ISSN NO. 2320-5407

Journal homepage: http://www.journalijar.com

INTERNATIONAL JOURNAL OF ADVANCED RESEARCH

RESEARCH ARTICLE

PHYSICOCHEMICAL AND SENSORY CHARACTERISTICS OF VALUE ADDED BREAK FAST BISCUITS

*** SUJITHA. R, AND Dr. A. THIRUMANI DEVI**

(Department of Food Science and Nutrition, Avinashilingam institute for home science and higher education for women, Coimbatore-641043)

Manuscript Info

Manuscript History:

Received: 11 January 2014
Final Accepted: 23 February 2014
Published Online: March 2014

Key words: Breakfast biscuits, Sensory quality, physicochemical properties, Rheological characteristics.

Corresponding Author

SUJITHA. R,

Abstract

Breakfast is the important meal of the day after an overnight fast. Common reasons for skipping breakfast include not liking the food, preference for sleeping and over eating. Biscuits are the most popular food item consumed by population. The value addition of developed breakfast biscuits are highly nutritious and it consists of whole grains like, whole wheat flour, buckwheat flour, black flour and flax seed flour, these are relatively rich in protein, fat, fiber, vitamins and minerals. The physicochemical and rheological properties of value added breakfast biscuits were studied and prepared to find out the acceptability and quality. The mixing tolerance index was 40 BU and it was increased up to 46BU at end of the storage period. Water absorption capacity was ranged from 90-140% and it increased during the storage period of 60 days. The moisture content was increased in value added flour and breakfast biscuits in storage period. The acceptability of breakfast biscuits was good for control but with addition of value added flour it was best and enriched with nutrient. The breakfast biscuits formed with addition of 55% wheat flour, 35% buckwheat flour and black gram flour and flax seed flour 5% had the overall acceptability score of 4.7. During storage period there was a lower limit of microbial growth.

Introduction

A healthy and balanced diet provides foods in the right amounts and combinations that are safe and free from disease and harmful substances. Eating well can also aid in the prevention of a variety of health problems, by maintaining a healthy body weight, and promoting a general feeling of well-being. Breakfast is the most important meal and it is the first meal of the day after an overnight fast. Starting the day with a nutritious breakfast is a simple way to make difference to overall well being as well as the ability to function well over the day. Eating breakfast as a child is important for establishing healthy habits for later in life. Common reasons for skipping breakfast include not liking the food served at breakfast, not wanting to eat in the morning, and a preference for sleeping, over eating (Mullie, 2006). Biscuits are the most popular food item consumed by a wide range of population due to their varied taste, long shelf life, and nutrient content and relatively low cost (Tyagi et al., 2006). The value addition of developed breakfast biscuits are highly nutritious and it consists of whole grains like, whole wheat flour, buckwheat flour, black flour and flax seed flour, these are relatively rich in protein, fat, fiber, vitamins and minerals. Value added breakfast biscuits are good for health and it fulfills the $1/3^{rd}$ of nutritional requirements of an individual. With these backdrops, the value added breakfast biscuits suitable for young children was prepared and evaluated to determine the physical, chemical, sensory characteristics and rheological properties and also to determine the nutrient content of the product.

Materials and methods

Selection and procurement of ingredients

Buckwheat flour, black gram flour, flax seed flour and whole wheat flour were selected for the preparation of value added breakfast biscuits. The ingredient of buckwheat flour was procured from Wellness Q.E.D, New Delhi and other ingredients were purchased from local market. Black gram was soaked at overnight and washed under tap water then dried in the sun light. After drying it was roasted and powdered and included in the preparation of value added breakfast biscuits.

Proximate composition of flour

Ash, moisture, carbohydrate, protein, fat, dietary fiber was estimated by the standard procedure given in AOAC Methods (2000).

Standardization and preparation of value added breakfast biscuits

Preparation of value added breakfast biscuits

Three blends were prepared by mixing wheat flour with buckwheat flour, black gram flour and flax seed flour in the different percent, as shown in Table I. Sugar and fat (butter) were mixed together, and then wheat flour, buckwheat flour, black gram flour, flax seed flour, baking powder and one teaspoon of milk were added to prepare soft dough using hand. The dough was allowed to stand 15 minutes until a uniform smooth texture was obtained. The dough was rolled on a flat rolling board sprinkled with some wheat flour to a uniform thickness using wooden hand roller. Circular biscuit cutter was used to cut the flatten dough, placed on a greased baking tray. The baking tray of four blends were baked in an oven at a temperature of 150°C for 20- 25 minutes when a brown colour was formed, then the biscuits were removed and allowed to cool, and packed in HDPE film and stored. The control biscuits were prepared using wheat flour with the same procedure adopted in method and stored at ambient temperature. The fresh biscuits samples are used to analyze the physicochemical characteristics, nutrients and microbial content.

Sensory evaluation of breakfast biscuits

Thirty post graduate students were selected for sensory evaluation. A five point score was formulated for the acceptance of appearance, texture, flavour, taste and over all acceptability. The product which obtained the highest scores through organoleptic evaluation by the panel members were considered as highly acceptable product. The evaluation was carried out thrice to obtain reliable results. The breakfast biscuits and value added flours were packed in different HDPE bags and stored at ambient temperature for the period of two months and it was observed once in a month.

Physical characteristics

Bulk density

The bulk density of sample (50 g) was put into a 100 ml graduated cylinder and tapped 20-30 times. The bulk density was calculated as weight per unit volume of sample.

$$\text{Bulk density} = \frac{\text{Biscuit weight (g)}}{\text{Biscuit volume (ml)}}$$

Spread ratio

Three rows of the five well formed biscuits were made and the height measured as well as arranging the same biscuits horizontally edge and the sum of the diameter measured.

$$\text{Spread ratio} = \frac{\text{Diameter}}{\text{Height}}$$

Diameter

The diameter (D), of biscuits was determined by placing six biscuits edge to edge. The total diameter of the six biscuits was measured in mm by using a caliper. The biscuits were rotated at an angle of 90° for duplicate reading. This act was repeated twice and average diameter was reported in millimetres.

Thickness

The thickness (T), of biscuits was determined by placing six biscuits on top of one another. The total height was measured in milli meters with the help of ruler. This process was repeated thrice to get an average value and results were reported in mm.

Weight

Weight of the biscuits was measured as average of values of four individual biscuits with the help of digital weighing balance (AOAC 2000).

Volume

Submerge the biscuits and baked into a jug of water with a scale on the side. The water starts on 100ml and the biscuit were put in to the jug then the volume goes up to 120ml the volume of the biscuit is 20ml. This it is 20 cubic cm as 1ml=1cm (to the power of 3) (AOAC 2000).

Water absorption capacity

Ground cookie sample was suspended in 30 ml of water at 30ºC in a 50 ml pre weighed centrifuge tube and centrifuged at 3000 rpm for 10 min. The supernatant was poured into dish. The remaining gel was weighed and the water absorption capacity was recorded.

$$\text{Water absorption capacity} = \frac{\text{Gel weight (g)}}{\text{Dry sample weight (g)}}$$

Chemical characteristics of breakfast biscuits

Assessment of chemical characteristics of biscuits is important aspects of value added food products. The chemical characteristics of biscuits such as ash, moisture, dry gluten and wet gluten were determined by AOAC Method (2000).

Rheological characteristics of value added flour

A flour sample of 50 - 300 grams on a 14 percent moisture basis is weighed and placed into the corresponding Farinographic mixing bowl. Water from a burette is added to the flour and mixed to form dough. As the dough is mixed, the Farinographic records a curve on graph paper. The amount of water added (absorption) affects the position of the curve on the graph paper. Less water increases dough consistency and moves the curve upward. The curve is centered on the 500-Brabender unit (BU) line ±20 BU by adding the appropriate amount of water and is run until the curve leaves the 500-BU line.

Nutrient analysis

Energy value was estimated by using bomb calorimeter, protein was determined based on AOAC method (Kjeldahl Method). Fat was conducted based on AOAC method Soxhlet Extraction method. Carbohydrate was estimated by Anthrone method. Fiber was determined by neutralization method (AOAC, 2000).

Peroxide value and Microbial analysis

Peroxide value is an indicator of rancidity development during storage. Peroxide value of fresh as well as 30 and 60 days old biscuits samples were determined as per the method described by Sadasivam and Manickam (2008).

Microbial population like bacteria and fungus were estimated by serial dilution followed by solidification in petriplate using nutrient agar and rose Bengal agar respectively. After solidification both bacteria and fungus colony containing plate were incubated at room temperature for 24-48 hours. Then formed colonies were count and convert as the number of colony forming units (CFU) per gram of sample fresh as well as 30 and 60 days of old sample

Statistical Analysis

The data was complied and analyzed by using statistical methods. Descriptive statistics mean, standard deviation, coefficient of variation and ANOVA test are computed using MS-Excel. The multiple ranges of tests were applied to determine the significant differences between samples

Results and discussion

Proximate composition of value added flour

The proximate composition as given in Table II shows, in control flour the ash content was 1.57 percent, moisture was 5.67 percent, carbohydrate was 77.74gm, protein was 10.1 gm, fat was 15 percent and dietary fiber was 2.1 percent. The moisture content of flour was increased during storage. In variation-A the ash content was 1.88 percent, moisture was 5.41 percent, carbohydrate was 77.62 gm, protein was 10.4 gm, fat was 16 percent and dietary fibre was 2.01 percent. For variation-B the ash content was 2.12 percent, moisture was 5.73 percent, carbohydrate was 74.9 gm, protein was 10.8 gm, fat was 14 percent and dietary fibre was 2.63 percent. For variation-C the ash content was 2.22 percent, moisture was 6.59 percent, carbohydrate was 70.9 gm, protein was 11.2 gm, fat was 12.9 and

dietary fibre was 2.7 percent. In all the variations along with control the proximate compositions were noted to have decrease during storage period of 30 and 60 days except moisture content

Table-I
Quantity of ingredients used in value added breakfast biscuits

Criteria	Whole Wheat Flour (g)	Buckwheat Flour (g)	Flax Seed Flour (g)	Black Gram Flour (g)	Butter (g)	Sugar (g)
Control	100	-	-	-	60	60
Variation- A	75	15	5	5	60	60
Variation- B	55	35	5	5	60	60
Variation- C	25	65	5	5	60	60

Table II
Proximate composition of value added flour

Criteria	**Control**			**Variation- A**			**Variation- B**			**Variation- C**		
	ATP	**30th day**	**60th day**	**ATP**	**30th day**	**60th day**	**ATP**	**30th day**	**60th day**	**ATP**	**30th day**	**60th day**
Ash (percent)	1.57	1.35	1.27	1.88	1.62	1.54	2.12	2.03	1.88	2.22	2.22	2.08
Moisture (percent)	5.67	8.36	7.88	5.41	6.81	7.45	5.73	7.87	7.97	6.59	8.47	8.66
CHO (gm)	77.74	71.5	67.9	77.6	71.3	66.3	74.9	68.9	57.5	70.9	68.3	64.5
Protein (gm)	10.1	9.8	9.45	10.4	10	10	10.8	10.4	10.2	11.2	10.9	10.8
Fat (percent)	15	8.82	3.58	16	8.98	4.39	14	10.7	4.96	12.9	10.4	4.44
Dietary fibre (percent)	2.1	1.8	1.7	2.01	1.98	1.6	2.63	2.58	2.34	2.7	2.4	2.0

1
CHO- Carbohydrate, ATP- At the Time of Preparation

Rheological characteristics of value added flour

A Farinographic property of wheat flour dough was affected by substitution of buckwheat flour or black gram flour or flax seed flour. From the obtained results (Figure I), it could be observed that the dough development time was initially three minutes and it was increased 3.04 minutes and 3.9 minutes during the storage period of 30th days and 60th day. Water absorption was initially 59.6 percent and it was decreased due to flour content, at end of the storage, it was 47.24 percent. Initially 'Softening of dough' was 66.9 BU and it was decreased and it was softened during storage period 58.65BU. Initially the mixing tolerance index was 40 BU and it was increased up to 46BU at end of the storage period.

Figure I Rheological characteristics of value added flour

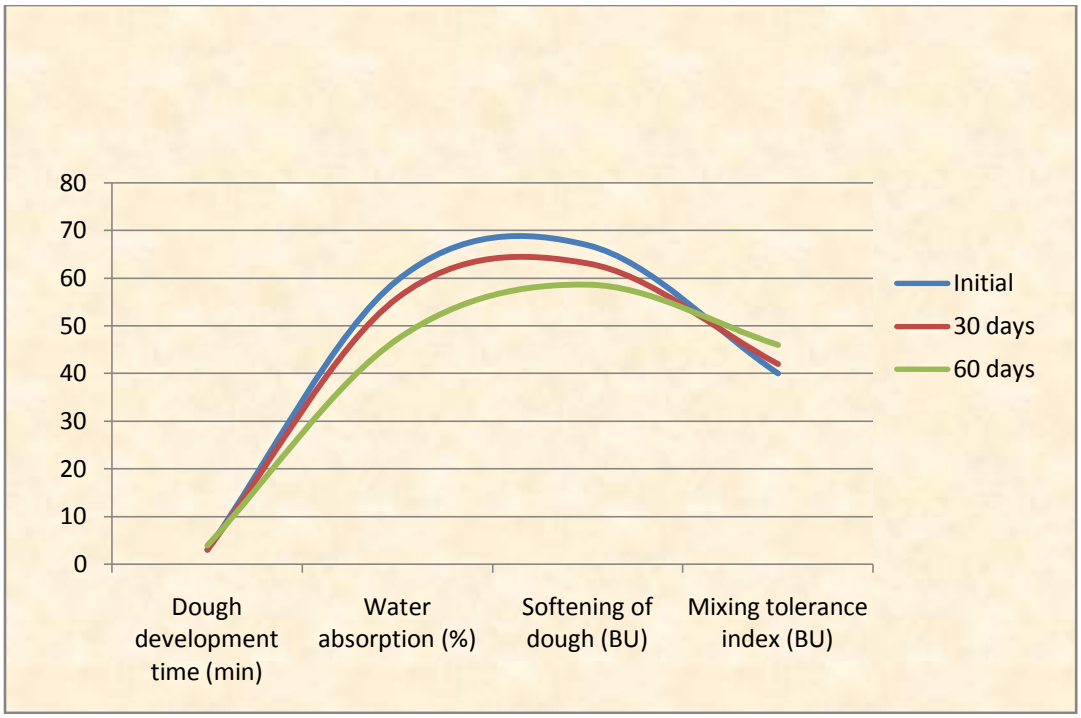


Table III
Mean score for breakfast biscuits

Criteria	Appearance	Texture	Flavour	Taste	Overall acceptability
Control	4.5	4.45	4.5	4.6	4.6
Variation A	4.33	4.48	4.52	4.52	4.5
Variation B	4.5	4.6	4.62	4.7	4.7
Variation C	4.35	4.25	4.45	4.4	4.3

The table III shows that the variation B got the highest scores of 4.5, 4.6, 4.62, 4.7 and 4.7 for its characteristics like appearance, texture, flavour, taste and overall acceptability respectively. From the mean overall acceptability score, it is evident to note that variation B got the highest mean scores for appearance, texture, flavour, taste and also overall acceptability

Mean scores for breakfast biscuits

Table IV
Analysis of variance (ANOVA) for breakfast biscuits

Parameter	Calculated F-value	Prob> F
Appearance	2.8226	0.099306**
Texture	28.8485	$6x10^{-5}$ ***
Flavour	12.7402	0.001369***
Taste	4.1147	0.0429**
Overall acceptability	7.7811	0.0071***

***- Significant at 1% level, **-Significant at 5% level, NS- Not Significant

Table IV shows that the P values for appearance and taste is lies between 0.05 and 0.01 indicating a difference between the variations in terms of appearance and taste at 5%. Thus there is a strong difference between the variations in means of all sensory characteristics

Physical characteristics of breakfast biscuits

The physical properties of breakfast biscuits are shown in Table II. The volume of biscuits ranged from 15.3-15.7ml, weight was ranged from 12.2-12.5g. It decreased during the storage period. The thickness was ranged from 0.5-0.6cm, diameter was 4.7-5 cm. Increased in thickness may be due to the decrease in diameter. The changes in diameter and thickness were reflected in spread ratio ranged from 4.5-5%. The bulk density was ranged from 0.5-0.7g/cm^3 and water absorption capacity was ranged from 90-140%. In all the variations it was observed that the water absorption capacity increased during the storage period of 60 days

Chemical components of breakfast biscuits

The table III shows the chemical properties of breakfast biscuits are the ash content was ranged from 2-0.9% and it was noted that the ash content was high in control followed by variation-A and Variation-C. The moisture content was ranged from 3.6-5.6% and it was increased during the storage period of 60 days. The dry gluten content was gradually increased and it was ranged from 6-11%. In same way the wet gluten content was decreased during the storage period and it was ranged from 18-22%.

Table V
Physical characteristics of breakfast biscuits

Criteria	Control			Variation- A			Variation- B			Variation- C		
	ATP*	30 days	60 days	ATP*	30 days	60 days	ATP*	30 days	60 days	ATP*	30 days	60 days
Volume (ml)	15.7	15.7	15.7	15.7	15.7	15.7	15.6	15.6	15.3	15.4	15.4	15.3
Weight (gm)	12.5	12.5	12.2	12.64	12.6	12.5	12.33	12.3	12.2	12.5	12.5	12.2
Thickness (cm)	0.5	0.6	0.6	0.7	0.7	0.8	0.6	0.7	0.7	0.6	0.7	0.7
Bulk density (g/cm3)	0.76	0.79	0.79	0.81	0.81	0.76	0.56	0.56	0.53	0.66	0.66	0.61
Spread ratio (percent)	5.20	5.01	5.01	4.61	4.61	4.53	4.62	4.62	4.58	4.63	4.63	4.53
Diameter (cm)	5	5	5	5	5	5	4.9	4.9	4.8	4.8	4.8	4.75
Water absorption capacity (percent)	90	92	95	93	96.5	98	120.2	124	129	135	137	140

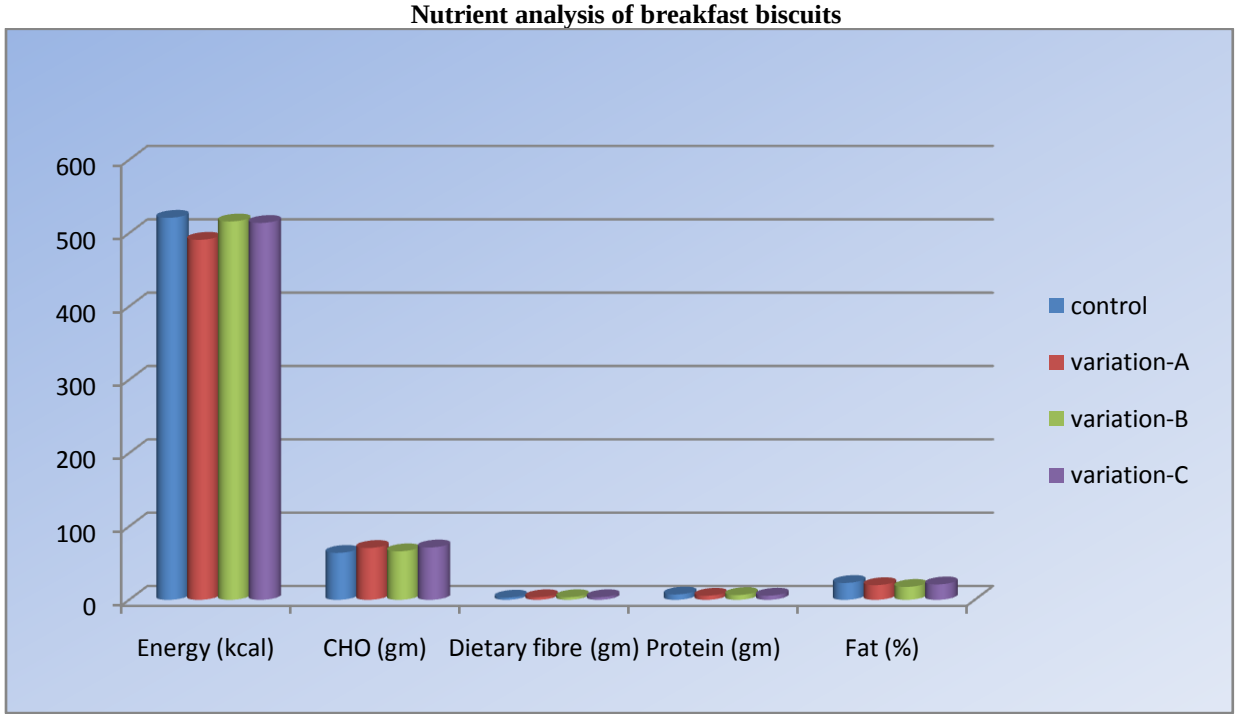
*ATP-At the Time of Preparation

Table VI

Chemical components of breakfast biscuits

Criteria	Control			Variation- A			Variation- B			Variation- C		
	ATP*	30 days	60 days	ATP*	30 days	60 days	ATP*	30 days	60 days	ATP*	30 days	60 days
Ash (%)	2.09	1	0.78	2.02	0.93	0.91	1.94	1.19	1.08	2	1.11	1.02
Moisture (%)	3.6	5.06	5.38	3.70	5.26	5.68	3.30	4.40	4.68	2.18	4.69	5.38
Dry gluten (%)	6.7	10.8	11	5.87	5.52	5.63	5.98	8.85	9.21	6.35	9.94	11
Wet gluten (%)	22.6	18.7	18.1	20.09	17.6	17.2	20.5	19.1	18.6	21.8	19.3	18.1

Figure II
Nutrient analysis of breakfast biscuits



Nutrient analysis of breakfast biscuits

Figure II shows that the nutrient analysis of control biscuits got the energy of 521kcal, carbohydrate of 64gm, dietary fibre of 2.9g, protein of 7.3gm, and fat of 23 percent. The nutrients were found to be decreased at the end of the study period (60th day).In variation-A breakfast biscuits, the energy value was 491kcal, carbohydrate was 70.71gm, dietary fibre was 3.56gm, protein was 5.57gm and fat was 20percent. The nutrients were decreased at the end of the study period (60th day). In variation-B breakfast biscuits the energy value was 516kcal, carbohydrate was 66.17gm, dietary fibre was 3.58gm, protein was 6.51gm and fat was 21percent. The nutrients were decreased at the end of the study period (60th day). In variation-C breakfast biscuits the energy value was 514kcal, 69.1gm of carbohydrate, 3.58gm of dietary fibre, 5.68gm of protein and fat was 21 percent. The nutrients were decreased at the end of the study period (60th day)

Microbial and Peroxide value of breakfast biscuits

The bacterial count for all the variations biscuits were found to be lower than the acceptable limit. Initially and 30 days, there was no bacterial count in the breakfast samples. But after 60th days, there was a lower limit of

colony forming unit ($1x10^5$CFU/g). The growth of fungus was also not observed in all three variations with control. It was interesting to note that there was no rancidity development in the formulated breakfast biscuits up to 60 days. The studies conducted by Aruna (2000) also indicated that no rancidity development was observed during storage period up to 60 days.

Conclusion

Breakfast is the most important meal of the day. However, it is the most often one most skipped meal. Skipping breakfast is a common behavior observed in overweight or obese children and adolescents and may be related to dieting and disordered eating habits. Breakfast skippers may be less likely to engage in physical activity, which may contribute to positive energy balance and weight gain. A person who eats a healthy breakfast feels better, looks better, can produce more cognitively and for a longer period of time. In this study, a healthy value added breakfast biscuits was formulated to meet the $1/3^{rd}$ nutritional requirements of an individual and it was contain all the necessary ingredients (whole wheat flour, buckwheat flour, black gram flour and flax seed flour) and it was subjected to physicochemical characterization and organoleptic evaluation. By sensory evaluation the best and acceptable variation was selected and used for further analysis. The physicochemical characteristics of breakfast biscuits revealed that physical and chemical properties of biscuits, rheological properties of biscuits, proximate composition of flour, nutrient and microbial analysis of the breakfast biscuits and cost effectiveness of biscuits and it was got the reliable results in all the characteristics and this it shows the variations are highly nutritious and there was a lower limit of microbial growth in the breakfast biscuits.

References

- AOAC, 2000, official methods of analysis. Association of Official Analytical Chemist
- Aruna, M.C., 2000. Development of vitamin fortified soy biscuits and its effect on the Nutritional status of: selected school children, MSc Thesis, HSC and RI,. Tamil Nadu Agricultural University, India.
- Mullie, P., De Ridder, C. D., Deriemaeker, P., Duvigneaud, N., & Hebbelink, M. (2006). Breakfast frequency and fruit and vegetable consumption in Belgian adolescents. Nutrition & Food Science, 36(5), 315-326.
- Sadasivam, S. and A. Manickam, 2008. Biochemical Methods, New Age International Publishers, New Delhi.
- Tyagi SK, Manikantan MR, Oberoi HS, Kaur G. 2006. Effect of mustard flour incorporation on nutritional, textural and organoleptic characteristics of biscuits. J Food Eng 80: 1043–1050.