IJFANS
International Journal of Food And Nutritional Sciences

Volume 4, Issue 5, Oct-Jan 2015, www.ijfans.com e-ISSN: 2320-7876

INTERNATIONAL JOURNAL OF FOOD AND NUTRITIONAL SCIENCES

IMPACT FACTOR ~ 1.021

Official Journal of IIFANS

INTERNATIONAL JOURNAL OF FOOD AND NUTRITIONAL SCIENCES

e-ISSN 2320 –7876 *www.ijfans.com*
Vol.4, Iss.5, Oct-Dec, 2015

Research Paper *Open Access*

DEVELOPMENT OF MULTIGRAIN PRODUCT (MUFFINS)

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Received on: 20h November, 2015 **Accepted on: 21st December, 2015**

ABSTRACT

In the present investigation attempts have been made to develop nutrient rich Multigrain Muffins by the addition of optimized proportion of Soybean, Ragi and Maize flour with various processed techniques (Soaking and Germination) and drying techniques (Sundry, Roasted and Oven dry) on the grains with other ingredients. The raw flour by combination of Soybean, Ragi and Maize by different ratio (50:20:30), (40:20:40) and (30:20:50) of Muffins was prepared with other ingredients & got higher sensory score of (30:20:50) ratio of flour's Muffins. By this ratio of Muffins consider as control and made experimental Muffins from this ratio by different processed flours and get higher score of Sundry flours' Muffins & it got higher nutritional value such as Protein, Carbohydrate, Energy, Moisture, Calcium and Phosphorus with highly significant and significant difference of this Muffin. The experimental Muffins were evaluated by nutritional, sensory, physical and texture profile analysis. These Muffins are being most preferred by consumers.

Key words: Proceed multigrain soybean, ragi, maize flour, value addition Muffins, sensory, Nutritional, physical, texture analysis

INTRODUCTION

Muffins are a type of semi –sweet cake or quick bread that is baked in appropriate portion. They are similar to cupcakes, although they are usually less sweet and lack in icing. Savory varieties, such cornbread muffins or cheese muffins also exist. The term also refers to disk-shaped muffin bread, called an English muffin outside the United Kingdom. As American style muffins are also available in commonwealth countries, the term muffins either refer to product, with the context usually making clear which is meant. There are many varieties such as low- fat and flavors of muffin mace with a specific ingredient such as blueberries, chocolate chips, raspberry, cinnamon, pumpkin, date, nut, lemon, banana, orange, peach, strawberry, almond, and carrot, baked into the muffin. Muffins are also eaten for breakfast alternatively they may be served for tea or at other meals (English muffin-kitchen dictionary –food.com).

Ragi (*Elesinecorocana*) is also known as „finger millet" which is popular millet in India consumed without dehulling. Ragi which is cultivated in Africa and wide range in India. Millets can be cultivated in wide range of soils and climates and because of their short growing seasons. It is rich in protein, fiber, minerals viz. iron, calcium, phosphorus, and vitamin content. Traditionally Ragi is processed by germination. There is also overall improvement in flavor profile of ragi during germination process (Kulkarni S.S., et al., 2012).

Soybean (*Glycine max*) seed is one of the largest sources of vegetable seed oil and protein. The feed and food industry which contain about 40% crude proteins and 20% oil. It is source of calcium, iron, carotene and ascorbic acid. Soy protein isolate (SPI) is commercial soy protein product at least 90% protein (dry basis) which has been widely applied in food industry as an important ingredient due to its nutritional value, desirable functional properties and low cost. Traditionally processing method of soybeans such as germination, soaking and dehulling are sometimes used to reduce or eliminate the ANFs that affect protein utilization (Dipika A.M.*et al.*, 2013).

Corn, commonly known as maize (Zea mays L.), is annual crop that belongs to the family of grass i.e. Poaceae. Maize is also recognized by different synonyms such as zea, corn, silk corn etc. In Hindi it is called Makka and Bara jovar. Maize is mother grain of Americans and is considered as the earliest cultivar of the new world. It is most widely distributed world"s plant. Maize is a crop having short life cycle and requires warm weather (Dilipkumar *et al.*, 2013). Maize provides many health benefits due to the presence of quality nutrients like rich source of vitamins A, B, E and many minerals. Its high fiber content ensures that it plays a significant role in the prevention of digestive ailments like constipation and hemorrhoids as well as colorectal cancer.

Soaking is one of the methods used to improve the nutritional value of raw materials in the manufacturing

of food product. During soaking the process of fermentation also occur simultaneously on the starch containing involving several species of bacteria which includes lactobacillus planetarium, Candida crusei and lactobacillus Delbruck. Soaking also leads to break down several components into simpler compounds which alter the texture, flavour, aroma, and taste (Narshil *et al.*, 2012).

Germination/sprouting/malting is a biochemical process which involves transition of a seed from dormant state to vital active state. It is a simple technique that has been reported to improve the nutritive value of foods. Several studies on the effect of germination on legumes have found that germination can increase protein content and dietary fiber; reduce tannin and phytic acid content and increase mineral bioavailability. Germination is reported to be associated with increase of vitamin concentrations and bioavailability of trace elements and mineral found that germination improves calcium, copper, manganese, zinc, riboflavin, niacin and ascorbic acid content. In cereal grains, germination increase oligosaccharides and amino acids concentration as observed in barley, wheat, oat and rice. Since germination is cheap and more effective in improving nutritional value it was incorporated in mixes to contribute to the nutrition of people (Dipika A.M *et al.*, 2012).

Sundry (without drying equipment) is the most widely practice agricultural processing operation in the word, more than 25,000,000 tones off ruts and grains are dried by solar energy per annum. In some countries, food are simply laid out in fields or on roofs or other flat surface and turned regularly until dry. Both solar & sun drying are simple inexpensive technologies in terms of both capital input and operating costs. Energy input and skilled labors are no required and in sun drying, very large amounts of crops can be dried at low cost.

Oven drying is the simplest way to dry food because you need almost no special equipment. It is also faster than sun drying or using a food dryer. But oven drying can be used only on a small scale. An ordinary kitchen oven can hold only 4 to 6 pounds of food at home. It is important to keep the oven temperature at 104˚f to 160˚ f(60˚C to 70˚C). So put an oven thermometer on the top tray about half way back where you can see it easily. Check the temperature about every half hour.

Roasting is known to increase their antioxidant activity. Thus, owing to numerous nutritional and functional advantages of these ingredients, they were used to formulate three different types of multi- nutrient mixes (Dipika A. M *et al.*, 2013).

The current study will focus on development of multigrain muffins. The nutritional, physical, texture and sensory evaluation of these muffins will also be carried out.

MATERIALS AND METHODS

The present investigation was undertaken of product development of multigrain muffins followed by different processing flour.

COLLECTTION OF MATERIALS

The ingredients for development of multigrain muffins viz ., soybeans, ragi, maize, butter, refined sugar, milk, baking powder, baking soda, salt, and vanilla extract ,the standard brands were purchased from local market of Anand, Gujarat.

STANDARDIZATION MULTIGRAIN PRODUCT

PREPARATION OF MUFFINS

Using the processing techniques (Soaking, Germination) and drying techniques (Sun drying, Roasting, Oven drying) of flours such as soybean, ragi and corn prepared and also using all the ingredients were prepared for muffins in different ratios (Table 1).

Table - 1_Different ratio's flours for preparation of Muffins

Flours	Ratios %		
CORN	30	40	50
RAGI	20	20	20
SOYBEAN	50	40	30
TOTAL	100	100	100

LECTION OF EXPERIMENTAL PRODUCT

Primary standard selection was done at different ratio (50:20:30, 40:20:40, 30:20:50) followed by untreated flours such as soybean, ragi, and Maize. After the sensory analysis (30:20:50) level was preferred with higher sensory score and final composition of control experimental product is as followed (Table-2).

Secondary standard selection was done at (30:20:50) using each of sun drying, roasted and oven-drying flours. After sensory analysis (30:20:50) of sun-drying was preferred with higher sensory score and final composition of experimental product (Table-3).

Table -2_Composition of Control Muffins (gm % W/W)

Ingredients (gm)	Total	Control Row flour's Muffin Ratio		
		A-50:20:30	B-40:20:40	C-30:20:50
Soybeans	50:40:30	50(15.29)	40(12.23)	30(9.17)
Ragi	20:20:20	20(6.11)	20(6.11)	20(6.11)
Maize	30:40:50	30(9.17)	40(12.23)	50(15.29)
Butter		40(12.23)	40(12.23)	40(12.23)
Refined sugar		60(18.34)	60(18.34)	60(18.34)
Milk		125(38.22)	125(38.22)	125(38.22)
Baking powder		1(0.30)	1(0.30)	1(0.30)
Baking soda		1(0.30)	1(0.30)	1(0.30)
Salt		Pinch	Pinch	Pinch
Vanilla extract		3-4 drops	3-4 drops	3-4 drops
Total		327(100)	327(100)	327(100)

Table: 3 Compositions of Experimental Muffins (gm % w/w)

Experimental Muffins Processed and dried flour's Muffin (30:20:50) Soybean: Ragi: Maize				
Ingredients (gm)	**M_0**	**M_1**	**M_2**	**M_3**
Soybeans	30(9.17)	30(9.17)	30(9.17)	30(9.17)
Ragi	20(6.11)	20(6.11)	20(6.11)	20(6.11)
Maize	50(15.29)	50(15.29)	50(15.29)	50(15.29)
Butter	40(12.23)	40(12.23)	40(12.23)	40(12.23)
Refined sugar	60(18.34)	60(18.34)	60(18.34)	60(18.34)
Milk	125(38.22)	125(38.22)	125(38.22)	125(38.22)
Baking powder	1(0.30)	1(0.30)	1(0.30)	1(0.30)
Baking soda	1(0.30)	1(0.30)	1(0.30)	1(0.30)
Salt	Pinch	Pinch	Pinch	Pinch
Vanilla extract	3-4 drops	3-4 drops	3-4 drops	3-4 drops
Total	327(100)	327(100)	327(100)	327(100)

Control Muffin M_0: Raw flour Muffin ratio of (30:20:50) soybean: Ragi: Maize, M_1: Sundry flour's Muffin M_2: Roasted flour's Muffin M_3: Oven dry flour's Muffin

PROCEDURE OF PRODUCT

From locally available ingredient is used i.e. soybean, ragi and corn in different ratios sieve the flours, baking powder, baking soda. Cream the butter & refined sugar by creaming method till it become smooth batter, then add flours and milk alternately, then add 2-3 drops vanilla extract and make smooth batter by continuous beating and bake for 20-30 mins at 180˚c until the muffins have been risen and are golden brown, carefully take the muffins out of the tin and allow to cool on cooling tray.

SENSORY EVALUATIONS

In this study, 20 untrained members from the Smt. K.P.Patel College were selected randomly. All the selected panelist were asked to evaluated different Muffins and all the essential quality attributes were needed to be score by each panel member. Different sensory attributes such as visual and organoleptic attributes like color, texture, flavor, taste, after taste, absence of defect, sponginess and over all acceptability. Among all the sensory characteristics of Muffins were given score 10. This minimum score was (zero) while the maximum score was (ten) the test was done to assess each attribute for all the products. The development sensory score card was presented to the panelist for the sensory evaluation of Muffins. Each panelist had to given score from 10 according to their judgment.

PHYSICAL ANALYSIS

1) **Diameter:** For the determination of diameter 6 Muffins were placed edge to edge. The total diameter of the 6 Muffins was measured in mm by using a ruler. The Muffins were rested at an angle of 90˚C for duplicate reading. These were repeated once more and average diameter was reported in millimeters (AACC, 2000).
2) **Thickness**: To determine the thickness of 6 Muffins were placed on top of one another. The total height was measured in millimeters with a ruler. The measurement was repeated thrice to get an average value and results were reported in mm (AACC, 2000).
3) **Density:** It is calculated by W/D^2 and expressed as kg/m^2 by following common technique known as the three point break, breaking strength and factorability of Muffin were measured (Gaines, 1991).

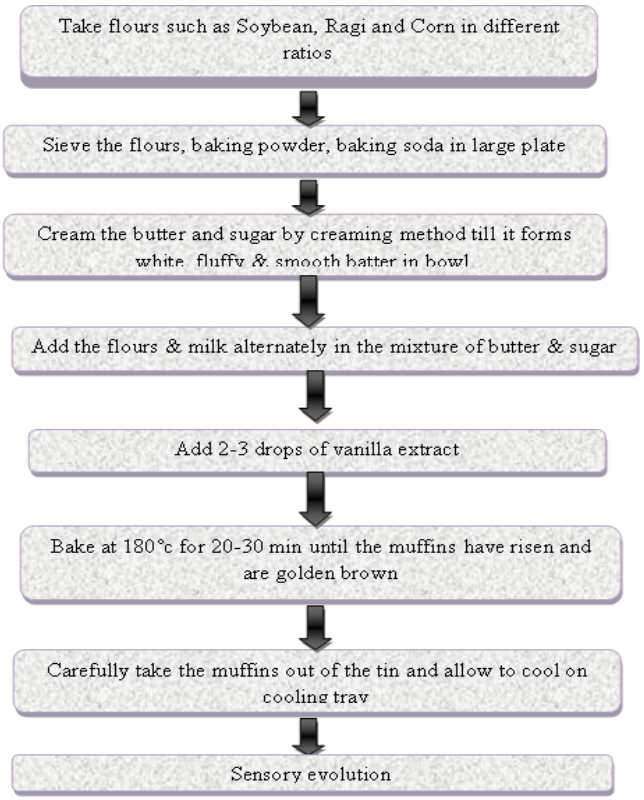

Fig – 1 Preparation of Muffins

Control Muffin: M_0

M_1

M_2

M_3

Fig: 2 Experimental Muffins

TEXTURE PROFILE ANALYSIS

TPA of muffins was carried out at room temperature using a TA-XT2 Texture Analyzer (Stable Micro Systems Ltd, Surrey, England, UK). Cubes of 2.5 cm were cut out of the centre of the muffins using a sharp knife. The cubes were evaluated by compressing twice to 50% their original height with a cross-head speed of 5.0 mm s–1 and a time of 5 s between compressions. Textural variables from force and area measurements were hardness = peak force (g) during the first compression cycle; cohesiveness = ratio of the positive force area during the second compression to that during the first compression; springiness = height that the sample recovers during the time that elapses between the end of the first bite and the start of the second bite (cm) and chewiness = hardness X cohesiveness X springiness (g cm). Three muffins from each formulation were used to evaluate textural parameters.

NUTRITIONAL ANALYSIS

The Ash, moisture and fat content was determined by AOAC 1990. Energy was calculated by using this formula Energy (Kcal) = (CHO gm% × 4) + (Total Fat % × 9) + (Protein gm% × 4) of factorial method of (AOAC 1995). CHO was estimated by B.I.S 1656 – 1997 method. Protein was estimated by the method given by Khjeldhal method in 1965.Calcium was estimated by the titrimetric method of Clark and Collip (1925). Phosphorus was estimated by the method of Fiske and subbarow (1925). Iron was estimated by Ramsay (1951).

STATISTICAL ANALYSIS

Statistical analysis of the data was carried out using single factor One-way Analysis of Variance (ANOVA) (M.S office excel) to determine the acceptability of the type of Muffin. The significance level of $p \leq 0.01$ & $p \leq 0.05$ and F value were considered.

RESULTS AND DISCUSSION

The prepared Multigrain Muffin at different ratio i.e. (50:20:30), (40:20:40) and (30:20:50) of Soybean: Ragi: Maize. Then selected the (30:20:50) of Soybean: Ragi: Maize flour's Muffin by sensory evaluation and after that prepared processing and drying techniques flour's Muffin i.e sundry flour's Muffin, Roasted flour's Muffin and Oven dry flour's Muffin were evaluated by Sensory evolution then selected Sundry flour's Muffin and analyzed the Nutritional and physical parameter of Control and Experimental Muffins. For Nutritional analysis i.e. Ash, Fat, Protein, Moisture CHO, Energy, Iron, Calcium and Phosphorus and for Physical parameter i.e Texture analysis, Thickness and Diameter.

In table-4 the mean value of Ash, Protein, Fat, Moisture, CHO, Energy, Iron, Calcium and Phosphorus contain in Control and Experimental Muffins were summarized.

The Ash content of Control Muffin $M_0$was 2.29±0.28 gm% whereas Experimental Muffins M_1 (1.87±0.23 gm %), M_2 (1.946±0.41 gm %) and M_3 (1.706±0.29 gm %). There was non significant difference observed in M0, M1, M2 and M3.

The Protein, Fat and Moisture content of M0 was 6.986±0.48 gm%, 11.088±0.87 gm%, and 33±1 gm% whereas in Experimental Muffins M1 (7.966±0.64 gm %), (15.593±0.62 gm %) and (22±2.64 gm %) in M2 (4.746±0.42 gm %), (15.703±0.15 gm %) and (31±3.60 gm %) M3 (4.886±0.24 gm %), (15.591±15.59 gm %) and (22±3.46 gm %) respectively. There was highly significant difference observed in M0, M1, M2 and M3.

The Carbohydrate and Energy content of Control Muffin M0 was 46.631 ±1.81 gm% and 314.265±2.047Kcal whereas Experimental Muffins M1 (55.901±3.61 gm %) and (395.809±9.667Kcal), in M2 (46.621±4.35 g and %) and (346.798±16.037Kcal) and in M3 (55.811±3.16 gm %) and (383.114±13.046Kcal) respectively. There was highly significant difference observed in M0, M1, M2 and M3.

The Iron and Phosphorus content of M0 was 4.032±0.60 mg% and 187.816±2.11 mg% whereas Experimental Muffins M1 (2.15±0.41 mg%) and

(161.248±9.49 mg%), in M2 (-0.067±0.11 mg%) and (146.608±2.43 mg%) and in M3 (-1.612±0.34 mg%) and (174.421±2.29 mg%) respectively. There was highly significant difference observed in M0, M1, M2 and M3.

The calcium content of M0 was 386.5±8.66mg% and 187.816±2.11 mg % whereas Experimental Muffins M1 (344±031.22 mg %), in M2 (321.5±22.91 mg %) and in M3 (339±0.75 mg %) and (174.421±2.29 mg %) respectively. There was significant difference observed in M0, M1, M2 and M3.

"The proximate composition results for *YCP* were 5.73% moisture, 1.28% fat, 21.17% protein, 7.60% ash, 64.22% carbohydrate and 38.73% total dietary fiber (*TDF*). Fresh young corn contained between 88 and 90% moisture" (Anis et al, 2014)

"The highest moisture content was in the soymilk muffin (34.2%), and the lowest was the flaxseed and soymilk muffin (31.6%). The average moisture content was 33.0%. The highest protein was found in the soymilk muffin (6.42%), and the lowest was in the flaxseed muffin (5.92%). The average protein content in the blue berry muffins was 6.12%. The overall ash content for all muffins was 1.62%.The flaxseed and soymilk muffin showed the highest ash content(1.65%) while the control and flaxseed muffins were the lowest (1.60%).The lipid content was highest, (14.4%) for the control muffin and lowest for the flaxseed and soymilk muffin (10.7%)"**(**Kerrie L et al., 2012).

"During the present research no significant difference was found in the moisture content and total carbohydrates for the three gluten-free muffins (T1-T3). The moisture content of the gluten-free muffin ranged between 20.19% and 31.64%. The moisture content of the muffins increased with the increase of the soy flour" (Simona M *et, al*., 2014).

"Moisture contents of *YCP* muffins were recorded between 28.15 and 30.44% while control had 25.23%. Similar finding related to increasing moisture content was also reported in peach dietary fiber muffin" (Grigelmo *et al.*, 1999).

"Mean protein content of *YCP* muffin significantly differed from control, where the values were increased from 6.77 to 9.94% and 6.73 to 7.93%, respectively and in line with the level of *YCP* used" (Anis Jauharah et al, 2014) "No significant difference was found in the moisture content and total carbohydrates for the three gluten-free muffins (T1- T3). The moisture content of the gluten-free muffins ranged between 20.19% and 31.64%" (Simona M *et.,al* 2014).

Table: 4- Mean value of Ash, Protein, Fat, Moisture, CHO, Energy, Iron, Calcium and Phosphorus content in control and experimental Muffins

MUFFINS									
Sample	**Ash (gm %)**	**Protein (gm %)**	**Fat (gm %)**	**Moisture (gm %)**	**CHO (gm %)**	**Energy (Kcal)**	**Iron (mg %)**	**Calcium (mg %)**	**Phosphorus (mg %)**
M_0	2.29 ±0.28	6.986 ±0.48	11.088 ±0.87	33 ±1	46.631 ±1.81	314.265 ±2.047	4.032 ±0.60	386.5 ±8.66	187.816 ±2.11
M_1	1.87 ±0.23	7.966 ±0.64	15.593 ±0.62	22 ±2.64	55.901 ±3.61	395.809 ±9.667	2.15 ±0.41	344 ±31.22	161.248 ±9.49
M_2	1.946 ±0.41	4.746 ±0.42	15.703 ±0.15	31 ±3.60	46.621 ±4.35	346.798 ±16.037	-0.067 ±0.11	321.5 ±22.91	146.608 ±2.43
M_3	1.706 ±0.29	4.886 ±0.24	15.591 ±15.59	22 ±3.46	55.811 ±3.16	383.114 ±13.046	-1.612 ±0.34	339 ±7.5	174.421 ±2.29
F-value	1.83672	34.3111	42.2659	12.36364	7.51560	31.1002	108.754	5.5938	35.3629
Significance	Ns	Hs	Hs	Hs	Hs	Hs	Hs	S	Hs

Mean value of four observation ± S.D, Value of sharing a common super script within a column is significantly different S = Significant difference *P<= 0.05; Hs = highly significant difference **P<= 0.01; Ns = Non significant difference >= 0.05

Fig 3.The mean value of sensory Attributes are summarizing in different ratio of Soybean, Ragi and Maize Muffin. Multigrain Muffins i.e used of different ratio of (50:20:30), (40:20:40) and (30:20:50) Sundry: Ragi: Maize flours that selected by sensory evaluation ratio of (30: 20: 50) Soybean, Ragi and Maize were analyzed for sensory characteristics. Sensory quality characteristics were evaluated by panel of 10 untrained members using composite scoring test. The Muffins were evaluated for their color, texture, taste, sponginess, flavor, mouth feel, after taste, absence of defect and over all acceptability. The mean value was analyzed using analysis of variance (ANOVA) method.

In the Sensory attributes Color score of the Sample-A ratio (50:20:30) of Soybean: Ragi: Maize Muffin was 8±0.91whereas for the sample B (40:20:40) Soybean: Ragi: Maize Muffin and Sample-C (30:20:50) Soybean: Ragi: Maize Muffin the score were7.8±1.13 and 8.75±1.03 respectively. In these which show sample B (40:20:40) Soybean: Ragi: Maize Muffin and Sample-C (30:20:50) Soybean: Ragi: Maize Muffin was non significant difference compared to the-A ratio (50:20:30) of Soybean: Ragi: Maize Muffin.

In the Sensory attributes Sponginess score of the Sample-A ratio (50:20:30) of Soybean: Ragi: Maize Muffin was7.75±1.27 whereas for the sample B (40:20:40) Soybean: Ragi: Maize Muffin and Sample-C (30:20:50) Soybean: Ragi: Maize Muffin the score were8.05±0.89and8.55±1.06respectively. In these which show sample B (40:20:40) Soybean: Ragi: Maize Muffin and Sample-C (30:20:50) Soybean: Ragi: Maize Muffin was non significant difference compared to the-A ratio (50:20:30) of Soybean: Ragi: Maize Muffin.

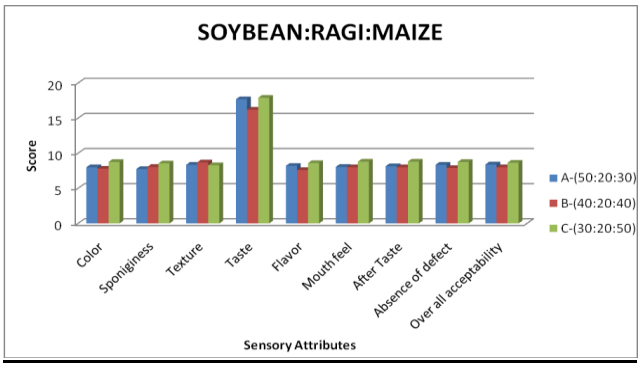

Fig: 3 Mean value of Sensory scores of Row flour Muffins at different ratio of Soybean, Ragi and Maize

In the Sensory attributes Texture score of the Sample-A ratio (50:20:30) of Soybean: Ragi: Maize Muffin was8.35±1.37whereas for the sample B (40:20:40) Soybean: Ragi: Maize Muffin and Sample-C (30:20:50) Soybean: Ragi: Maize Muffin the score were8.7±2.71and 8.3±0.94respectively. In these which show sample B (40:20:40) Soybean: Ragi: Maize Muffin and Sample-C (30:20:50) Soybean: Ragi: Maize Muffin was non significant difference compared to the-A ratio (50:20:30) of Soybean: Ragi: Maize Muffin.

In the Sensory attributes Taste score of the Sample-A ratio (50:20:30) of Soybean: Ragi: Maize Muffin was17.7±1.47whereas for the sample B (40:20:40) Soybean: Ragi: Maize Muffin and Sample-C (30:20:50) Soybean: Ragi: Maize Muffin the score were16.2±3.82 and 17.9±1.59 respectively. In these which shows sample B (40:20:40) Soybean: Ragi: Maize Muffin and Sample-C (30:20:50) Soybean: Ragi: Maize Muffin was non significant difference compared to the-A ratio (50:20:30) of Soybean: Ragi: Maize Muffin.

In the Sensory attributes Flavor score of the Sample-A ratio (50:20:30) of Soybean: Ragi: Maize Muffin was8.2±1.54whereas for the sample B (40:20:40) Soybean: Ragi: Maize Muffin and Sample-C (30:20:50) Soybean: Ragi: Maize Muffin the score were7.6±1.074 and 8.6±1.17respectively. In these which show sample B (40:20:40) Soybean: Ragi: Maize Muffin and Sample-C (30:20:50) Soybean: Ragi: Maize Muffin was non significant difference compared to the-A ratio (50:20:30) of Soybean: Ragi: Maize Muffin.

In the Sensory attributes Mouth feel score of the Sample-A ratio (50:20:30) of Soybean: Ragi: Maize Muffin was8.05±1.46whereas for the sample B (40:20:40) Soybean: Ragi: Maize Muffin and Sample-C (30:20:50) Soybean: Ragi: Maize Muffin the score were8±1.28 and 8.8±1.17 respectively. In these which show sample B (40:20:40) Soybean: Ragi: Maize Muffin and Sample-C (30:20:50) Soybean: Ragi: Maize Muffin was non significant difference compared to the-A ratio (50:20:30) of Soybean: Ragi: Maize Muffin.

In the Sensory attributes After Taste score of the Sample-A ratio (50:20:30) of Soybean: Ragi: Maize Muffin was 8.05±1.56 whereas for the sample B (40:20:40) Soybean: Ragi: Maize Muffin and Sample-C (30:20:50) Soybean: Ragi: Maize Muffin the score were8±1.24 and 8.8±1.05 respectively. In these which show sample B (40:20:40) Soybean: Ragi: Maize Muffin and Sample-C (30:20:50) Soybean: Ragi: Maize Muffin was non significant difference compared to the-A ratio (50:20:30) of Soybean: Ragi: Maize Muffin.

In the Sensory attributes Absence of defect score of the Sample-A ratio (50:20:30) of Soybean: Ragi: Maize Muffin was 8±0.91whereas for the sample B (40:20:40) Soybean: Ragi: Maize Muffin and Sample-C (30:20:50) Soybean: Ragi: Maize Muffin the score were7.8±1.13 and 8.75±1.03 respectively. In these which shows sample B (40:20:40) Soybean: Ragi: Maize Muffin and Sample-C (30:20:50) Soybean: Ragi: Maize Muffin was non significant difference compared to the-A ratio (50:20:30) of Soybean: Ragi: Maize Muffin.

In the Sensory attributes Over all acceptability score of the Sample-A ratio (50:20:30) of Soybean: Ragi: Maize Muffin was 8.4±1.57 whereas for the sample B (40:20:40) Soybean: Ragi: Maize Muffin and Sample-C (30:20:50) Soybean: Ragi: Maize Muffin the score were8±1.49 and 8.65±1.24 respectively. In these which shows sample B (40:20:40) Soybean: Ragi: Maize Muffin and Sample-C (30:20:50) Soybean: Ragi: Maize Muffin was non significant difference compared to the-A ratio (50:20:30) of Soybean: Ragi: Maize Muffin.

The mean value of sensory Attributes are summarizing in different ratio of Experimental Muffin (Fig 4). Multigrain Muffins i.e Control and Experimental Muffins by using different processed (Soaking and Germination) and drying techniques (Sundry, Ragi and Oven dry) of flours by 1 ratio that selected by sensory evaluation of ratio of (30: 20: 50) Soybean, Ragi and Maize were analyzed for sensory characteristics. Sensory quality characteristics were evaluated by panel of 10 untrained members using composite scoring test. The Muffins were evaluated for their color, texture, taste, sponginess, flavor, mouth feel, after taste, absence of defect and over all acceptability.

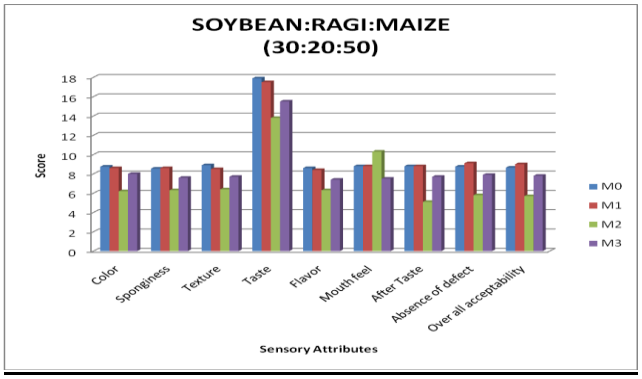

Fig: 4 Mean Value of Sensory scores of Control and Experimental Muffins of different processing flours

In this phase the systematic sensory evaluation of standard product was carried out one Ratio that was selected by previous sensory evolution which was different processed experimental products compared with control product of product by panel of 10 judges. The composite scoring test was conducted.

In the Sensory attributes Color score of the Control Muffin M_0 was 8.75±1.03 whereas for Experimental Muffin M_1, M_2, M_3, the score were 8.6±0.60, 6.3±1.05 and 8±1.15 respectively. In these which show M_0, M_1, M_2 and M_3 was highly significant difference.

In the Sensory attributes Sponginess score of the Control Muffin M_0 was 8.5±1.06 whereas for Experimental Muffin M_1, M_2, M_3, the score were 8.6.±0.84, 6.3±1.05 and 7.6±1.26 respectively. In these which show M_0, M_1, M_2 and M_3 was highly significant difference.

In the Sensory attributes Texture score of the Control Muffin M_0 was 8.3±0.94 whereas for Experimental Muffin M_1, M_2, M_3, the score were 8.5±0.70, 6.4±1.26 and 7.7±1.41 respectively. In these which show M_0, M_1, M_2 and $M_3$was highly significant difference.

In the Sensory attributes Taste score of the Control Muffin M_0 was 17.9±1.59 whereas for, Experimental Muffin M_1, M_2, M_3, the score were 17.5±1.58, 13.8±1.61 and 15.5±1.84 respectively. In these which show M_0, M_1, M_2 and M_3 was highly significant difference.

In the sensory attributes Flavor score of the Control Muffin $M_0$was 8.6±1.17 whereas for experimental muffin M_1, M_2, M_3, the score were 8.4±0.96, 6.3±1.15 and 7.4±1.34 respectively. In these which show M_0, M_1, M_2 and $M_3$was significant difference.

In the Sensory attributes Mouth feel score of the Control Muffin $M_0$was 8.8±1.03 whereas for Experimental MuffinM_1, M_2, M_3, the score were8.8±1.03, 10.3±15.75 and 7.5±1.17 respectively. In these which show M_0, M_1, M_2 and $M_3$was non significant difference.

In the Sensory attributes After Taste score of the Control Muffin M_0 was 8.8±1.03 whereas for Experimental Muffin M_1, M_2, M_3, the score were 8.8±0.78, 5.1±1.28 and 7.7±0.94 respectively. In these which show M_0, M_1, M_2 and $M_3$was highly significant difference.

In the Sensory attributes Absence of defect score of the Control Muffin M0 was 8.75±1.03 whereas for Experimental MuffinM_1, M_2, M_3, the score were9.1±0.87, 5.8±1.75 and 7.9±1.37 respectively. In these which show M_0, M_1, M_2 and M_3 was highly significant difference.

In the Sensory attributes Overall acceptability score of the Control Muffin M_0 was 8.65±1.24 whereas for Experimental Muffin M_1, M_2, M_3, the score were 9±0.94, 5.7±1.41 and 7.8±1.13 respectively. In these which show M_0, M_1, M_2 and M_3 was highly significant difference.

Table 5-The value of Texture profile are summarize in different ratio of Experimental Muffin. The Texture profile analysis was analyzed in the test was conducted using TX.XT Plus Texture Analyzer (Stable Micro Systems Ltd., Surrey, *UK*) in A.D Patel institute of technology in Anand.

In the Texture attributes Cohesiveness of the Control Muffin M_0 was 0.179814 whereas for Experimental Muffins M_1, M_2, M_3, there were 0.275099, 0.189039 and 0.342935776 respectively.

In the Texture attributes Springiness of the Control Muffin was M_0 3.687363 mm whereas for Experimental MuffinsM_1, M_2, M_3, the score were 5.964125mm, 3.052705mm and 5.031582771mm respectively.

In the Texture attributes Springiness Index of the Control Muffin M_0 was 0.306454 whereas for Experimental Muffins M_1, M_2, M_3, there were 0.495813, 0.371241 and 0.698770207 respectively.

In the Texture attributes Gumminess of the Control Muffin M_0 was 0.032356kgf whereas for Experimental Muffins M_1, M_2, M_3, there were 0.068258kgf, 0.089861kgf and 0.12447191kgf respectively.

In the Texture attributes Chewiness of the Control Muffin $M_0$was 0.11931kgf.mm whereas for Experimental MuffinsM_1, M_2, M_3there were0.407101 kgf.mm and 0.62629072 kgf.mm respectively.

In the Texture attributes Fracture Force of the Control Muffin M_0 was 0.010821kgf whereas for Experimental Muffins M_1, M_2, M_3, there were 0.011267kgf, 0.014513kgf and 0.012050043kgf respectively.

In the Texture attributes Adhesive Force of the Control Muffin M_0 was 0.017606kgf whereas for Sundry flour's Muffin, Roasted flour's Muffin and Oven dry flour's Muffin, there were 0.024486kgf, 0.037179kgf and 0.003850687kgf respectively.

In the Texture attributes Adhesiveness of the Control Muffin was 0.011058 kgf.mm whereas for Experimental Muffins M_1, M_2, M_3, there were 0.022148kgf, 0.017835kgf and -0.001232669kgf respectively.

In the Texture attributes Stiffness of the Control Muffin M_0 was 0.023175kgf/mm whereas for Experimental Muffins M_1, M_2, M_3, the score were 0.023594kgf/mm, 0.081202kgf/mm and 0.064863142kgf/mm respectively.

"Instrumental analysis of muffin textural properties was performed to record hardness, springiness, cohesiveness, resilience and chewiness. The soft inner portion of muffin was evaluated. Each muffin was cut into 2.5 cm sided cube, where the upper and lower crusts were eliminated. A 75 mm diameter aluminum plate (P/75) was used for compression. The test was performed under the following states: Test speed: 1 mm/s; strain: 50% and trigger force: 5 g. Muffin cube was compressed twice to obtain the four primary texture parameters (hardness, springiness, cohesiveness and resilience). Chewiness, the only secondary texture parameter, was calculated as the product of hardness × cohesiveness × springiness. (Anis *et al*, 2014).

EXPERIMENTAL MUFFINS OF DIFFERENT PROCESSING FLOUR
SOYBEAN: RAGI: CORN (30:20:50)

M0: Control Muffin M1: Sundry flour's Muffin
M2: Roasted flour's Muffin M3 : Oven dry flour's Muffin

Table 6 and Fig 5 a, b, c, d - The value of Texture profile are summarizing in different ratio of Experimental Muffin. The Texture profile analysis was analyzed in the test was conducted using TX.XT Plus Texture Analyzer

(Stable Micro Systems Ltd., Surrey, *UK*) in A.D Patel institute of technology in Anand. In the Texture attributes Sample Heigh tof the Control Muffin $M_0$was 24 mm whereas for Experimental MuffinsM_1, M_2, M_3, there were 24 mm, 16 mm and 14 mm respectively. In the Texture attributes Hardness1of the Control Muffin M_0 was 0.179943kgfwhereas for Experimental MuffinsM_1, M_2, M_3, there were 0.248123kgf, 0.248123kgf and 0.362959829kgf respectively. In the Texture attributes Hardness2 of the Control Muffin $M_0$was 0.362959829kgf whereas for Experimental Muffins M_1, M_2, M_3, there were0.217365kgf, 0.390501kgf and 0.313242635kgf respectively. In the Texture attributes Area1of the Control Muffin was $M_0$1.022619 kgf.mm whereas for Experimental MuffinsM_1, M_2, M_3, there were 1.244168 kgf.mm, 1.908272 kgf.mm and 0.924967406 kgf.mm respectively. In the Texture attributesArea2of the Control Muffin was $M_0$0.183881 kgf.mm whereas for Experimental MuffinsM_1, M_2, M_3, there were0.34227 kgf.mm, 0.360737 kgf.mm and 0.317204415 kgf.mm respectively.

Table 5: Texture profile analysis of Control and Experimental Muffins of different processing flours

Texture Attributes	Control and Experimental Muffins (Soybean :Ragi: Maize (30:20:50))			
	M_0	M_1	M_2	M_3
Cohesiveness	0.179814	0.275099	0.189039	0.342935776
Springiness (mm)	3.687363	5.964125	3.052705	5.031582771
Springiness Index	0.306454	0.495813	0.371241	0.698770207
Gumminess (kgf)	0.032356	0.068258	0.089861	0.12447191
Chewiness (kgf.mm)	0.11931	0.407101	0.27432	0.62629072
Fracture Force (kgf)	0.010821	0.011267	0.014513	0.012050043
Adhesive Force (kgf)	0.017606	0.024486	0.037179	0.003850687
Adhesiveness (kgf.mm)	0.011058	0.022148	0.017835	-0.001232669
Stiffness (kgf/mm)	0.023175	0.023594	0.081202	0.064863142

Table 6 Texture profile analysis of Control and Experimental Muffins of different processing flours

Control and Experimental Muffins (Soybean : Ragi: Maize (30:20:50))				
Texture Attributes	**M_0**	**M_1**	**M_2**	**M_3**
Sample Height (mm)	24	24	16	14
Hardness1 (kgf)	0.179943	0.248123	0.47536	0.362959829
Hardness 2(kgf)	0.362959829	0.217365	0.390501	0.313242635
Area1 (kgf.mm)	1.022619	1.244168	1.908272	0.924967406
Area 2(kgf.mm)	0.183881	0.34227	0.360737	0.317204415

Table 7 -The values of physical parameter was summarizing in different ratio of Soybean, Ragi and Maize Muffin. In the physical parameter 1 pc wt of the Sample-A ratio (50:20:30) of Soybean: Ragi: Maize Muffin was 31.6 g whereas for the sample B (40:20:40) Soybean: Ragi: Maize Muffin and Sample-C (30:20:50) Soybean: Ragi: Maize Muffin, the value was 31.6 g and 29.9 g respectively. In the physical parameter Diameter of the Sample-A ratio (50:20:30) of Soybean: Ragi: Maize Muffin was 7.10whereas for the sample B (40:20:40) Soybean: Ragi: Maize Muffin and Sample-C (30:20:50) Soybean: Ragi: Maize Muffin, the value was 7.60 and 7.10 respectively. In the physical parameter Thickness of the Sample-A ratio (50:20:30) of Soybean: Ragi: Maize Muffin was 20.84whereas for the sample B (40:20:40) Soybean: Ragi: Maize Muffin and Sample-C (30:20:50) Soybean: Ragi: Maize Muffin, the value was 19.10 and 19.10 respectively. In the physical parameter Density of the Sample-A ratio (50:20:30) of Soybean: Ragi: Maize Muffin was 0.626(kg/m^2) whereas for the sample B (40:20:40) Soybean: Ragi: Maize Muffin and Sample-C (30:20:50) Soybean: Ragi: Maize Muffin he value was 0.491(kg/m^2) and0.593 (kg/m^2) respectively.

RATIO OF FLOURS THAT ARE USED FOR ROW FLOUR'S MUFFINS

SOYBEAN: RAGI: CORN A (50 :20 :30), B (40 :20 :40), C (30 :20 :50)

Table 8 - The value of physical parameter was summarizing in Control and Experimental Muffin. In the physical parameter 1 pc wt value of the Control Muffin $M_0$29.9 g was whereas for Experimental MuffinM_1, M_2, M_3, the value were30.5 g, 33.6 g and 27.5 g respectively. In the physical parameter Diameter value of the Control Muffin M_0 7.10 was whereas for Experimental MuffinM_1, M_2, M_3, the value were7.10, 7.10 and 7 respectively. In the physical parameter Thickness value of the Control Muffin $M_0$was 19.60 whereas for Experimental MuffinM_1, M_2, M_3, the value were19.60, 19.84 and 19.70 respectively. In the physical parameter Density value of the Control Muffin $M_0$was 0.593 (kg/m^2) whereas for Experimental MuffinM_1, M_2, M_3, the value were0.605 (kg/m^2), 0.665 (kg/m^2) and 0.561 (kg/m^2) respectively.

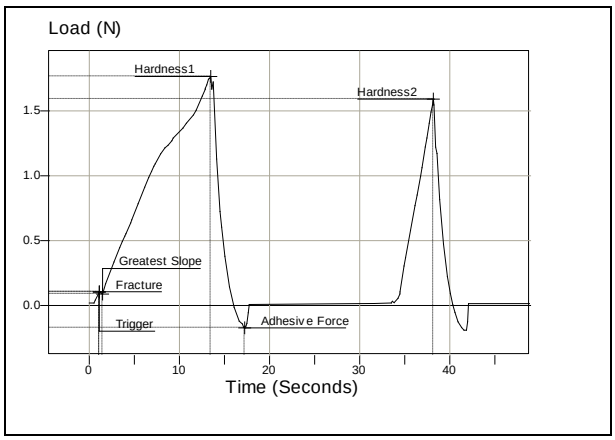

Fig5(a) CONTROL MUFFIN: M_0

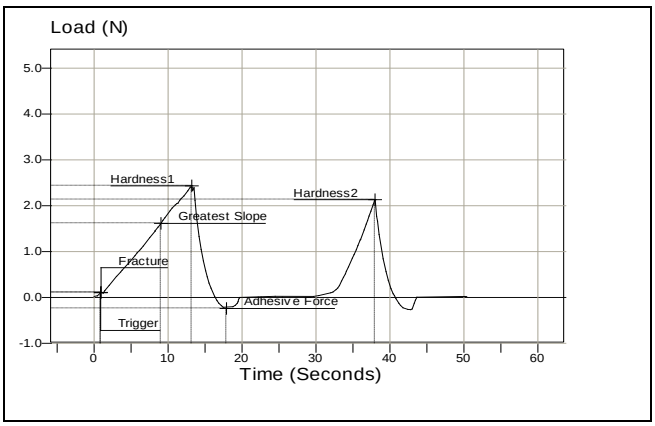

Fig5(b) SUNDRY FLOUR'S MUFFIN M_1

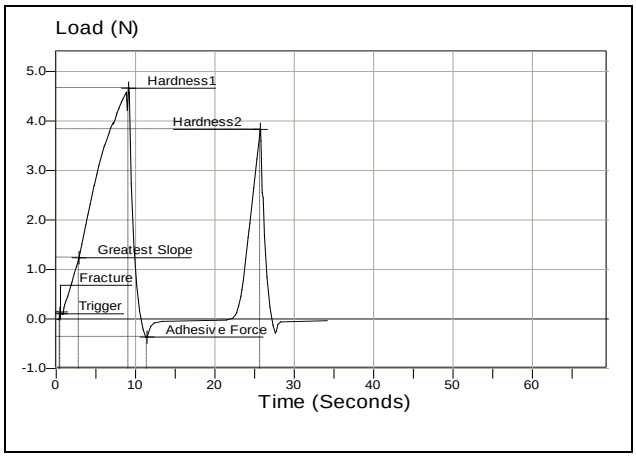

Fig5(c) ROASTED FLOUR'S MUFFIN: M_2

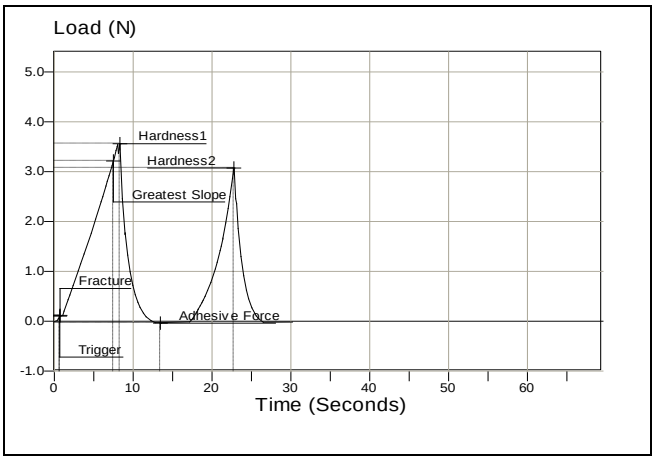

Fig5(d) OVEN DRY FLOUR'S MUFFIN: M_3

Table: 7 Physical parameter in raw flour Muffins

Control raw flour Muffins by different ratio of flour (Soybean: Ragi: Maize)			
Physical diameter	**A**	**B**	**C**
1 pc wt (g)	31.6	31.6	29.9
Diameter	7.10	7.60	7.10
Thickness	20.84	19.10	19.10
Density (kg/m^2)	0.626	0.491	0.593

EXPERIMENTAL MUFFINS OF DIFFERENT PROCESSING FLOUR

Table: 8 Physical Parameter of Control and Experimental Muffins

Control and Experimental Muffins (SOYBEAN:RAGI:CORN) (30 : 20 : 50)				
Physical diameter	**M_0**	**M_1**	**M_2**	**M_3**
1 pc wt (g)	29.9	30.5	33.6	27.5
Diameter	7.10	7.10	7.10	7
Thickness	19.60	19.60	19.84	19.70
Density (kg/m^2)	0.593	0.605	0.665	0.561

SOYBEAN: RAGI: CORN (30:20:50)

- M_0 : Control Muffin
- M_1 : Sundry flour's Muffin
- M_2 : Roasted flour's Muffins
- M_3 : Oven dry flour's Muffin

CONCLUSION

This research concluded that sundry flour's Muffins contain higher Nutritional value such as Ash, Protein, Fat, Moisture, Iron, Calcium and Phosphorus compared to other flour's Muffins. In the sensory evaluation .The sundry flour formations for the Muffin has the better overall consumer acceptability compared to roasted or oven dry flour's muffins, which has the lowest overall consumer acceptability because of the bitter taste or texture. Sundry flour formulated Muffins are the softest Muffins and most acceptable Muffin formulations in terms

of overall consumer acceptability. The sundry Muffins have also higher value in texture and physical analysis.

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