



## DEVELOPMENT OF PROCESS TECHNOLOGY MAKING OF RAGI MALT BISCUITS

S. P. Sonawane<sup>1</sup>, Thakor N. J.<sup>2</sup> and A. A. Sawant<sup>3</sup>

<sup>1</sup>Associate Professor, <sup>2</sup>Ex. Professor and Head, <sup>3</sup>Ph.D. Scholar & Assistant Professor,  
Dept. of APE, CAET, Dr. BSKKV, Dapoli, Dist. Ratnagiri

Received: 08/08/2017

Edited: 16/08/2017

Accepted: 21/08/2017

**Abstract:** Ragi (*Eleusine coracana*) or also known as 'Finger millet' is the major cereal crop after rice produced in Konkan region. Finger millet has good amount of tryptophan, cystine and methionine which are very crucial for human health and growth. It is also rich source of calcium, iron and phosphorus. Because of several economic and nutritional advantages of finger millet, this will be the best ingredients for bakery after wheat. Malt from finger millet can be used for making digestible baking and liquid foods. However scientific information on the use of finger millet in bakery product is not available. Therefore this investigation was proposed to make biscuits based on finger millet malt flour, rava (semolina) and refined wheat flour (maida). Different combinations of finger millet flour, rava and maida were used to make the ragi malt biscuits. Biscuits prepared using malted finger millet (70%) with rava (15%) and maida (15%) was having acceptability for texture, flavour (first rank) and colour (second rank) in organoleptic evaluation. It is therefore recommended to make finger millet biscuits of high energy value and good acceptability to the consumer using finger millet malt, rava and maida in proportion of 70:15:15.

**Key words:** Ragi, Malt biscuits, processing.

### Introduction

Finger millet (*Eleusine coracana*) or ragi is the major cereal crop after rice produced in Konkan region. Because of several economic and nutritional advantages of finger millet, This will be the best ingredients for bakery industry after wheat. However scientific information on the use of finger millet in bakery product is not available.

The composition of finger millet is, proteins 7.3%, fat 1.3%, carbohydrate 72%, crude fiber 3.6% and minerals 2.7% with calcium 344 mg/100gm (Gopalan *et al.* 1971). It is one of the richest sources of calcium, which is about 10 fold higher as compared to other food grains. In view of its better nutritional quality and relatively cheaper than wheat, it is proposed to make biscuits based on finger millet malt flour, rava (semolina) and refined wheat flour (maida).

### Material & Methods

The important engineering properties of finger millet (Variety : *Dapoli -1*) were measured as these are important from the point of view of designing of various machineries for processing, milling, drying, storage, conveying and storage structures of finger millet. This basic data will be used in future for further studies.

Also computer programme was developed to determine the thermal properties of finger millet (Thermal conductivity, Thermal diffusivity and specific heat) using the values of constituents such as carbohydrates, protein fat, ash and moisture content of the grain. Using this programme thermal properties of finger millet were determined. The properties of finger millet measured were as shown in Table No.1.

**Table No. 1: Physical properties of Finger millet (Variety: *Dapoli -1*)**

Sr. No.	Physical Properties of Finger millet	Average Value
1.	Shape of grain	Spherical
2.	Colour	Brown
3.	1000 kernel weight (g)	2.9
4.	Length (L) ,mm	1.63

5.	Breadth (B), mm	1.56
6.	Thickness (T), mm	1.42
7.	Geometric mean diameter (D), mm	1.53
8.	Sphericity (D/L)	0.94
9.	Bulk Density, kg/m <sup>3</sup>	778.13
10.	True Density, kg/m <sup>3</sup>	1250.00
11.	Porosity, %	37.70
12.	Terminal Velocity, m/s	2.4
13.	Thermal Conductivity, W m <sup>-1</sup> °C	310
14.	Thermal Diffusivity, m <sup>2</sup> /sec	1.04 x 10 <sup>-7</sup>
15.	Specific heat, KW °C	1.95 x 10 <sup>5</sup>

**Malting**

Malting is a controlled germination process which activates the enzymes of the resting grain resulting in the conversion of cereal starch to fermentable sugars, partial hydrolysis of cereal proteins and other macromolecules. Normally malt means barley malt. Other cereal grains are also used for malting such as Finger millet (*Ragi*) and Jowar. High portion of malt is used for preparation of Brewing and manufacture of distilled liquor whereas small portion of malt is for - Manufacture of industrial alcohol

Other uses of malt are in preparation of Bakery products and candies, breakfast cereals, infant foods, malted milk concentrate, pharmaceutical preparations, textile desizing etc.

**Finger millet Malt**

Finger millet is malted and the flour of the malted grain is used as a nourishing food for infants since malting releases the amylase which dextrinise the grain starch. Malted finger millet flour is also called as ragi malt (*Nachani Sattva*) and is used in the preparation of milk beverages.

**Formulation of Finger millet malt Biscuits and its quality evaluation**

There were about twelve treatments (combination of 30 %, 50%, 70 % and 90 % malt and 20, 30 and 40 minute baking time) used for study. During this study baking temperature kept

constant and malt percentage & baking time was varied.

**Treatments details:**

- Malt – 4 levels (30 %, 50%, 70 % and 90 %)
- Baking duration – 3 levels (20, 30 and 40 minute)
- Baking Temperature – 150 °C

Maida (Refined wheat flour), rawa, sugar powder, vegetable oil, baking powder *etc* were procured from Dapoli local market. Malt was made from finger millet grain through the process of germination.

The pre cleaned ragi were washed thoroughly and soaked in excess water for 24 hrs. The soaked seeds were spread over clean cloth about 10 mm thick bed to germinate for 48 hrs. The sprouts were sun dried to 12 % moisture and roots were removed from sprouts with gentle brushing by hand and finally aspired off. Thus malt was prepared from finger millet grains. Then biscuits were prepared as per the treatments of the experiment using this malt.

Sensory evaluation of biscuits prepared using finger millet malt was carried out to decide the malt percentage and baking time combination. It was performed through the panel of 11 random judges. The test was performed for texture, colour and flavour of biscuit through score from 1 to 9. The results of sensory evaluation were as shown in Table No.2.

**Table No. 2: Sensory evaluation of Finger millet biscuit for its acceptability (Year -2004-05)**

Treatment	Colour	Flavour	Texture	Overall Acceptability
T1	6.55	5.91	6.45	18.91
T2	6.27	6.36	6.36	18.99
T3	6.55	6.09	6.55	19.19

T4	7.00	6.27	6.73	20
T5	6.82	6.55	6.73	20.1
T6	7.00	7.00	7.27	21.27
T7	7.27	7.00	6.73	21
T8	6.64	7.27	6.45	20.36
<b>T9</b>	<b>7.36</b>	<b>7.82</b>	<b>7.36</b>	<b>22.54</b>
T10	6.82	7.18	7.09	21.09
T11	6.91	7.00	7.27	21.18
T12	6.82	7.45	6.55	20.82

Considering the aspects of colour (7.36), flavour (7.82) and texture (7.36) treatment T9 with 70 % malt and 40 minute baking time at 150<sup>0</sup>C was acceptable to the consumers.

It was suggested by Research Review Committee of university to compare the quality of developed finger millet biscuits with the quality of finger millet (*nagli*) biscuits available in the market. Accordingly experiment was performed.

**Comparison of developed finger millet biscuit with commercial biscuit:** Finger millet biscuits

were prepared using malt of both brown and white Finger millet varieties. Quality of finger millet malt biscuit prepared was compared with the finger millet biscuit available in the market and sensory evaluation was performed through the panel of 10 random judges. The test was performed for texture, colour and flavour of biscuit through score from 1 to 10. Score 1 out of 10 indicates extremely dislike and score 10 out of 10 indicates most like. Overall acceptability for the sample is given based on score out of 30.

**Table No. 3: Sensory evaluation of Finger millet biscuit (Subjective test)**

No.	Quality Attributes	Sample A	Sample B	Sample C
1	Colour	7.29	7.93	7.29
2	Texture	7.43	7.64	7.57
3	Flavour	7.00	7.14	7.21
4	Overall Acceptability	21.71	22.71	22.07

Sample A-Developed Finger Millet Malt Biscuits (Brown)

Sample B-Developed Finger Millet Malt Biscuits (White)

Sample C- Finger Millet Biscuits available in the market (Finger millet flour)

Comparison was made with the biscuits available in the market which is made from finger millet flour and not the malt as mentioned on the label. More over it was having many other ingredients in order to add flavor and aroma. Overall acceptability of developed Finger Millet Malt Biscuits (White) was higher than the commercial Finger

Millet Biscuits and developed Finger Millet Malt Biscuits (Brown).

**Measurement of colour by objective test**

Colour of finger millet malt biscuit prepared and finger millet biscuit available in the market was measured using Hunter colorimeter. The results of the colour comparison of biscuits were as shown in Table No. 4.

**Table No. 4: Colour values of Finger millet biscuits**

No.	Colour Component	Developed Finger millet malt biscuits		Finger millet biscuits available in the market
		Brown	White	
1	Average L value (darker to Lighter)	30.53	54.81	30.99
2	Average a value (Red to Green)	8.34	5.60	8.29
3	Average b value (Yellow to Blue)	11.16	16.50	10.93

The colour of developed Finger Millet Malt Biscuits (White) was lighter, slightly yellower and light reddish than the commercial Finger Millet Biscuits and developed Finger Millet Malt Biscuits (Brown).

**Nutritional composition of Finger millet (*ragi*) malt biscuits:** The finger millet malt biscuits developed were evaluated for nutritional properties and also nutritional properties of finger millet biscuits available in the market indicated on their label were tabulated as follows.

**Table No. 5: Nutritional composition of developed finger millet of biscuits with commercial biscuits**

No.	Particulars	Finger millet biscuits available in the market ( <i>M/s Jabagirdar, Nashik</i> )	Finger millet malt biscuits (DBSKKV)
1.	Protein content, g/100g	7.60	5.0
2.	Fat, g/100g	14.60	20.0
3.	Dietary Fiber, g/100g	1.98	3.9
4.	Carbohydrate, g/100g	74.18	71.1
5.	Energy, cal/100g	459	640
6.	Calcium, mg/100g	168	264
7	Iron, mg/100g	1.98	2.18

In practice people are consuming gluco biscuits using wheat flour as major ingredient. Hence nutritional values of the developed finger millet biscuit were also compared with Parle G Gluco biscuits for energy status. The average energy of finger millet malt biscuit developed, finger millet malt biscuit and Parle G Gluco biscuits available in the market were 641, 459 and 453 Calories / 100g respectively.

**Conclusions:**

Based on experimentation of the developed finger millet malt biscuits and comparison with available finger millet biscuits in the market specific conclusions were drawn as follows:

1. Biscuits can be made from finger millet malt.
2. Finger millet malt biscuit has 50 % higher energy value than the commercial available finger millet biscuits.
3. Biscuits prepared using malted finger millet (70%) with rava (15%) and maida (15%) was having acceptability for texture, flavour (first rank) and colour (second rank) in organoleptic evaluation.
4. Sensory evaluation revealed that biscuits prepared from white finger millet malt has relatively more overall acceptability than commercial finger millet biscuit and brown finger millet malt biscuits.

**References:**

Akubor, P.I. and J.E. Obeigbuna. 1999. Chemical and functional properties of ungerminated and germinated millet flour, *Journal of Food Science and Technology*, CFTRI, Mysore, Vol.36, pp 241-243.

Anonymous, 1996. *Lost Crops of Africa: Volume 1- Grains*, Board on science and Technology for International Development (BOSTID), National Research Council, National Academy Press, Washington, D.C. USA.

Anu, Sehgal S., and Kawatra A. 2007. Use of pearl millet and green gram flours in biscuits and their sensory and nutritional quality. *Journal of Food Science and Technology*, CFTRI, Mysore, Vol.44 (5), pp 536-538.

Desikachar, H.S.R. 1998. Development of weaning foods with high calorie Density and low hot paste viscosity using traditional technologies, *Post Harvest Conservation Food*, CFTRI Mysore.

Lovis L.J. 2003 Alternatives to wheat flour in baked goods. *Cereal Food World* 48 : PP 61-63.

Malleshi, N.G. 2001. Nutritional qualities of millets and Pseudo cereals. In: *Course material of short term course on Processing and value addition to millets and Pseudo cereals*, Nov. 2001, CFTRI Mysore, PP: 17- 26.

Patil R.T. and L.K.Sinha 2002 *Post Harvest Technology of Nutricereals*, Papers presented in XXXVI Annual Convention of ISAE, IIT Kharagpur.

Seetharam A. 1997. *Waiting for Incentives*, *The Hindu survey of Indian Agriculture*, Pp 55-59.