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Utilization of *Moringa Oleifera* Leaves and *Hordeum Vulgare* in Wheat Biscuits

PreethiGanesan[1], SangeethaGandhi Sivasubramaniyan[2], BeulahChristy Israel[1], thirumoorthy Ramasubbu[1], SureshKanna Ganesan[1]

[1]*Student, Department of Food Technology, JCT College of Engineering and Technology, Coimbatore, India.*

[2]*Assistant Professor, Department of Food Technology, JCT College of Engineering and Technology, Coimbatore, India.*

Corresponding Author: preethiganeshan124189@gmail.com

Abstract: Biscuit is a baked food product which is made using flour as the main ingredient. Biscuits have soft and crumbly interior with browned crust. This study was conducted to improve the nutritional property of baked products especially biscuits by incorporating *Hordeum vulgare* (Barley) and *Moringa oleifera* (moringa) leave extract in wheat biscuits. Moringa leaves belongs to *Moringacea* family. Moringa have enormous potential for benefitting humanity. It is Rich in vitamin C and B6. Moringa leaves also contains high amount of calcium, phosphorus, antioxidants and iron. Barley is a rich source of nutrients including proteins, fibers and vitamin B6. Barley also has low Glycemic Index. Moringa leave extract and sprouted and dried barley flour are mixed with wheat flour at different compositions and baking powder, shortenings and palm sugar candy extract are also added and the dough is prepared. This dough is baked at 170°C for 25 minutes. The incorporation of moringa leaves extract and barley flour in wheat biscuits showed positive result in terms of enhanced nutrient content, taste, appearance, color and mouth feel. The incorporation of barley flour and moringa leave extract showed considerable changes in physiochemical properties and results in enhanced nutritional content.

Key Words:- ***Biscuits, Barley, Moringa oleifera, Nutrition, Wheat.***

I. INTRODUCTION

The bakery industry in India is one of the biggest fields in the food processing sectors. Bakery products are classified into three broad sections such as breads, biscuits and cakes. Biscuits are cheap and ready-to-eat baked food products that are consumed in many countries by peoples from all age group. Children are very fond of biscuits and cookies. It is made by blending flour, fat shortenings, sugars and water as basic ingredients [1-3]. Biscuits contains huge amount of non-calorie sugars which are when taken continuously causes obesity, diabetes etc. Biscuits, being a snack that is commonly consumed by people is made up of high calorie ingredients which when taken for too long may have a negative effect on consumer health [4]. While this Moringa leaves and barley incorporated biscuits will have a positive impact because of their higher nutrition content. Moringa leaves consist of enormous potential nutrient that benefit human health. These leaves are inexpensive, abundantly available still are under exploitation and are mostly discarded or go waste. Moringa leaves contains a diversity of flavanoids and phenolic acids, which have health enhancing effects and thus reduces the burden of non-communicable diseases [5]. It is a good source of vitamin A, B and C and minerals such as calcium and iron. It is also a good source of good cholesterol, high density lipoprotein which in high levels protect from cardiovascular disease. Moringa leaves have no toxic elements, so they are completely safe for consumption [6]. Moringa leaves are considered to be the most nutritious leaf. Moringa leaves promotes metabolism with bio-available ingredients and also promotes natural serum cholesterol and cell structure of the body. Moringa leaves acts as good antioxidant and takes care of the immune system of the body [7]. Barley is one of the most widely consumed grains all over the world. It is rich in fiber, molybdenum and manganese. It also contains good amounts of carbohydrate (65%), vitamins (2.2%), minerals (10%), protein (23.78%), fat (7.03%), antioxidant, phosphorus (2.3%), niacin, magnesium and copper. Soaking and sprouting inducesall the activities of the bio-component [2]. Barley contains soluble fibers vitamins β-glucan which reduces hunger and enhances feelings of fullness. Barley's high fiber content promotes a good balance of but bacteria which plays an important role in digestion. The β-glucanfound in have been shown to reduce badlow density lipoprotein(LDL) cholesterol by binding to bile acids [8]. Palm sugar candy is used instead of normal sugar because it contains more essential nutrients. It is some good nutrient rich, source of vitamin B, low glycemic index sweetener and

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rich in iron and phytonutrients including zinc and potassium [9]. The purpose of this study is to develop value added biscuits from moringa leaves, barley, wheat and palm sugar candies. This combination of ingredients will increase the nutrient value of the biscuits and also helps to gain the nutrient of moringa leaves easily and efficiently.

II. MATERIALS AND METHODS

Moringa leaves (Figure 1), wheat, barley, palm sugar candy (Figure 2), butter, baking powder and salt were purchased from local market. They were taken to the laboratory for processing. The entire process took place at department of Food Technology in JCT College of Engineering and Technology, Tamil Nadu, India.

Fig.1. Fresh moringa leaves and Leaf extract

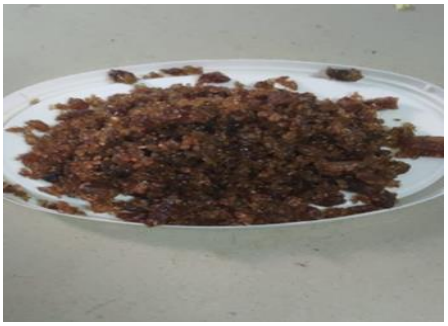

Fig.2. Palm sugar

Fig.3. Barley

A. Preparation of Moringa Leave Extract

Moringa leaves were purchased from the local market. They are cleaned well using distilled water and are separated from the stalks. Then they are diced into small pieces and grinded into a fine paste. Little water was added to it and the extract is separated using a filter press (Table 1) [10].

Table: 1 Nutritional content of fresh moringa leaves (per 100 gm)

Nutrients	Fresh leaves
Moisture(%)	75.9
Energy (kcal)	92
Protein(g)	6.7
Carbohydrates(g)	12.5
Fat(g)	1.7
Fibre(g)	0.9
Vitamin C (mg)	220
Beta carotene (µg)	6780
Iron(mg)	0.85
Calcium(mg)	440
Phosphorus(mg)	70

B. Preparation of Biscuits:

Wheat flour is blended with moringa leave extract and barley at various proportions. Other ingredients are carefully measured and mixed well with the flour mixture until required consistency is achieved. Kneading is done for 5 minutes to obtain a soft dough. Rolling pins were used to roll the dough and desired shapes were obtained using cookie cutter. They were baked at 170°C for 25 minutes, allowed to cool and packed well (Figure 3, 4).

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Fig.4. Dough before baking

Fig.5. Final Backed Product

Table: 2 Composition of ingredients

Ingredients	**T1**	**T2**	**T3**	**T4**	**T5**
Wheat flour (g)	100	90	80	70	60
Barley (g)	0	10	20	30	40
Moringa leaf extract (ml)	0	15	20	25	30
Fat (g)	15	20	20	20	20
Palm sugar (g)	25	35	35	35	35
Salt (g)	1	1	1	1	1

T1, T2, T3, T4 and T5 are Biscuits with different composition of ingredients.

C. Sensory Evaluation:

The sensory evaluation was performed by evaluating five major sensory attributes such as appearance, aroma, texture, taste and overall acceptability using nine-point hedonic scale. Twenty members including staffs and students from the department were used for this study.

D. Biochemical Physical Analysis:

The moisture content, crude protein, crude fiber, ash and fat contents of the biscuits where determined using various methods [[1]1,12].

Moisture Content:

Moisture analysis of the moringa biscuits were determined by weighing a known amount of sample in sample cups and then dried in hot air oven at 95°C to 105°C.

Ash Content:

Ash content was determined by using a muffle furnace. The samples were powdered first and were taken in a crucible and then burnt in muffle furnace and by using this technique the ash content of the biscuits were determined.

Nutrient Content:

Protein content of the biscuits was estimated by determining using Biuret method. It is low sensitivity method. The protein quantity is measured using spectrometer at 540 nm. Carbohydrate is estimated using Anthrone method [13]. Fat content in the produced biscuit is determined using Solvent extraction-gravimetric method. Vitamin C content in the biscuits was determined by using 2,6 dichloro indophenol method.

Physical Properties:

The weight (g), diameter(cm) and thickness(cm) of the five randomly selected biscuits were evaluated. The spread ratio of biscuits was obtained by dividing diameter (cm) of the biscuits by their thickness(cm).

III. RESULT AND DISCUSSION

The incorporation of moringa leaves and barley flour in wheat biscuits showed enhanced nutrition content, texture, color and flavor (Figures 3).

The sensory evaluation of the biscuits done and results are shown in Table 3 [12]. It is shown that biscuits have higher level of sensory properties in T3 sample.

Table.3. Sensory evaluation of wheat biscuits enriched with moringa leaves and barley

Samples	Appearance	Taste	Texture	Aroma	Overall acceptability
T1	8.15	7.85	8.0	8.20	8.05
T2	8.10	7.80	8.10	8.20	8.05
T3	8.10	7.95	8.25	8.10	8.10
T4	7.85	7.45	7.90	7.80	7.75
T5	7.60	7.30	7.65	7.55	7.52
Mean	7.96	7.67	7.98	7.97	7.89

The nutrient content of biscuits such as fat, protein, fiber, vitamin and the moisture content, ash content were determined using various standard methods and shown in Table 4. The analysis of these biscuits showed that the nutritional content of wheat biscuits enriched with moringa leaves and barley flour have more nutrition than the usual wheat biscuit (T1).

Table.4. Biochemical analysis of prepared biscuits

Parameters	T1	T2	T3	T4	T5
Moisture (%)	11.55	11.0	10.55	10.35	9.44
Protein (%)	13.45	14.76	16.87	19.55	20.85
Vitamin C (%)	0	5.6	8.8	11.2	14.1
Carbohydrate (%)	68.67	70.55	71.90	73.40	74.88
Fat (%)	1.70	1.98	2.30	2.67	3.17
Ash (%)	1.96	2.33	2.72	3.18	3.56

IV. CONCLUSION

The incorporation of barley flour and moringa leavesinto wheat biscuits formulation had considerable changes in physiochemical properties of the biscuits. It is concluded from the study that barley flour and moringa leaf extract can be successfully incorporated in biscuits to yield biscuits of enhanced nutritional quality with acceptable sensory attributes. Biscuits of acceptable

sensory attributes were produced of barley and moringa leave extract respectively. In developing countries like India it would be of economically important in enhancing/promoting the utilization of moringa leaves.

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