emission of cassava crackers. Cassava crackers, based in cassava starch and water, were produced by deep - fat frying in oil at 140, 150 and 160˚C. Physical properties of cassava crackers were monitored at 5 , 10 and 15s of the frying process, moisture content, bulk density, linear expansion and penetration forces and sound emission were evaluated. The result showed that with increased frying (time and temp.), the moisture content , the linear expansion, the number of force and sound peaks significantly increased while the density and maximum and mean of forces peaks decreased. Further it could be seen that with higher temperature the number of small size air cells increased. Correlations were found between physical and textural properties and sound emission. Moisture content, bulk density, maximum of sound peak, maximum of sound peak , maximum force and mean force were negatively correlated with linear expansion, number of sound peaks and number of forces peaks (Saeleaw and Schleining 2011).

The physical and chemical qualities like peroxide value (PV), free fatty acid (FFA) and p-anisidine value (p-AV) of used oil and fried chicken drumsticks the marinated chicken drumsticks were fried at 170, 180 and 190˚C for 15,18 and 21 minute. The color, viscosity of used oil and surface color of fried chicken tended to increase with frying temperature and time. The pv increased with increase in frying time, FFA and p-AV increase with frying time and temperature. The quality of used fried oil as repeated frying for 3 consecutive days by 10 batches a day show better oil quality than those continue frying for 30 batches a day (Susina et al., 2011).

PHYSICAL AND FUNCTIONAL PROPERTIES:

The functional properties have been the function of protein in different food systems. These include providing acceptable colour, flavor, odour and texture to the food products. Some of the desirable functional properties are easy wettability, good water dispensability and clear dispersion over a wide PH range, desirable viscosity, gel foaming, elasticity, film foaming and aeration properties (Jonhson 1970).

Water uptake by besan and chicking vetch flour which is attributed primarily to their protein content and also affected by a number of factors including pH. Water absorption is considered by some of the first and the critical step in imparting desired functional properties to protein (Kuntz, 1971).

The thermal treatment reduced water absorption in rice, green gram black gram and fat absorption in green gram dhal (Geethalakshmi and Prakash 2000).

The extrusion using rice flour and replacing part of it with either khesari dhal (Lathyrus sativus) or chickpea (Cicer arietinum L.) flour. The physicochemical characteristics of the extrudate (rice +khesari or cjickpea flour) were studies and compared. The extruded khesari dhal flour had more expansion or puffing when compared to chickpea flour. The bulk density decreased with an increase in pulse content but the decrease is more for khesari dhal snacks. The sheer force required to break the extrudate is less for khesari dhal extrudates which also decreased with an increase in pulse content and it is less at all protein in comparison to chickpea snack (Singh et al., 2003).

Ragi was incorporated ragi at different levels (5, 15 and 25 %) toa deep fat fried snack item namely "chakli'' to study its effect on fat absorption, sensory and storage parameters. There sets of products were prepared incorporating untreated , dry heat treated and gelatinized ragi flour. The control products were without ragi flour. Results indicated tha the fat absorbed by the control was 19% ragi flour incorporation (5 %) increased fat content to 24 % but on further increase of ragi flour (15 and 25 %), it decreased to 19.7 and 18 %, respectively. Incorporation of untreated and dry heat treated ragi flour resulted in a slight decline in the sensory ratings of products. The effects were more adverse with higher level of incorporation. On incorporating of gelatinized ragi flour (5%), significantly higher rating were obtained for texture, flavor and overall quality of products in comparison with the control. The free fatty acid content of products was very low and increased during 4 weeks of storage. It can be concluded from the results that incorporation of higher amounts of ragi resulted in lower fat uptake but compromised the sensory quality of the product. However , incorporating at the 5% level had the opposite effect. Gelatinization as a pretreatment was found to improve the quality of product (Leena Sebastian 2005).

The proimate composition of prepared chakli was as follows moisture 3.0 to 4.3%, proteins 8.2 to 9.8%, total ash 2.8 to 4.1 % and fat 17.1 to 19.8 %. Products prepared from heat treated flours and with added shortening had higher sensory quality scores than products prepared from untreated floues and without shortening (Geethalakshmi and Prakash 2000).

Millet is a minor cereal of high nutritional value , but its consumption is limitied this is thought to be mainly due to the non- availability of ready – to – use or ready – to – eat millet products. It is suggested that processing millet to prepare ready – to – eat food may increase its economic and nutritional value. Studies were , therefore, conducted to evaluate the functional properties of popped, flaked, roller dried and extrusion cooked millet for potential use as ready – to – eat products (Ushakumari et al., 2004).

Material and Methods

Determination of Moisture Content

Moisture was resolute by usual executive Methods of Analysis of the AOAC(1990). This involved drying to a constant weight at 100 0C and calculating moisture as the loss in weight of the dried rice samples. The crucible was thoroughly washed and dried in an oven at 100 0C for 30 min and allowed to cool inside desiccators. After cooling, they were weighed using weighing balance and their various weights recorded as (W1). This, 2.0g of the finely ground rice samples were put into the crucibles and weighed to get W2. Therefore, the sample plus crucible were placed inside the oven and dried at 100 0C for 4 hours, cooled and weighed at the same temperature for 30 min until constant weights were obtained to get W3 (Oko et al., 2012). Then, the moisture content of the rice sample was calculated from the equation:

% moisture= (W2-W3) / (W2-W1) * 100

Where, W1 = Initial weight of empty crucible, W2 = Weight of crucible + sample before drying and W3 = Final weight of crucible + sample after drying.

Determination of Ash Content

Total ash of the rice sample was determined by Furnace Incineration described by AOAC (1990). based on the vaporization of water and volatiles with burning organic substances in the presence of oxygen in the air to CO2 at a temperature of 600 0C (dry ashing). About 1.0g of finely ground dried sample was weighed into a 277 tared porcelain crucible and incinerated at 600 0C for 6 hr in an ashing muffle furnace until ash was obtained (Oko. et al.,2012).

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.A.O sample

Determination of Crude Fiber

Crude fiber was determined using the method of AOAC (1990) About 2.0g of the rice sample was hydrolyzed in a beaker with petroleum ether after which it was boiled under reflex for 30 min with 200ml of a solution containing 1.25% H2SO4 per 100ml of solution. The solution was filtered through a filter paper onto a fluted funnel. After filtration, the samples were washed with boiled water until they were no longer acidic. Then, the residue was transferred onto a beaker and boiled for another 30 min with 200ml of solution containing 1.25% NaOH per 100ml. The boiled samples were washed with boiled distilled water. The residues were filtered through

Gooch filter crucible, dried at 1000C for 2 hours in an oven, cooled and washed. (Oko et al., 2012).

The percentage crude fiber in the rice sample was calculated as per the formula:

% Crude fiber = (Wt. After drying) / (Wt. Of sample)*100

Determination of Fat

Total fat in the rice sample was determined using Soxhlet extraction for 4 hr starting with methanol and ethanol, respectively. About 250ml clean boiling flasks were dried in an oven at 105-110 0C for about 30 min and cooled in a dessicator. Approximately, 2.0g of samples were and filled with about 300ml of petroleum ether (boiling point 40-60 0 C). The extraction thimbles were plugged tightly with cotton wool. After that, the flask was dried at 105-110 0 C for 1 hour when it was almost free of petroleum ether (Oko et al.,2012).

After drying, it was cooled in a dessicator and weighed. Then, 5 fat in the rice sample was computed using the formula below:

%fat = weight of fat / weight of sample*100

Determination of 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 2.0g 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 1.0g copper sulphate and a speck of selenium catalyst into the mixture, and 25ml concentrated sulphuric acid was introduced. The whole mixture was subjected to heating in the fume cupboard. Theheating was done gently at first and increased with occasional shaking till the solution assumed a green color. The temperature of digester was above 420˚C for about 30 min. The solution was cooled and black particles showing at the neck of the flask were washed down with distilled water. The solution was re-heaated gently at first until the green color disappeared. Then, it was allowed to cool. After cooling, the digest was transferred into a 250ml volumetric flask with several washings and made up to the mark with distilled water and then distilled using Markham distillation apparatus (Oko et, al.2012).

% carbohydrate = 100 – (%moisture + %crude fiber + %protein + %lipid + %ash)

Functional Properties

Water holding Capacity:

Flour (4g) was mixed with 24ml of water in a 50ml capacity centrifuge tube. The contentment were stirred for 30s after an interval of 5 min. After 30 min the tubes were centrifuged at 1600*g for 25 min. The free water was decanted and the percentage of absorbed water determined from the difference in weight (Annapure et al., 1997).

Water absorption index (WAI):

Water absorption index (WAI) and water solubility index (WSI) of extrudates will be determined according to this given method in which for cereals suspension of 2.5g of ground extrudate sample (100 mesh) was prepared in 2.5ml distilled water at room temperature for 30min by gently stirring during the period ,and then centrifuged at 3000 rpm for this 15min. The supernatant was decanted carefully into an or sediment was weighed. WAI was taken as the weight of ground sample the supernatant liquid from the WAI test was dried to constant weight of dry solid recovered by solid in the dry sample (Suksomboon et al., 2011).

Bulk density:

The radial expansion index (EI) was calculated for 15 sample by dividing the average diameter of the extruded products by the internal diameter of the extruder die – nozzle orifice.

The bulk density (BD) was determined in dried (50± 2 ℃, 12h) extrudates with 75-85g kg moisture content. BD(g ml) was calculated by dividing the extrudate piece weight by its apparent volume. The average diameter and length of 15 sample from each treatment werte measured and the apparent volume (mm) was calculated as V = 1/4

Where d(mm) is the average diameter of the extruded product and h (mm) is its length (Zazueta-Morales et al.,2001).

Functional Properties

Amylose content(AC):

One millilitre of ethanol (95%) and 9ml 1 NaOH were added to 100mg of flour. After mixing, the samples were heated for 10min in a boiling water bath to gelatinise the starch. Samples were cooled down and transferred to a 100ml volumetric flask and 5ml of starch solution and 1ml 1 N acetic acid were added. After addition of 2ml iodine solution the volume was adjusted to 100ml with distilled water, mixed, and allowed to stand for 20min. The absorbance was measured at 620nm using a spectrophotometer. The amylase content was determined from a previous standard curve of potato amylase (Juliano, 1985). Rice varieties were classified into five group saccording to their amylase content (Siebenhandle-Ehn et al., 2011).

Waxy(1-2%), very low(10-20%), intermediate (20-25%), and high (25-33%)

Determination of total anthocyanin 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 525nm against blank. Cyanidin 3-glucoside equivalent per 100g flour (Elezabeth and Subramanian, 2013).

Determination of 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 (75g/l) was added to the mixture after 2min reaction time. The absorbance of the resulting blue color was measured at 760nm against a blank after 5min of reaction at 50C. Ferulic acid was used as standard and TPC was expressed as mg ferulic acid (FA) equivalent per 100g flour (Sakakibara et al., 2003).

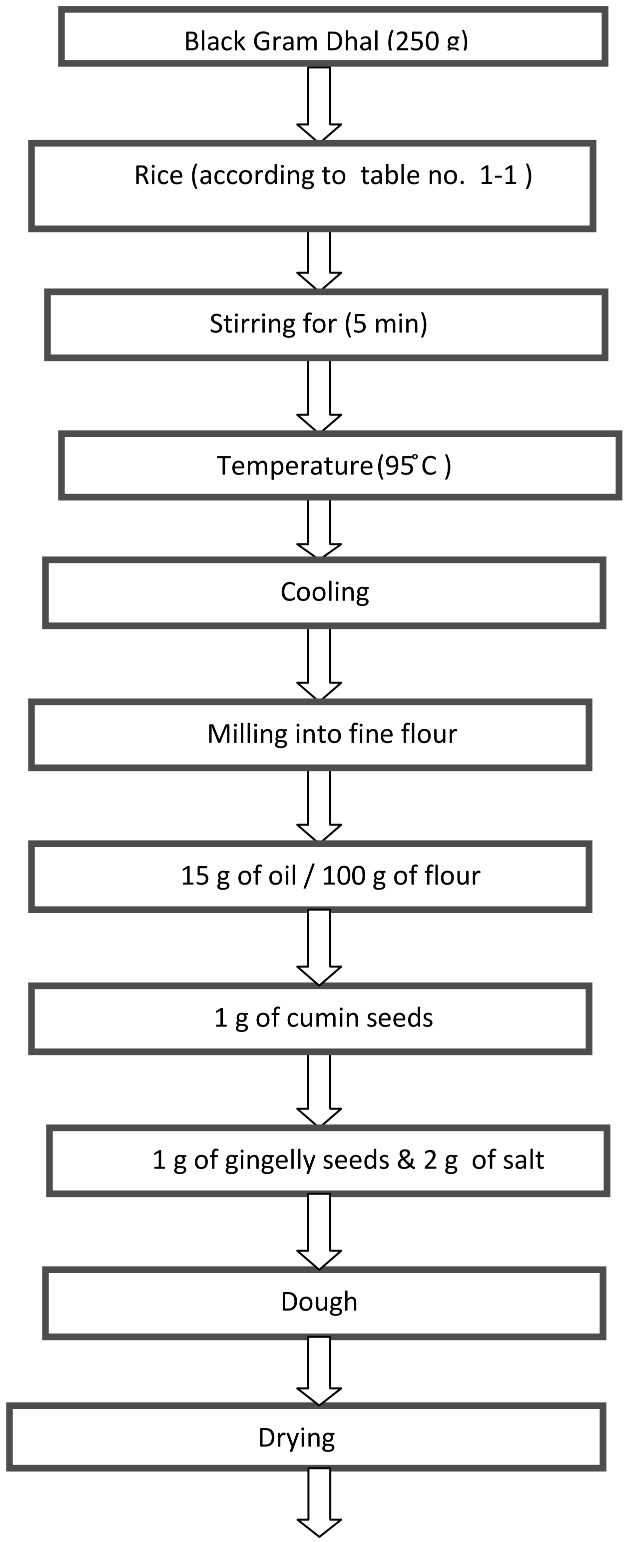
Trolox equivalent antioxidant capacity (TEAC):

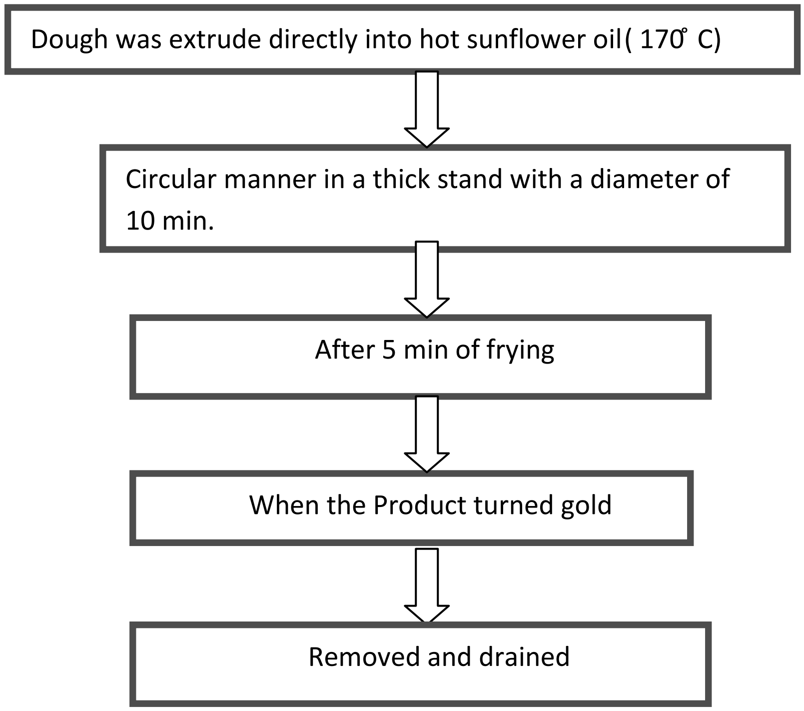
The ABTS radical cation scavenging assay was analysed following a modified a stable stock solution of ABTS radical cation was produced by reacting a 7mm aqueous solution of ABTS with potassium persulfate in the dark at room temperature for 12-16h before use. Rice extract (120 ll) was allowed to react with 1.5ml of a diluted ABTS radical cation solution (absorbance of 0.70±0.02 AU at 734nm). The absorbance at 734 nm of the mixture was measured after 1min sreaction time. Results were expressed as Trolox equivalents antioxidants capacity (TEAC) in mol of Trolox per 100g of flour (Siebenhandl-Eh et al.,2011).

Table No. 1-1 :

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

Preparation of Products




Dough was extrude directly into hot sunflower oil(170̊ C)
Circular manner in a thick stand with a diameter of 10 min.
After 5 min of frying
When the Product turned gold
Removed and drained

OBJECTIVES

1. Standardization of black rice incorporation for the development of cold extruded product.

2. Effect of black rice incorporation of physic- chemical and functional properties.

3. To study the shelf life of the developed product.

Sensory

Sensory evaluation of developed product:

The sensory quality characteristics of the developed products such as colour, taste, texture, flavor and overall acceptability were evaluated by panel of judges using nine point hedonic scale as described by (Amerine et al.,1965). According to sensory score card evaluation the best sampe was chosen for the further study.

storage studies

The storage stability of chakli finalized in sensory studies along with control were carried out using aluminium foil, polypropylene, low density polyethylene (LDPE) pouches for a period of 1 month at ambient conditions. All sample were drawn periodically after 0 , 15 and 30 days analyzed for sensory qualities.

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 malnutrition, heart diseases, diabetes, cancer. The scope of this study 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

Reference:

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