

## Original Research Article

# Studies on Utilization of Kodo Millet Flour in the Preparation of Biscuits

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## ABSTRACT

Kodo millet is a rich source of carbohydrate, protein, calcium and can be utilized in bakery products such as biscuits. The prepared samples were analyzed for nutritional composition. The changes occurred during storage of biscuits were also studied. Preliminary experiments were conducted to find out optimum level of kodo millet flour for preparation of quality biscuits. The quality biscuits were prepared from 50% maida and 50% kodo millet flour. Chemical composition of kodo millet showed that the moisture content was 10.90%, carbohydrates 65.90%, protein 8.30%, fat 1.30%, crude fiber 8.50%, calcium 27.00 mg/ 100 g and iron 1.70 mg/ 100 g. The physical properties of kodo millet has creamish white colour, bulk density 650kg/m<sup>3</sup>. The fresh biscuits had 4.07 % moisture, 10.05% protein, 26.62% fat, 4.30% crude fibre, 69.62% carbohydrates, 24.88 mg/100g calcium and 2.17mg/100g iron. The sensory evaluation of biscuits was carried out regularly at a interval of one month. The mean score for colour and appearance was 8.80, flavour 8.70, texture 8.80, taste 8.80 and overall acceptability 8.77 on 9 point hedonic scales. Storage study of biscuits showed that the biscuits prepared by incorporation of 50% maida and 50% kodo millet flour packed in polypropylene (PP) and low density polyethylene (LDPE) and can be stored up to 3 months in good quality with minimum losses in sensory, nutritional and textural characteristics.

### Keywords

Bakery products, cookies, nutrients, energy, protein, iron, calcium and several vitamins

## Introduction

Bakery products are important sources of nutrients, viz. energy, protein, iron, calcium and several vitamins. Most bakery products can easily be enriched and fortified to meet the specific needs of the target groups and vulnerable sections of the population who are undernourished.

Bakery products can also be formulated in such a way to meet specific therapeutic needs of consumers. Among the bakery products, cookies are most significant. Cookies are a

form of confectionary products usually dried to low moisture content. Compared to extensively all over the world as a snack food and on a large scale in developing country.

The kodo millet whole grain consumption has health promoting effects like prevention of insulin resistance, heart disease, diabetes, ischemic stroke, obesity, breast cancer, childhood asthma and premature death (Balasubramanian, 2013) because of this benefits, millets can be used in functional food and as a nutraceuticals. Hence they are also called as 'nutricereals'.

In addition, because of their important contribution to national food security and potential health benefits, of combating various diseases (Shahidi and Chandrashekara, 2013), millet grains are now receiving increased interest from food processors, technologist and nutritionist.

Once a poor man's staple, now adorns the plates of affluent and health conscious people. Kodo millet is major food source in the deccan plateau in India (Gujrat, Karnataka and part of Tamil Nadu), some regions of Maharashtra, Odisha, West Bengal, Rajasthan, Uttar Pradesh and Himalayas and consumed traditionally as health and vitality foods in from rural India (Hegde and Chandra, 2005).

### **Materials and Methods**

The experiment was conducted in the laboratory of Department of Food Science and Technology, Post Graduate Institute at Mahatma Phule Krishi Vidyapeeth, Rahuri during the year 2019-2020. Kodo millet was purchased from local market.

#### **Packaging material**

The packaging materials like polypropylene (PP) and low density polyethylene (LDPE) were purchased from the local market.

#### **Procedure for preparation of biscuits by incorporating kodo millet flour**

The procedure for preparation of biscuits by incorporating kodo millet flour is as below

#### **Physico-chemical analysis of raw material and biscuits**

The method described in A. A.C. C. (2000) for determining moisture was used. The protein content of biscuits was estimated by

determining total nitrogen content using standard Micro-Kjeldhal method and fat content of the biscuits estimated by the soxhlet method A.A.C.C (2000). The crude fiber content in the product was estimated by A.A.A.C. (2000).

The carbohydrate content in the selected biscuits were obtained by subtracting from 100, the sum of values of moisture, protein, fat, ash and crude fiber content per 100 g of the sample (Raghuramulu, *et al.*, 1993). Calcium and iron were analyzed using atomic absorption spectrometry (AAS).

#### **Packaging and storage of kodo millet flour biscuits**

The selected treatment (T<sub>50</sub>) of maida and kodo millet flour biscuits was packed in polypropylene (PP) and low density polyethylene (LDPE) and stored at ambient (27±2°C) for 90 days. The samples were drawn at an interval of 30 days and evaluated for chemical and sensory quality.

#### **Sensory evaluation of biscuits incorporated with kodo millet flour**

Sensory evaluation of maida and kodo millet flour incorporated biscuits was carried on 9 point hedonic scale. The average scores of the ten judges for different quality characteristics *viz.* colour and appearance, flavour, texture, taste and overall acceptability were recorded.

#### **Statistical analysis**

All experiments were carried out by using Factorial Completely Randomized Design (FCRD). The data obtained in the present investigation were analyzed for the statistical significance according to the procedure given by Rangaswamy (2010).

## Results and Discussion

### Physico-chemical composition of raw materials used in the preparation of biscuits

The moisture content of sample (Table.1) was observed to be 10.90 per cent is helpful for good shelf life of grains. The protein, fat, crude fiber and carbohydrate content of kodo millet were found to be 8.30, 1.30, 8.50 and 65.90 per cent, respectively. The calcium content of sample was 27.0 mg and iron content was 1.70 mg. Maida contains moisture was observed 13.30 per cent (Table 1). The protein, fat and carbohydrate content of maida were found to be 12.10, 0.90 and 73.90 per cent, respectively. Crude fiber content was observed to be 0.30 per cent and total carbohydrate was 73.90 per cent. The calcium content of sample was 23.00 g and iron content was 2.70.

### Sensory evaluations of fresh biscuits prepared by incorporation of maida and kodo millet flour

The organoleptic evaluation of biscuits prepared by different combination of maida and kodo millet flour were carried out. The biscuits were prepared and presented to panel of ten judge for assessing the quality and acceptability of product.

Organoleptic evaluation of biscuits was carried out using a 9 point hedonic scale of sensory characteristics such as colour, texture, taste and overall acceptability. Treatment T<sub>50</sub> i.e. 50% maida and 50% kodo millet flour was selected and kept for 3 months storage study. Chemical analysis and sensory evaluation was done at interval of 30 days.

**Table.1** Treatment details

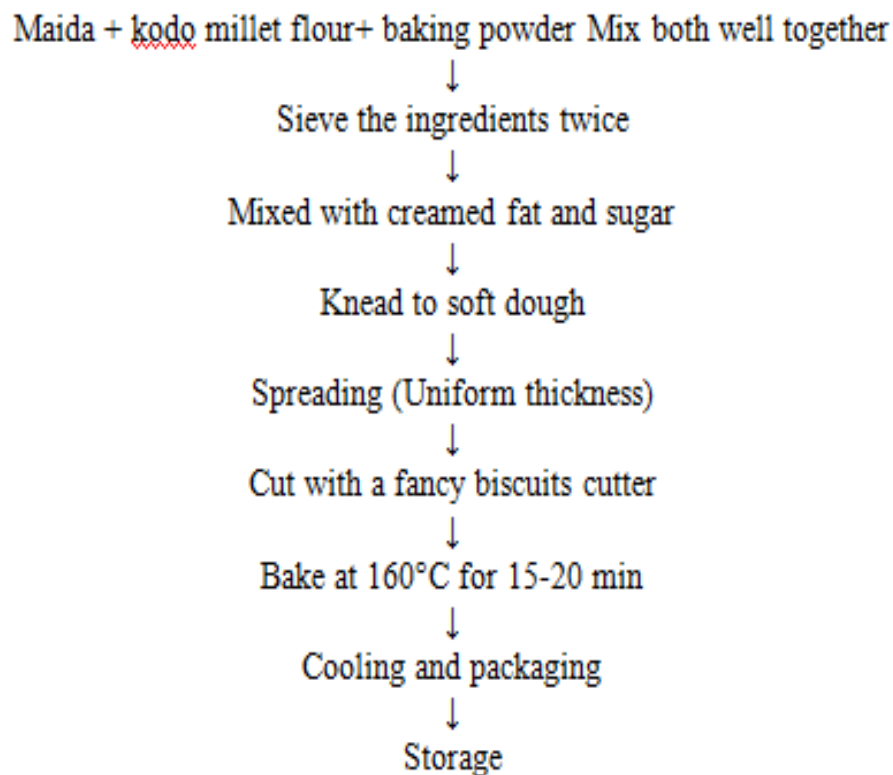
<b>Treatments</b>	<b>Maida (%)</b>	<b>Kodo millet flour (%)</b>
T <sub>0</sub> (Control)	100	0
T <sub>1</sub>	90	10
T <sub>2</sub>	80	20
T <sub>3</sub>	70	30
T <sub>4</sub>	60	40
T <sub>5</sub>	50	50
T <sub>6</sub>	40	60
T <sub>7</sub>	30	70
T <sub>8</sub>	20	80
T <sub>9</sub>	10	90
T <sub>10</sub>	0	100

**Table.2** Physico-chemical composition of raw materials used in the preparation of biscuits

Sr. no.	Physical and Chemical constituents	Mean value (Maida)	Mean value (Kodo millet flour)
1.	Colour	White	Creamish white
2.	Bulk density (kg/ml <sup>3</sup> )	0.48	650
3.	Moisture (%)	13.30	10.90
4.	Protein (%)	12.10	8.30
5.	Fat (%)	0.90	1.30
6.	Crude fiber (%)	0.30	8.50
7.	Carbohydrates (%)	73.90	65.90
8.	Calcium (mg/100g)	23.00	27.00
9.	Iron (mg/100g)	2.70	1.70

\*Each value represents the average of three determinations

**Fig.1** Flow sheet for preparation of biscuits



**Table.3** Chemical analysis of maida and kodo millet flour incorporated biscuits during storage

Parameter	Moisture (%)	Protein (%)	Fat (%)	Crude fiber (%)	Carbohydrate (%)	Calcium (mg/100 g)	Iron (mg/100 g)
<b>Treatment</b>							
T <sub>0</sub> : BMKF <sub>0</sub>	4.19	11.78	25.31	0.20	73.63	22.81	2.58
T <sub>1</sub> : BMKF <sub>50</sub>	4.13	10.02	25.56	4.27	69.59	24.83	2.08
S.E. ±	0.002	0.006	0.002	0.00	0.002	0.002	0.003
CD at 5%	0.007	0.017	0.007	0.00	0.007	0.007	0.010
<b>Packaging material</b>							
P <sub>1</sub> : Low Density Polyethylene	4.15	10.98	25.44	2.25	71.62	23.83	2.34
P <sub>2</sub> : Polypropylene	4.18	10.82	25.42	2.23	71.60	23.81	2.32
S.E. ±	0.002	0.002	0.002	0.002	0.002	0.002	0.003
CD at 5%	0.007	0.017	0.007	0.007	0.007	0.007	0.010
<b>Storage period</b>							
C <sub>1</sub> : 30 days	4.13	10.80	25.48	2.27	71.64	23.85	2.36
C <sub>2</sub> : 60 days	4.16	10.98	25.43	2.24	71.61	23.82	2.33
C <sub>3</sub> : 90 days	4.20	10.92	25.39	2.20	71.57	23.78	2.30
S.E. ±	0.003	0.007	0.003	0.003	0.003	0.003	0.004
CD at 5%	0.008	0.021	0.008	0.008	0.008	0.008	0.012
<b>Interaction</b>							
T <sub>0</sub> P <sub>0</sub> C <sub>1</sub>	4.15	12.03	25.37	0.25	73.68	22.86	2.63
T <sub>0</sub> P <sub>0</sub> C <sub>2</sub>	4.18	11.94	25.30	0.22	73.65	22.83	2.61
T <sub>0</sub> P <sub>0</sub> C <sub>3</sub>	4.20	11.88	25.28	0.18	73.61	22.79	2.56
T <sub>0</sub> P <sub>1</sub> C <sub>1</sub>	4.17	11.08	25.35	0.23	73.66	22.83	2.61
T <sub>0</sub> P <sub>1</sub> C <sub>2</sub>	4.21	11.94	25.30	0.19	73.62	22.81	2.57
T <sub>0</sub> P <sub>1</sub> C <sub>3</sub>	4.25	11.86	25.26	0.17	73.58	22.76	2.54
T <sub>1</sub> P <sub>0</sub> C <sub>1</sub>	4.09	10.04	25.61	4.33	69.64	24.88	2.12
T <sub>1</sub> P <sub>0</sub> C <sub>2</sub>	4.12	10.04	25.57	4.29	69.61	24.85	2.09
T <sub>1</sub> P <sub>0</sub> C <sub>3</sub>	4.17	9.99	25.53	4.24	69.57	24.81	2.06
T <sub>1</sub> P <sub>1</sub> C <sub>1</sub>	4.11	10.08	25.59	4.30	69.61	24.85	2.11
T <sub>1</sub> P <sub>1</sub> C <sub>2</sub>	4.15	10.00	25.55	4.27	69.58	24.82	2.08
T <sub>1</sub> P <sub>1</sub> C <sub>3</sub>	4.19	9.97	25.51	4.22	69.55	24.79	2.05
S.E. ±	0.006	0.014	0.006	0.006	0.006	0.006	0.008
CD at 5%	NS	0.042	NS	NS	NS	NS	NS

Parameter

Where, BMKF<sub>0</sub>: Biscuits with 100% maida and 0% kodo millet flour.

BMKF<sub>50</sub>: Biscuits with 50% maida and 50% kodo millet flour.

**Table.4** Changes in sensory quality of maida and kodo millet flour biscuits during storage period

Parameter	Colour and appearance	Flavour	Texture	Taste	Overall acceptability
<b>Treatment</b>					
T <sub>0</sub> : BMKF <sub>0</sub>	8.00	8.16	7.96	8.13	8.14
T <sub>1</sub> : BMKF <sub>50</sub>	8.18	8.21	8.01	8.26	8.29
S.E. ±	0.024	0.024	0.024	0.024	0.010
CD at 5%	0.069	NS	NS	0.069	0.029
<b>Packaging material</b>					
P <sub>1</sub> : Low Density Polyethylene	8.15	8.26	8.23	8.26	8.23
P <sub>2</sub> : Polypropylene	8.03	8.11	7.75	8.13	8.20
S.E. ±	0.024	0.024	0.024	0.024	0.010
CD at 5%	0.069	0.069	0.069	0.069	0.029
<b>Storage period</b>					
C <sub>1</sub> : 30 days	8.20	8.40	8.32	8.40	8.40
C <sub>2</sub> : 60 days	8.05	8.15	8.17	8.20	8.20
C <sub>3</sub> : 90 days	8.02	8.02	7.47	8.00	8.04
S.E. ±	0.029	0.029	0.029	0.029	0.012
CD at 5%	0.084	0.084	0.084	0.084	0.035
<b>Interaction</b>					
T <sub>0</sub> P <sub>0</sub> C <sub>1</sub>	8.20	8.40	8.40	8.40	8.35
T <sub>0</sub> P <sub>0</sub> C <sub>2</sub>	8.00	8.20	8.20	8.20	8.15
T <sub>0</sub> P <sub>0</sub> C <sub>3</sub>	7.90	8.10	8.00	8.00	8.00
T <sub>0</sub> P <sub>1</sub> C <sub>1</sub>	8.10	8.30	8.20	8.30	8.33
T <sub>0</sub> P <sub>1</sub> C <sub>2</sub>	7.80	8.00	8.10	8.10	8.13
T <sub>0</sub> P <sub>1</sub> C <sub>3</sub>	8.00	8.00	6.90	7.80	7.90
T <sub>1</sub> P <sub>0</sub> C <sub>1</sub>	8.30	8.50	8.40	8.50	8.48
T <sub>1</sub> P <sub>0</sub> C <sub>2</sub>	8.30	8.30	8.30	8.30	8.28
T <sub>1</sub> P <sub>0</sub> C <sub>3</sub>	8.20	8.10	8.10	8.20	8.15
T <sub>1</sub> P <sub>1</sub> C <sub>1</sub>	8.20	8.40	8.30	8.40	8.47
T <sub>1</sub> P <sub>1</sub> C <sub>2</sub>	8.10	8.10	8.10	8.20	8.26
T <sub>1</sub> P <sub>1</sub> C <sub>3</sub>	8.00	7.90	7.90	8.00	8.13
S.E. ±	0.058	0.05	0.058	0.058	0.024
CD at 5%	NS	NS	NS	NS	NS

Parameter

Where, BMKF<sub>0</sub>: Biscuits with 100% maida and 0% kodo millet flour.

BMKF<sub>50</sub>: Biscuits with 50% maida and 50% kodo millet flour.

### **Chemical analysis of maida and kodo millet flour incorporated biscuits during storage**

The moisture content (Table 2.) of biscuits was increased from 4.09 to 4.17 per cent in LDPE and 4.11 to 4.19 per cent in PP. The protein, fat, crude fiber, carbohydrates, calcium and iron content of maida and kodo millet flour biscuits were decreased from 10.04 to 9.99 per cent, 25.61 to 25.53 per cent, 4.33 to 4.24 per cent, 69.64 to 69.57 per cent, 24.88 to 24.81 mg/100g, 2.12 to 2.06 mg/100g in LDPE respectively and in PP protein, fat, crude fiber, carbohydrates, calcium and iron content were decreased from 10.08 to 9.97 per cent, 25.59 to 25.51 per cent, 4.30 to 4.22 per cent, 69.61 to 69.55 per cent, 24.85 to 24.79 mg/100g, 2.11 to 2.05 mg/100g respectively. The increased in moisture content of biscuits in both the packaging material might be due to hygroscopic nature of biscuits. The protein value was affected by proper storage so the protein value was decreased. The fat, crude fiber, ash, calcium and iron was decreased might be due to increase in moisture.

### **Changes in sensory parameters of maida and kodo millet flour incorporated biscuits during Storage**

Maida and kodo millet flour incorporated biscuits (50% maida and 50% kodo millet flour) remained in good condition at ambient temperature during the entire storage period of 3 months. The biscuits stored in low density polypropylene (LDPE) showed good quality than polypropylene (PP) during 3 months of storage. The overall acceptability score of maida and kodo millet flour incorporated biscuits was decreased from 8.48 to 8.15 in LDPE and 8.47 to 8.13 in PP.

Maida and kodo millet flour incorporated biscuits prepared with combination of 50%

maida and 50% kodo millet flour was best and it was fairly stable to storage period for chemical composition. The biscuits remained in good condition during storage period of 3 month. The biscuits stored in low density polyethylene bag (LDPE) showed good quality than polypropylene (PP) and during 3 month storage.

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