Quality characteristics of cookies prepared from oats and finger millet based composite flour

Vijayakumar. M. Chappalwar[2], Dayanand Peter[2*], H. Bobde, Steffi. M. John[2]

[2.] Department of Food Processing and Engineering, Karunya University, Coimbatore, 641114

Abstract

Cookies were made from oats and finger millet based composite flour. Oats and finger millet flour was mixed with wheat flour at ratios 10:10:80, 20:20:60, 30:30:40 and 40:40:20 respectively. The cookies were evaluated for proximate composition and chemicalcomposition. Chemical composition of the prepared cookies showed that oat and finger miller flour addition significantly improved the dietary fiber content ranging from 1.45% to 3.05%, protein content ranging from 8.30% to 10.69%and crude fat content between 21.32%and 23.37%. The proximate composition analysisrevealed that moisture content of cookies made from wheat flour was slightly higher than that in cookies made from oats and finger millet flour. This might be due to higher temperature employed during drying of the grains. Oat and finger millet flour contained higher fat, fiber and ash as compared to wheat flour (6.10%:1.98%, 3.91%:3.62% and 1.82%:1.76%) respectively. The higher levels of crude fiber and ash content in oats and finger millet blend might be due to reason that the wheat flour used in the manufacture of cookies was in the refined (Maida) form. The chemical composition resulted that the cookies with oat, finger millet and wheat flour in ratios 0:0:100 showed higher amounts of moisture content and carbohydrate than cookies with oat, finger millet and wheat in ratios of 40:40:20. Higher amounts of ash content, crude fiber, crude fat, crude protein was found in cookies with oat, finger millet and wheat flour with ratios of 40:40:20 respectively than cookies with oat , finger millet and wheat flour in ratios of 0:0:100.

1. Introduction

Baking Industry is considered as one of the major segments of food processing in India. Baked products are gaining popularity because of their availability, ready to eat convenience and reasonably good shelf life. Cookies hold an important position insnack food industry due to variety in taste, crispiness and digestibility. Cookies aremade in a variety of style using an array of ingredients including sugars, spices, chocolates, butter, peanut butter, nuts or dried fruits. (Abdul Waheed, 2010).

Cookies are ideal for nutrient availability, palatability, compactness and convenience. They differfrom other bakery products like bread and cakes because of having lowmoisture content, comparatively free from microbial spoilage long shelf life of the product.

Oatsare rich source of dietary fiber but more importantly, oats are high in fiber, specifically, b-glucan, which reduces blood cholesterol level by increasing the excretion of bile in the body (Jenkins and Kendall, 2012). The nutrition

composition of oat per 100gm indicates carbohydrate 66g, dietary fiber 11g, fat 7g, protein 17g, pantothenic acid (B5) 1.3 mg, iron 5 mg, magnesium 177g and b-glucan 54g. In addition to this it is also rich source of amino acid, B vitamins and many minerals(Marquart and Caben 2005).

Oats have numerous uses in food most commonly they are rolled or crushed into oatmeal or into fine oat flour. Thought, oatmeal is chiefly eaten as porridge, but may also be consumed raw and cookies with raw oats are becoming increasingly popular.

Finger millet (*EleusinianCaracara)* is an important staple food in the eastern and central Africa as well as some parts of India (Majumder*et al*., 2006). It is rich in protein, iron, calcium, phosphorous, fiber and vitamin content. The calcium content is higher than all the cereals and iodine content is said to be highest among all the food grains. Finger millet has best quality protein along with the presence of essential amino acid, vitamin A, vitamin B, and phosphorous (Gopalan*et al*., 2004). Thus finger millet is a good source of diet for growing children, expecting women, old age people and patients. It helps to control blood glucose levels in diabetic patients very efficiently. The bulkiness of the fibers and slower digestion rates makes us feel fuller on, fewer calories and therefore may help to prevent eating excess calories (Kang *et al*., 2008).

As discussed above it is clear that Oat and Finger millet havethe nutritional strength in terms of b-glucan, dietary fiber, functional fiber, starch patter as well as high calcium, mineral and iron content and can be considered as fortification for plain cookies. The present study was conducted for this purpose.

2. Materials And Methods

2.1.Preparation of Composite Flour

Composite flour utilized in the preparation of oat and Finger millet flour cookies was prepared by blending proportion of oats and Finger millet flour with wheat flour in the following blends to standardizethe formulation of composite flour cookies:

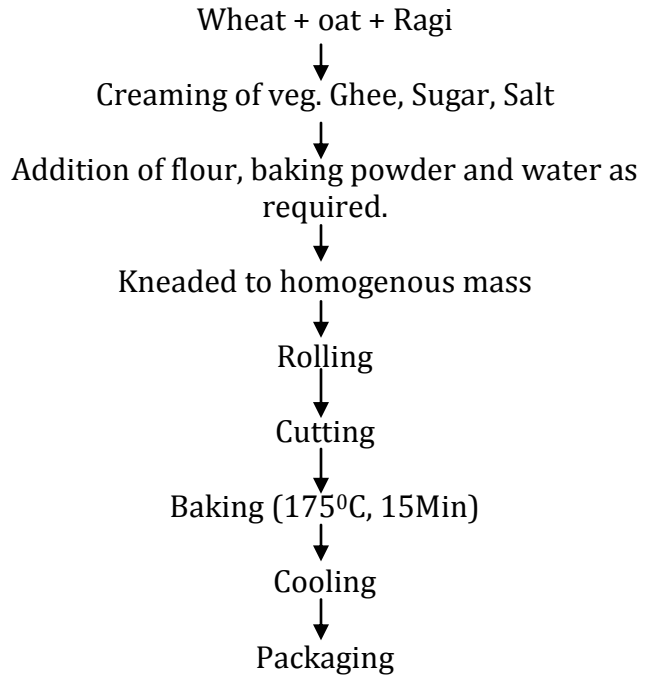
Treatments	Composition of Flour (%)		
	Oat	Finger Millet	Wheat
T_1	0	0	100
T_2	10	10	80
T_3	20	20	60
T_4	30	30	40
T_5	40	40	20

2.2 *Manufacture of Cookies:*

The composite blend flour cookies were prepared using the basic formula developed by Gaines and Tsen (1980):

Ingredients	Quantity (g)
Flour	100
Sugar	33
Shortening	34
Glucose	1
Salt	1
Sodium bicarbonate	0.27
Ammonium bicarbonate	0.20
Distilled water	As per requirements

Flow chart for preparation of cookies



2.3 Analytical methods

2.31 Determination of Moisture Content

Moisture was estimated by weighing accurately 5g of ground sample and subjected to oven drying at 110^{0}C for 4h. It was again weighed after cooling in desiccators until the constant weight was obtained. The resultant loss in weight was calculated as moisture content. (AOAC. 1998) $MC = \frac{(W_2 - W) \times 100}{W_1 - W}$

Where, W= Weight of empty petridish

W_1= Weight of petridish with sample before drying

W_2= Weight of petridish with sample after drying to constant weight

2.32 Determination of fat

5g ground sample was weighed accurately to thimble and defatted with the petroleum ether in soxhlet apparatus for 6-8 hours at 80^{0}C. The resultant ether was evaporated and lipid content was calculated. (AOAC. 1988)

$$\text{Fat (\%)} = \frac{(W_2 - W_1) \times 100}{W}$$

Where, W_2= Weight of flask with oil (g)

W_1= Weight of empty flask (g)

W=Weight of initial sample (g)

2.33 Determination of protein

Protein was determined by Micro-kjeldhal method (AOAC. 1998)using 0.5g of ground sample by digesting the same with concentrated H_2SO_4 containing catalyst mixture for 3-4 hours at 100^{0}C. It was then distilled with 40% of NaOH and liberated ammonia was trapped in per cent of boric acid and then it was titrated with 0.1N HCL using mixed indicator (Methyl red: Bromocresol green @ 1:5). The percent percentage was estimated in the sample using multiplying factor 6.25.

$$\text{Nitrogen \%} = \frac{[(\text{sampletitre} - \text{blanktitre}) \times \text{Normality of HCL} \times 14 \times 100]}{[(\text{weight of sample} \times 100)]}$$

Protein %= Nitrogen% ×6.25

2.34 Determination of carbohydrate

5g of sample was weighed accurately in test tube and kept in ice water bath for few minute followed by the addition of cold H_2SO_4(72%) with gentle stirring. The viscous pest was diluted with distilled water to obtain final concentration 2N with respect to acid. It was then refluxed at 98^{0}C for 3-4 hrs to achieve complete hydrolysis. The sugar content was estimated by phenol H_2SO_4 method, using glucose as standard curve.

The optical density was measured at 480nm using spectrophotometer.

Amount of carbohydrate in 100mg of sample= mg of sample × 100 / Volume of test sample

2.35 Determination of ash content

5g of sample was weighed into crucible which was heated at low flame till all the material was completely charred and cooled.Then it was kept in muffle furnace for about 5hrs at 600^0C. It was again cooled in desiccators and weighed and repeated until two consecutive weights were constant. The percent ash was calculated by knowing the difference between initial and final weight. (AOAC. 1998).

Total ash= $\frac{(W_2-W) \times 100}{W_1-W}$

Where, W= Weight of empty dish

W_1=Weight of dish with sample

W_2=Weight of dish with ash

2.36 Determination of crude fiber

The fat free sample(2g) was taken in triplicate and digested with 200ml of 1.25% H_2SO_4 by gentle boiling for 30 min and filtering the content through muslin cloth under succession. Washed the residue free of acid using hot distilled water and then transferred to the beaker for alkali digestion by treating with 1.25% NAOH (200ml) for 30 min. the contents were filtered through muslin cloth. Wash the residue free of alkali by using hot distilled water. The residue was dried in an oven for 4hrs. The loss in weight after ignition represents the crude fibers content in the sample (AOAC, 1998).

2.37 Statistical analysis

The data obtained for each parameter was subjected to statistical analysis of variance (ANOVA) within the treatments, packaging material and storage intervals and interaction among these parameters. The comparison of means was carried out by Complete Randomization Design (CRD) as per the methods given by Pans and Sukhatme (1967). The analysis of variance revealed at the significance of S.E and CD at 5% level is mentioned wherever required.

3. RESULT AND DISCUSSIONS

3.1 Proximate composition:Proximate composition of oat and finger millet flour used for the experiment is tabulated below:

Particulars	Wheat flour (%)	Oat flour (%)	Finger millet flour (%)
Moisture	8.92	7.68	8.67
Protein	11.19	16.91	8.52
Ash	1.68	1.82	1.76
Crude fat	1.65	6.10	1.98
Crude fiber	1.89	3.91	3.62
Carbohydrate	72.15	65.7	75.31

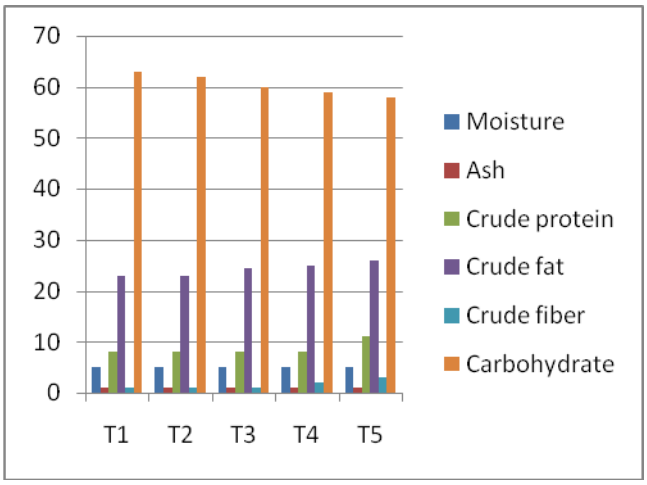
The moisture content of wheat flour was slightly higher that of the composite blend flour. This may be due to higher temperature employed during drying of grains. Oat and finger millet flour contains higher fat, fiber, ash. The higher fiber content was due to presence of few oat and finger millet bran particles present in flour. Carbohydrate content of oat flour was low due to use of wheat flour in the form of maida.

3.2 Chemical composition of oat, finger millet and wheat flour:

Treatment	Moisture (%)	Ash (%)	Crude			Carbohydrate (%)
			Protein (%)	Fat (%)	Fiber (%)	
T_1	4.21	1.49	8.3	21.3	1.45	63.84
T_2	4.1	1.53	8.95	22.2	1.89	61.12
T_3	3.89	1.53	9.26	21.64	2.16	60.49
T_4	3.75	1.57	10.12	22.19	2.68	59.68
T_5	3.45	1.62	10.69	23.27	3.05	58.23

3.3 Moisture Content:

It can be seen from the graph that moisture content decreased with increase in oats and finger millet flour content in the composite cookies.



The results show that cookies with 40% oat and finger millet flour had the lowest moisture content while cookies with 0% oat and finger millet flour had more moisture content.

3.4 Ash Content

Ash content in a food substance indicates inorganic remains when the organic matter has been burnt away. High ash content was observed in cookies with 40%oat and finger millet followed by cookies with 30% oat and finger millet, while minimum ash content was observed in cookies with 0% oat and finger millet flour.

3.5 Crude Protein

Cookies with 40% oat and finger millet contain higher protein while 0% oat and finger millet flour or control lower amount of protein. The increase in protein content could be due to increase in the proportion of oat and finger millet flour.

3.6 Crude Fat

High fat was observed in cookies containing 40% oat and finger millet flour. The increase in fat content in the final product with increase in percentage level of oat flour may be due to higher percentage of fat content in oatmeal used for fortification.

3.7 Crude Fiber

The mean for crude fiber content of oat flour fortified cookies showed that fiber content increased with the increase in different level of oat flour.

3.8 Carbohydrate

Carbohydrate content decreased with increase in different level of oats and finger millet composition in flour. Cookies with 0% oat and finger millet flour contain more carbohydrate followed by cookies with 30% oat and finger millet flour. The decrease could be due to the low content of carbohydrate in the add oat flour which agreed with the finding of Iwe (2003).

3.9 Physical properties of oat and finger millet flour cookies:

The cookies were prepared using oat and finger millet at different levels ranging from 0 to 40%. The prepared cookies were evaluated for its quality and sensory acceptability using 9 point hedonic scale. The cookies were evaluated with

respect to color, flavor, taste, texture, appearance and overall acceptability. The sensory score resulted that there was an increase in sensory score with the addition ofoat and finger millet flour improved flavor, taste, texture, appearance, overall acceptability of the final product.

Physical properties of oat and finger millet flour cookies:

Sample	Weight (g)	Diameter(cm)	Thickness (cm)	Spread Factor
T_1	10.83	4.24	0.80	53.00
T_2	10.80	4.26	0.80	53.25
T_3	10.80	4.29	0.78	55.00
T_4	10.79	4.31	0.78	55.25
T_5	10.78	4.35	0.76	57.23

4. Summary and conclusion

The interest in the inclusion of oat and finger millet flour in the formula is due to its high content of soluble fiber consisting especially b-glucan, proteins, energy vitamins and minerals, such as magnesium, manganese, iron, copper and zinc, which are highly beneficial to human's health. Finger millet provides highest level of calcium, antioxidant properties, photochemical, which makes it easy and slowly digestible. Hence it helps to control blood glucose levels in diabetic patients very efficiently. In the product development cookies were fortified with oat flour and finger millet flour at 0, 10, 20, 30 and 40% level of incorporation. The product prepared was evaluated for color, flavor, taste, texture appearance and overall acceptability using departmental semi trained panel members on 9 point hedonic rating. The sensory score revealed that replacement of oat and finger millet flour has significant effect on almost characteristics of the cookies. However, textural qualities and appearance were improved to greater extends that all other samples. Physical properties of the oat and finger millet and wheat flour cookies revealed that maximum spread factor was observed in sample containing 30%(T_4) and 40%(T_5) oat flour. Hence it could be concluded that oat and finger millet flour up to the level of 40% enhances physical properties of cookies. Chemical properties of cookies showed that oat and finger millet flour addition significantly improved the dietary fiber, protein and fat content of cookies. The product was regularly evaluated for its sensory quality at every 15 days of interval.

Thus in the light of scientific data of the present investigation, it may be concluded that that oat and finger millet flour can be used successfully in preparation of cookies at the replacement level of 30% and 40% levels without any undesirable changes in physical, chemical and organoleptic attributes of cookies. The 40% oat and finger millet flour cookies were crispier as compared to 30% oat and finger millet flour cookies, so there may be a chance of breakage during transportation. From this observation it was concluded that 30% oat and finger millet flour cookies was good quality and easy to handle as compared to 40% oat and finger millet flour cookies. Moreover this finished product can be consumed by socio economically poor and vulnerable groups of people. It is interesting to note that the incorporation of oat and finger millet flour yielded cookies with better as compared to Maida cookies oat and finger millet flour not only improved the overall acceptability of the product but also improves the nutritive value of the product.

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