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NUTRITIONAL AND SENSORY PROPERTIES OF CHAPATIS AND BISCUITS OF OATS FLOUR BLENDED WITH EGG WHITE PROTEIN, FLAXSEEDS AND CAROM SEEDS

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Abstract—*Avena sativa is an important cereal crop commonly known as oat. Avena sativa is an important cereal crop commonly known as oat. Oats are receiving increased interest because of their excellent health related properties. They are a rich source of soluble fiber, balanced proteins, vitamins and minerals, which are essential for human health (Brindzova et al., 2008). Oats have been labeled as a functional food as they contain β-glucan, minerals and antioxidants. Oat has the highest protein level (12–20%)) among cereals with a superior amino acid profile due to higher amounts of limiting amino acids lysine and threonine. Protein nutritive value of oats, including protein digestibility in the range of 90.3–94.2%, biological value 74.5–79.6%, net protein utilisation 69.1–72.4 and protein efficiency ratio 2.25–2.38 make it suitable for use in human foods. The proximate chemical composition analysis of raw material and products were observed. The protein content of biscuits (13.04±0.33) and chapatis (11.68±0.08%) were higher than raw oats flour (9.8±0.45%). The significant increase in protein content of both products due to incorporation of egg white protein powder in raw oats flour for preparation of biscuits and chapatis, which improves the nutritional value of products.*

1. INTRODUCTION

Avena sativa is an important cereal crop commonly known as oat. Oat (*Avena sativa*) ranking sixth in world production and almost 9608318 hectares of land is under oat cultivation as a fodder crop with worldwide production of an average of 21.06 million tonnes (FAO, 2012). Oats are receiving increased interest because of their excellent health related properties. They are a rich source of soluble fiber, balanced proteins, vitamins and minerals, which are essential for human health (Brindzova et al., 2008). Oats have been labeled as a functional food as they contain β-glucan, minerals and antioxidants. Oat has the highest protein level (12–20%) (Mohamed et al., 2009) among cereals with a superior amino acid profile due to higher amounts of limiting amino acids lysine and threonine (Klose & Arendt, 2012). Protein nutritive value of oats, including protein digestibility in the range of 90.3–94.2%, biological value 74.5–79.6%, net protein utilisation 69.1–72.4 and protein efficiency ratio 2.25–2.38 (Pedo et al., 1999), make it suitable for use in human foods. In India, oats are grown in the state of Punjab, Haryana, Uttar Pradesh and Bihar, Maharashtra, Karnataka, Andhra Pradesh, Tamilnadu, West Bengal, Jammu Kashmir and Gujarat (Patel et al., 2011).

The concepts of food consumption are changing from previous to present time. Previous emphasis has been on survival, hunger satisfaction, health maintenance and absence of adverse effects on health and current emphasis is on encouraging the use of nutraceutical foods which promise to promote better health and well-being thus helping to reduce the risk of chronic diseases such as obesity, diabetes, cardiovascular disease and cancer. Oats have nutraceutical properties in the form of antioxidants. Hence they also called as 'nutri-cereals'. Being non-glutinous, oats are safe for people suffering from gluten allergy and celiac disease. They are non-acid forming, and hence easy to digest. They are also non-allergenic. Processing methods like soaking, malting, decortication, and cooking affect anti-oxidant content and activity (Sarita et al; 2016).

Oats are used to make chapattis, porridge, flakes, baking products such as breads, cakes, muffins, cookies and biscuits by mixed with other grain flour like wheat. Other uses include bakery products and snacks to a very limited extent. It is estimated that 93% of oats is used as food, the remainder 7% being divided between animal and poultry feed (ICRISAT, 2017).

2. MATERIAL AND METHODS

2.1 Materials

Oats, flaxseeds, carom seeds and poultry eggs were procured from local market, Sirsa. All the chemicals used were of analytical grade. Swadesh bags were used to store the samples and products.

2.2 Methods

2.2.1 Sample preparation

The clean and healthy oats grains were used for preparation of flour. Oats were ground with the help of an electric grinder into fine flour. The ground content was sieved through a sieve to obtained pure flour free from large particles. The powdered sample was stored in air tight container for further uses. Flax seeds & carom seeds were also ground to fine flour together in an electric grinder.

Eggs were boiled in large pot until they were thoroughly cooked, about 12 minutes. Then, eggs were transferred to colander and run them under cold water. Boiled eggs were peeled off and whites were separated from yolks. Boiled whites were broken into small pieces and arranged evenly spaced on non-stick or foil lined baking trays. Drying them at low temperature for 8-10 hours in oven. When eggs had crisped up and resembled thin pieces of toffee, they were removed from oven and let them cool. When cooled, egg white pieces were ground in grinder until they become a fine powder. The powder was stored in air tight container for further uses.

2.2.2 Chapati making properties of oats flour blended with egg white protein, flax seeds and carom seeds

Flour (100 g) was taken in a bowl. Egg white powder (10.0 g), flaxseeds and carom seeds powder (4.0 g) and salt (as required) was added in flour. All ingredients were mixed with hot water for 5 min to obtain dough of thick and smooth consistency. The dough was rested for 5 min. The flat pan was heated on medium low heat. The dough was divided into small round balls. The dough was rolled in one direction and raw chapati was placed on heated flat pan. The raw chapati was cooked on both sides. The chapati was allowed to cool at room temperature and then placed in polythene pouches and placed in an air tight container.

2.2.3 Biscuit making properties of oats flour blended with egg white protein, flaxseeds and carom seeds

For making biscuits, hydrogenated fat (55.0 g) was heated in a pan to melt it. Flour (175 g) was mixed with sugar (77.6 g), egg white protein powder (17.5 g), flaxseeds and carom seed powder (7.5 g), and salt in desired amount and sodium bicarbonate (1.5 g) in a separate laboratory mixer. Then all ingredients were mixed with hydrogenated fat to make dough. Milk was also added to provide smoothness. Then the rolled out dough was spread on a tray, having a layer of fat, in a sheet of uniform thickness. Then the dough was cut into desired shapes with a cutter. The cut biscuits were placed on tray by placing a layer of fat on trays. The biscuits were baked at 130°C for 45 min. Baked biscuits were cooled and placed in polythene pouches and stored in an air tight container.

2.3 Analytical methods

2.3.1 Chemical composition

Determination of Moisture Content:

The samples were randomly selected (oats flour, chapatis and biscuits) to estimate their moisture content. (AOAC, 2000) About 2.0 g of sample was taken in pre weighed petri-plate and put in hot air oven at 130°C for 3 hr. After complete incubation, samples were cooled in desiccators and again weighed. The moisture content (%) was calculated as follows:

$$\% \text{ Moisture} = \frac{w_1 - w_2}{w_1 - w} \times 100$$

w = Weight of petri-plate

w_1= Weight of petri-plate + sample before drying

w_2 = Weight of petri-plate + dried sample.

Determination of Ash Content:

About 2.0 g of each selected sample was weighed into a porcelain crucible and incinerated at 550^{0}C for 5 hr in an ashing muffle furnace until ash was obtained. (AOAC, 2000) The ash was cooled in a dessicator and reweighed. The % ash content in the sample was calculated as:

$$\% \text{ Ash} = \frac{\text{Weight of ash}}{\text{Weight of original sample}} \times 100$$

Determination of Crude Fibre:

Crude fibre was determined using the method of AOAC, 1999. About 2.0 g of the each sample was hydrolyzed in a beaker with petroleum ether after which it was boiled under reflex for 30 min with 200 ml of a solution containing 1.25% H_2SO_4 per 100 ml 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 200 ml of solution containing 1.25% NaOH per 100 ml. The boiled samples were washed with boiled distilled water. The residues were filtered through Gooch filter crucible, dried at 100^{0}C for 2 hr in an oven, cooled and washed. The percentage crude fibre in the sample was calculated as :

$$\% \text{ crude fiber} = \frac{\text{Weight after drying}}{\text{Weight of sample}} \text{ X } 100$$

Determination of Fat:

Total fat in the samples was determined using Soxhlet extraction for 4 hr starting with methanol and ethanol, respectively. About 250 ml clean boiling flasks were dried in an oven at 105-110^{0}C for about 30 min and cooled in a dessicator. 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^{0}C). The extraction thimbles were plugged tightly with cotton wool. After that, the Soxhlet apparatus was assembled and allowed to reflux for 6 hr. 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^{0}C for 1 hr when it was almost free of petroleum ether. After drying, it was cooled in a dessicator and weighed. Then, % fat in the sample was computed using the formula below:

% fat = weight of fat X 100 weight of sample

Determination of Protein:

Crude protein of the sample was determined using the Kjedahl method as prescribed by AOAC, 2000. One gram of the sample was introduced into the digestion flask. 5.0 g of Kjedahl catalyst (9 parts of potassium sulphate with 1 part of copper sulphate) and 200 ml of conc. H_2SO_4 was added to the samples. Prepare a tube containing the above chemical except sample as blank. Place the flasks in an inclined position and heat gently unit frothing ceases. Boil briskly until solution clears. Cool and add 60ml distilled water. Immediately connect flask to digestion bulb on condenser immersed in standard acid and add 5-7 drops of mix indicator in a receiver. Rotate the flask to mix content thoroughly; then heat until all NH_3 is distilled. Remove receiver, wash the tip of condenser and titrate excess standard acid with standard NaOH solution.

The percentage total was calculated:

$$\% \text{ Protein} = \frac{(A-B) \times N \times 14.007 \times 6.25}{W}$$

A is volume (ml) of 0.2 N HCl used in sample titration

B is volume (ml) of 0.2 N HCl used in blank titration

N is normality of HCl

W is weight (g) of sample

14.007 is atomic weight of nitrogen

6.25 is the protein- nitrogen conversation factor

Determination of Carbohydrate:

The total percentage carbohydrate content in sample was determined by the difference method. This method involved adding the total values of crude protein, lipid, crude fibre, moisture and ash constituents of the sample and subtracting it from 100. The value obtained is the percentage carbohydrate constituent of the sample.

Thus:

% Carbohydrate =100 – (% moisture + % crude fibre + % protein + %lipid + % ash).

Sensory Evaluation

Chapati and biscuits prepared using oats flour blended with egg white protein, flax seeds and carom seed were evaluated by a selected panel of 9 members, which was based mainly on the appearance, taste, aroma and overall acceptability of the product.

Result

Proximate composition of oats flour

Composition	Quantity
Moisture content	7.0±1.10%
Ash content	2.18±0.73%
Fat content	5.5±0.50%
Protein content	9.8±0.45%
Crude fibre content	1.26±0.25%.
Carbohydrate content	73.0±0.60%

The moisture and fat content of oats flour varied from 7.0±1.10% and 5.5±0.50%, respectively. Sehgal et al., (2006) reported that moisture and fat content of 7.7-12.50% and 5.14-6.85% in oats flour. The ash content is measure of mineral content in food products. Oats are good source of minerals specially calcium. The protein, ash and fiber content of oats flour ranged between 9.8±0.45%, 2.18±0.73% and 1.26±0.25%, respectively. Oats flour exhibited total carbohydrate content in the range of 73.09±0.60%. Wani et al., (2014) reported that total carbohydrate content in the ranged of 66.49-70.00%, respectively.

Proximate composition of chapati and biscuit prepared byoats flour blended with egg white protein, flaxseeds and carom seeds

Parameter	Chapati	Biscuit
Moisture content	30.85±0.17%	5.38±0.51%
Ash content	2.20±0.48%	2.68±0.20%
Crude fat content	5.90±1.50%	20.44±1.0%
Protein content	11.68±0.08%	13.04±0.33%
Crude fiber content	1.12±0.28%	1.013±0.26%
Carbohydrate content	42.25±0.50%	56.317±0.46%

The moisture of chapati and biscuits prepared by oats flour blended with egg white protein, flaxseeds and carom seeds were observed 30.85±0.17% and 7.38±0.51%, respectively. The ash, protein, fiber and carbohydrate content of chapati were found 2.20±0.48%, 11.68±0.08%, 1.12±0.28% and 42.25±0.50%, respectively. The fat content chapati varied from 5.90±1.50%. The ash content of any food product refers to its mineral content. Oats considered as good source of minerals. The ash content of biscuits prepared by oats flour blended with egg white protein, flaxseeds and carom seeds were 3.68±0.20%. Similar values for ash content of oats biscuits was observed 1.0±0.2% (Mehra et al., 2017). This increase in values of ash content of biscuits (2.68±0.20%) as compared to raw oats was may be due to incorporation of

flaxseeds and carom seeds powder in raw oats flour for preparation of biscuits. The protein, fat, fiber and carbohydrate content of biscuits range between 12.45±0.11%, 20.44±1.0%, 1.013±0.26% and 56.317±0.46%, respectively. Srivastava et al, (2012) studies on oats biscuits observed the similar values of carbohydrate content 52.9-56.4% (Mehra et al., 2017)

Sensory evaluation

Sensory attributes	Chapatis	Biscuits
Color	7.2±0.32	7.0±0.42
Appearance	7.0±0.21	6.5±0.13
Taste	7.5±0.09	7.5±0.22
Texture	7.5±0.09	7.0±0.15
Overall acceptability	7.15±0.26	7.0±0.23

Results of sensory evaluation of chapatis and biscuit made from oats flour blended with egg white protein powder, flaxseeds and carom seeds powder were evaluated using nine point hedonic scale (Table) and it was observed that prepared chapatis and biscuit were found under category of 'Moderately desirable' (7.15±0.26 and 7.0±0.23). Color, appearance, texture and taste were acceptable. Texture of chapatis had organoleptic score of 6.9±0.45 and taste had highest organoleptic score of 7.5±0.09%. The color of blended oats flour was grey and soft to bite as compared to whole oats flour chapattis which are usually hard to bite. The taste was sharp and slightly bitter. The taste and colour of biscuits found 7.5±0.22 and 7.0±0.42. The color of biscuits was dark brown. The taste was very desirable.

Conclusion

The proximate chemical composition analysis of raw material and products were observed. The protein content of biscuits (13.04±0.33) and chapatis (11.68±0.08%) were higher than raw oats flour (9.8±0.45%). The significant increase in protein content of both products due to incorporation of egg white protein powder in raw oats flour for preparation of biscuits and chapatis, which improves the nutritional value of products.

The sensory evaluation of chapatis and biscuits indicates that both products were observed under category of 'moderately desirable' according to nine point hedonic scale' organolpetic score. Both the products were obtained is highly acceptable on the basis of sensory evaluation.

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