The Andhra Agric. J 66 (4): 640-644, 2019

Development of Value Added Biscuits by Using Foxtail millet and *Moringa* Leaves

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ABSTRACT

The present work was carried out to standardize the biscuits prepared from different blends of Foxtail millet and *Moringa* leaves. Samples of one variety of foxtail millet (Surya Nandi) were collected from ARS, Reddipalli, Anantapuramu District and *Moringa leaves* were collected from local areas of SVN colony, Guntur and those along with other ingredients were processed for further use. Different variations of ingredients were used to prepare biscuits. Those ratios were 90:10:0 as control, 70:20:10, 60:20:20, 50:20:30, 40:20:40 and 30:20:50 of Foxtail Millet, whole wheat flour and *Moringa* leaves respectively. Sensory evaluation was done by composite scoring test. The mean scores of sensory evaluation were subjected to Krushkal Walli H-Test. Results showed that the ratio of (Formula 1) 90:10:0 Foxtail Millet, whole wheat flour and *Moringa* leaves respectively gained highest score. It was considered as control sample. Among the *Moringa* incorporated biscuits, formula 2 with ratios of 70:20:10 Foxtail Millet, whole wheat flour and *Moringa* leaves respectively, gained highest acceptability which was on par with the control sample. Since formula 2 found to be highly acceptable in the biscuits prepared with 70:20:10 Foxtail Millet, whole wheat flour and *Moringa* leaves respectively, were considered for further studies relating physical properties, proximate compositionand mineral estimation. Cost of production was evaluated for most accepted biscuits formula 2. The cost was evaluated for standardized weights of ingredients for 100 g of biscuits. The price of 100g of the biscuits was approximately Rs. 30.00

Key Words: *Biscuits, Foxtail millet, Moringa leaves, Sensory evaluation and proximate composition,Whole wheat flour*

Foxtail millet (*Setaria italica*), is also termed as Italian millet and it is a type of minor millet. Foxtail millet is a member of the poaceae grass family and is one of the oldest crops. It is a valuable source of human food in Africa and Asia. China is the main producing country whereas India is the second largest producing country (Lingyan *et al.*, 2017). It plays a very important role in the agriculture and food of many developing countries because of its sustainability to grow under adverse heat and limited rainfall conditions (Vithal and Girish, 2006).

Foxtail millet is a good source of protein (12.3/ 100g), dietary fiber (14g/100g) and the carbohydrate content is low (60g/100g). Besides it is rich in minerals (3g/100g) and phytochemicals (Uma *et al.,* 2014). Foxtail millet is a good source of â-carotene (126191µg/100g) (Goudar *et al.,* 2011).

The physical properties including weight, bulk density, and grain density are 6.1 g, 477.1 kg/m3 and 12.4 g respectively and the volume was 1.6 ml (Balasubramanian and Viswanathan, 2009).

In Andhra Pradesh many varieties of Foxtail millet are grown. Those are Prasad, Krishnadevaraya, Narasinharaya, Sri Lakshmi, SIA- 3085, Surya Nandi, SIA- 3156.

Moringa is an everlasting tree and grows throughout most of the tropical regions. *Moringa* oleifera (drumstick tree), also known as 'mother's best friend' and commonly known as sajina or moonga in sub-tropical regions, is considered as the miracle tree due to its marvellous nutritional and medicinal values from ancient time (Sanjukta *et al.,* 2013). *Moringa* oleifera is the most widely cultivated species among the 13 known species of Moringaceae family, which is native to the sub-Himalayan part of North West India, which is now indigenous to many sub-tropical regions in Africa, tropical America, Sri Lanka, Mexico, Malaysia and the Philippines Islands etc. (Rathnayake *et al.,* 2015).

Every part of the drumstick tree is enriched with various ingredients that contribute to its magical health benefits. The leaves are round shaped with highly leafy flavour and slight bitter taste (Sanjukta *et al.,* 2013). These leaves are a storehouse of nutrients. They are rich in minerals like copper, potassium, iron, magnesium, zinc and calcium (Kasolo *et al.,* 2010), vitamins like beta-carotene, B vitamins such as folic acid, pyridoxine and nicotinic acid, vitamin C, D and E (Mbikay and Majambu, 2012). The dried *Moringa* leaves contained 27.2% of protein, 17.1% of fat, 5.9% of moisture and 38.6% of carbohydrates (Yameogo *et al.,* 2011).Hence the present study was carried out to estimate the nutritive composition of most accepted biscuits.

MATERIAL AND METHODS

Sample selection and Preparation

Sample of one variety of Foxtail millet (Surya Nandi) collected from Agricultural Research Station, Reddipalli, Anantapuramu District. The Foxtail millet was dehulled. The dehulled grains were cleaned in one lot and used for the study. Bulk samples of *Moringa leaves*, free from blemishes and damage, were procured from local areas of SVN colony, Guntur and used for the study.

Preparationof *Moringa* leaves powder

Blanching of *Moringa* leaves

Blanching of leaves is generally done to ensure a complete inactivation of enzymes responsible for oxidation (Mutiara *et al.,* 2012). In the present study *Moringa* leaves were blanchedby immersing in boiling water by the addition of 0.2% sodium bicarbonate at 100 °C for 5 minutes.

Drying of *Moringa* leaves using solar drier

The blanched *Moringa* leaves were dried in solar drier at about 35 ± 3°C for about 12 hours.

Preparation of *Moringa* leaves powder

Dried *Moringa* leaves wereground into fine powder using electric mixer

Development of biscuits using different recipe formulations

Different levels of ingredients were used to prepare biscuits. Those ratios were 90:10:0, 70:20:10, 60:20:20, 50:20:30, 40:20:40 and 30:20:50 of Foxtail Millet, whole wheat flour and *Moringa* leaves respectively. The formulations were mentioned in Table 1.

Table 1. Different formulations of recipes

S.No	Ingredients	Formulations					
		Formula 1	Formula 2	Formula 3	Formula 4	Formula 5	Formula 6
1	Foxtail millet flour (g)	90	70	60	50	40	30
2	Whole wheat flour (g)	10	20	20	20	20	20
3	*Moringa* leaves powder (g)	0	10	20	30	40	50
4	Butter(g)	50	50	50	50	50	50
5	Sugar (g)	50	50	50	50	50	50
6	Milk (mL)	As required	As required	As required	As required	As required	As required
7	Custard powder (g)	20	20	20	20	20	20
8	Baking powder (g)	1.25	1.25	1.25	1.25	1.25	1.25
9	Vanilla essence	Few drops	Few drops	Few drops	Few drops	Few drops	Few drops

Schematic representation of process optimisation for production of Foxtail millet and *Moringa leaves* powder biscuits

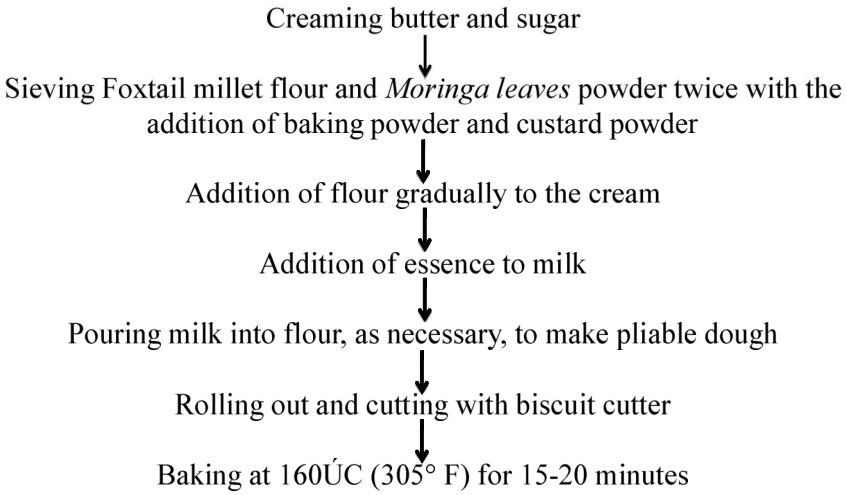

Figure 1. Schematic representation of biscuits making process

Organoleptic evaluation by using composite scoring test

Composite scoring is a type of rating scale. The specific characteristics of a product are rated separately. This method is helpful in grading products and comparison of quality attributes by indicating the faulty characteristics in a poor product. In the present study sensory evaluation of Foxtail millet and *Moringa* leaves biscuits was carried out by a panel of 20 semi trained judges from the Department of Foods and Nutrition, College of Home Science, Acharya N.G. Ranga Agricultural University, Guntur.

Statistical analysis

The analytical data will be tested using Krushkal Walli H-Test (One-Way analysis and Non-Parametric) (Gopal and Kanji 2006).

Physical properties of developed biscuits

Length of biscuits

The length of the biscuit was measured by using vernier callipers. The value was expressed as a means of 10 randomly selected biscuits.

Diameter of biscuits

Diameter of biscuits was measured by the method descried inAACC(2000) **.**To determine the diameter (D), six biscuits were placed edge to edge. The total diameter of the six biscuits was measured in mm by using a ruler. The biscuits were rotated at an angle of 90° for duplicate reading. This was repeated once more and average diameter was reported in millimetres (Hussain *et al.,* 2006).

Thickness of biscuits

Thickness of biscuits was measured by the method descried in AACC (2000), to determine the thickness (T), six biscuits were placed on top of one another. The total height was measured in millimetres with the help of ruler. This process was repeated thrice to get an average value and results were reported in mm (Hussain *et al*., 2006).

Spread factor of biscuits

Spread factor of biscuits was measured by the method descried in AACC (2000). It was determined from the diameter and thickness, with the help of following formula:

$$SF=\frac{D}{T}\times CF\times 10$$ CF is a correction factor (1.0) at constant atmospheric pressure (Hussain *et al.,* 2006).

Sample Analysis

The proximate analyses such as moisture, protein, carbohydrates, fat, energy, carbohydrates and ash were carried out in triplicates and mean values were reported. All the chemical analysis were estimated by using the standard methods of AOAC, 2006 (for energy and carbohydrates) AOAC, 2006 (moisture, protein, carbohydrates, fat, ash and for minerals).

Moisture content was determined by using dry oven method. Ash content was estimated by using Muffle furnace. Fat content was determined by using Soxhlet method. Protein content was estimated by using Micro Kjeldhal method. Energy was determined by Bomb Calorimeter. Carbohydrate content was analyzed by Anthrone method. Crude fibre content was determined by using alkali method. Minerals were estimated by Atomic Absorption Spectrophotometer. The proximate composition and mineral composition were mentioned in Table 2 and Table 3.

Table 2. Proximates composition of Foxtail millet and *Moringa* leaves biscuits

S.No.	Proximates	Formula 2 (70:20:10 ratios of Foxtail millet: whole wheat flour: Moringa leaves powder respectively) Composition- g/ 100g	% RDA attained per 100 g biscuits
1	Energy (kcal)	343	17
2	Carbohydrate (g)	59	20
3	Total protein (g)	7.5	12
4	Total fat (g)	4.8	24
5	Total dietary fiber (g)	21.4	53
6	Ash (%)	2.2	-
7	Moisture (%)	8.4	-

Table 3. Mineral composition of Foxtail millet and *Moringa* leaves biscuits

S.No.	Minerals	Formula 2(70:20:10 ratios of Foxtail millet: whole wheat flour: Moringa leaves powder respectively) Composition- mg/ 100g	% RDA attained per 100g
1	Calcium	72.4	12
2	Zinc	68.3	100
3	Iron	7.22	7.2
4	Magnesium	252	74
5	Potassium	452	12.9

RESULTS AND DISCUSSION

Standardization of biscuits was done. Different variations of ingredients were used to prepare biscuits. Those ratios were 90:10:0 as control, 70:20:10, 60:20:20, 50:20:30, 40:20:40 and 30:20:50 of Foxtail Millet, whole wheat flour and *Moringa* leaves respectively. Sensory evaluation was done by composite scoring test. This method is helpful in grading products and comparison of quality attributes by indicating the faulty characteristics in a poor product.

The mean scores of sensory evaluation were subjected to Krushkal Walli H-Test, which is a one-Way analysis and non-parametric test. A biscuit preference score is a combination of four to five components, viz. tastes, appearance, smell and texture. Each component had a minimum score is 0 and the maximum 20. Six biscuit formulations are compared using these scores by 20 panels of accredited tasters. The control ratio of Formula 1 (90:10:0 of Foxtail millet: whole wheat flour: *Moringa* leaves flour) gained highest acceptability when compared to other formulations. When compared with value addition of *Moringa* leaves formulations the Formula 2 (70:20:10 of Foxtail millet: whole wheat flour: *Moringa* leaves flour) gained highest acceptability with mean score of 18.18 and Formula 6 (70:20:10 of Foxtail millet: whole wheat flour: *Moringa* leaves flour) gained lowest overall acceptability with mean score of 11.1.

Physical characteristics were determined for both control biscuits formula 1 and the most accepted biscuits formula 2. The control biscuits had 46 mm of diameter, 8 mm of thickness and 57.5 of spread factor. The most accepted biscuits had11g of mass, 278mm of diameter, 48 mm of thickness and 57.9 of spread factor.

Proximate composition was evaluated for most accepted biscuits formula 2. It contains 343 kcal of energy, 59g of carbohydrate, 7.5 g of total protein, 4.8g of fat 21.4g of total dietary fiber, 2.2% of ash content and 8.4% of moisture content per 100g. Mineral composition was evaluated for most accepted biscuits formula 2. 100g of the biscuits contained72.4 mg of calcium, 68.3 mg of zinc, 7.22 mg of iron, 252 mg of magnesium and 452 mg of potassium per 100g.

CONCLUSION

The result obtained from the present study showed that if the ratio of *Moringa* leaves was increased, the dough hardness and fructurabilty were increased. It can be concluded that the biscuits made with millets and green leaves powder especially *Moringa* leaves possess the potential to enter in bakery sector.

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Received on 15.07.2019 and revised on 10.02.2020