

Formulation and Optimisation of Nutrient Rich Multigrain Gluten Free Muffins from Soybean, Rice, Flaxseed and Corn Flour

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Abstract- The Concept of Multigrain gluten free muffin comes due to change in life style and gluten intolerance people. Common grains included in multigrain foods include Soya, rice, corn and flaxseed. For preparation of muffins Rice flour, Soya flour, Corn flour and flaxseeds were used along with Butter, Sugar, eggs, dry fruits, muffin cups, milk, Vanilla extract and Cocoa powder. Muffins are prepared according to standard recipes. For optimisation of product Design Expert Software 9.0 was used. As depended variables different combinations were used. The independent variables were Texture Profile Analysis, Chemical analysis and sensory analysis. Sensory evaluation was conducted on 9 point hedonic scale for attributes like colour, taste, texture, appearance, and overall acceptability. It was found that, all the blends of flours (rice, corn, soy, flaxseed) and had improved both nutritional and sensory qualities of gluten-free muffins. From the use of eggs and soybean extract, a larger amount of protein is originated. It was found that gluten free flours combinations could be used to produce good quality muffins with acceptable physical and sensory qualities.

Key Words: - Muffins, Multigrain, Optimisation of product, New product Development.

I. INTRODUCTION

Muffin is an individual sized baked product. It can refer to two distinct items, a part-raised flatbread and a cupcake-like quick bread. The term muffins regularly allude to a singular measured quick bread item which could be sweet or exquisite. A high quality muffin is described by Halliday and Noble (1946) as follows: To be good, muffin should be very light, so light in fact that when one picks them up one is surprised that anything of their size should weigh so little. The outside should be baked to a golden brown shade; should be symmetrical in shape, with no tendency to form peaks or knobs at the top; and should have a somewhat pebbled, rather than a smooth and even surface. The inside should show round holes of fairly uniform size but should have none of the long, narrow ones sometimes called "tunnels". The Concept of Multigrain gluten free muffin comes due to change in life style and gluten intolerance people. Multigrain refers to a food that contains more than one type of grain. Common grains included in multigrain foods include Soya, rice, corn and flaxseed. Since a growing number of people are suffering from celiac disease, the use of gluten-free products is increasing and thereby need gluten-free diet. The aim of the present work was to test rice flour, Corn flour with the addition of soybean and flaxseed flour for the development of gluten-free muffins targeting a good sensory acceptance and good nutritional value and also shelf life of multigrain gluten free products to facilitate commercialization.

II. MATERIALS AND METHODS:

Raw materials :

- (i) Dry ingredient: Rice flour, Soya flour, Corn flour and flaxseeds
- (ii) Wet ingredient: Butter, Sugar, eggs, dry fruits, muffin cups and milk
- (iii) Vanilla extract and Cocoa powder

Formulation of Muffin Sample:

Sr. No.	Ingredients	(%/w/w)
1.	Flour (Rice, Soya, Corn and flaxseeds flour)	25
2.	Eggs	20
3.	Sugar	25
4.	Butter	20
5.	Yoghurt	5
6.	Baking Powder	0.3
7.	Baking Soda	0.3
8.	Dry Fruits	4.4

Muffin Preparation Process:

1. Pre-heat oven at 170^oC.
2. Weighing of all ingredients.
3. Combine both Dry (Soya Flour, Corn Flour, Rice Flour, Flaxseed Flour) and Wet (Eggs, Butter, Sugar) ingredients in a bowl.
4. Mix well up to all lumps disappears from the batter because improper mixing has a direct effect on baked product.

5. Pour this batter in baking cups.
6. Once the batter is mixed, put the muffins in the preheated oven right away. Batters that use baking powder and baking soda need to be baked immediately so the leavening power is not lost.
7. Grease the baking cups on the bottom of moulds.
8. Baking time and Temperature
 - a. Treat and Richards (1966) and Peckham (1969) recommended baking muffins between 400^o F to 425^o F. In experiments by Briant and Klosterman (1950), Matthews et al. (1965) and Peckham(1969) a temperature of 425^o F was used to produce excellent muffins.
 - b. Baking time of muffins varies from 20 to 25 min and will depend upon the size of the muffin cuos and on the ingredients used (Peckham, 1969). Matthews (1965) baked muffins for 20 min while Briant and Klosterman (1950) baked them foe 22 min. Treat and Richardsd (1966) suggested 20 to 25 min of baking time but suggested as much as 30 min baking time for certain muffin variations.
9. To store muffins, cool completely place them in a plastic bag seal and store at room temperature.
10. Muffin has been cooled prior to wrapping or packaging. This allows the structure to “set” and reduces the formation of moisture condensation within the package. Condensed moisture creates an undesirable medium that promotes bacterial growth and spoilage.

Different Variations for optimization of multigrain muffin:

Run	Component 1 A: Rice Flour(RF)	Component 2 B: Corn Flour(CF)	Component 3 C: Soya Flour(SF)	Component 4 D: Flaxseed Flour(FS)	Total
1	5.075111	4.924889	10	5	25
2	4.777184	10	5.222816	5	25
3	7.048456	10	5.625047	2.326497	25
4	10	10	3.908868	1.091132	25

SENSORY METHODOLOGIES USED TO EVALUATE MUFFIN:

Evaluation method used for Sensory Evaluation was 9 point Hedonic scale. Muffins were rated for external and internal characteristics and eating quality. The characteristics taken into account for sensory evaluation were colour, taste, texture, appearance and overall acceptability.

Each panel member tested one muffin from each sample. Muffins were selected randomly and tested immediately after being removed from the oven. Evaluation Sheet, pen, knife, glass of water was provided to the panellists

TEXTURE ANALYSIS:

Texture profile analysis (TPA) was done with the help of Texture Analyzer. During TPA the test samples were compressed twice using a texture analyzer to get an insight that how sample behave when chewed.

Parameters of measurement for TPA are: Hardness(H), Cohesiveness(C), Springiness(S), Gumminess(G), and Chewiness(Ch)

Shelf Life Study:

Shelf life studies were carried out after every 24 hours of intervals i.e. 0, 24, 48, and 72 hours by keeping muffins at room temperature. During these intervals, muffins were evaluated for sensory characteristics and mineral analysis.

Nutritional Analysis:

-Estimation of moisture content: Standard method (AOAC ,1996) for moisture content determination.

$$\text{Moisture \%} = \frac{(W1-W2)}{W1} * 100$$

W1-W

-Estimation of protein: Kjeldhal method was used for the estimation of protein.

-Fat Analysis: Fat analysis was done with Soxhlet Appratus
 - Ash Content (AOAC, 1996) : Ash content was determined by direct gravimetric method (AOAC, 1996) that includes ashing of the samples in an oven at 550^oC until constant weight was attained.

- Estimation of Dietary Fibre Content: (AOAC 2000; method 985.29)

$$\text{Calculations: \%Total dietary fibre} = \frac{(\text{weight residue-protein-ash-blank})}{\text{Weight of residue}} * 100$$

III. RESULT AND DISCUSSION:

Quality of muffin depends mainly on the quality of its batter’s physical properties. Batter viscosity is an important physical property as it is closely related to the final quality of a baked product. A good quality muffin should be a uniformly aerated baked product.

Sensory evaluation of gluten-free muffins.

20 samples of the gluten free muffins were analysed which was obtained by Design Expert Software 9.0 and among those 20 samples formulation with maximum desirability is chosen as the optimized formulation of multigrain gluten free muffins. Sensory analysis was carried out by using untrained panellists to measure sensory characteristics like senses of sight, smell, taste, touch and acceptability of food product. Mean score for sensory evaluation of muffins given in table:

Treatments	Colour	Texture	Taste	Flavour	Overall Acceptability
Sample 1	8	7.9	8	8	7.975
Sample 2	7.9	8	7.8	7.6	7.825
Sample 3	7.8	7.2	7.3	7.1	7.35
Sample 4	6.2	6.4	7.3	7.5	6.85

With increasing level of flour soy the colour of muffins turned from light brown to dark brown, leading to higher acceptance. It may be due to the non enzymatic reaction (Maillard reaction) between reducing sugar molecules and lysine protein. Mean score of taste increased from 6.25 to 8, while the texture increased from 6.3 to 7.9 in case of high level of soy flour.

The decrease in overall acceptability was due to decrease in texture, flavour, and taste score. Sample having formulation ratio RF: SF: CF: FS (10:4.9:5.07:5) got the highest scores for the sensory attributes than other treatment.

Chemical Analysis of Gluten free muffins:

During the present research no significant difference was found in the moisture content for the gluten-free muffins the moisture content of the gluten-free muffins ranged between 20.19% and 31.64%, due to the fact that soy flour and rice flour absorb higher quantity of water. A high level of moisture content may be indicate short shelf life of composite muffins as they encourage microbial growth leads to spoilage.

The protein content and fat content of the gluten -free muffins is high in which soy flour is 10%. The protein content ranged from 7.12% to 9.06% and the fat content varied from 13.25% to 15.06% while the protein content of controlled muffin ranges from 6.48% to 8.68% and the fat content varied from 12.75% to 14.31%.

From the analysis of the gluten-free muffin, it is verified that the muffin developed in this project work presented greater quantities of protein and fat. A larger amount of protein is originated from the use of eggs and soybean extract.

OPTIMIZATION OF THE PRODUCT

The Optimized formulations are as follows:

Optimized solution using Design Expert Software 9.0

No.	rice flour	soya flour	corn flour	flaxseed flour	Desirability
1	5.075111	4.924889	10	5	1
2	4.777184	10	5.222816	5	1
3	7.048456	10	5.625047	2.326497	1
4	10	10	3.908868	1.091132	1

Out of the 20 stated formulations, the formulation with maximum desirability is chosen as the optimized formulation of multigrain gluten free muffins.

IV. CONCLUSION

The present dissertation report “Development of multigrain gluten free muffin” was carried out in Food Science & Technology Department, National Institute of Food Technology Entrepreneurship & Management, Kundli, Haryana. Five experiments were performed taking into

account, four independent variables viz., rice flour, corn flour, soya flour, flaxseed flour. Responses were examined for various characteristics of texture (hardness, springiness, gumminess, and chewiness), protein, fat and sensory attributes of muffin. The Data was analyzed by using Design Expert Software 9.0. Responses obtained after each trial were analyzed to visualize the interactive effect of variables on different characteristics. Gluten free flours combinations could be used to produce good quality muffins with acceptable physical and sensory qualities. These muffins are advantageous for people suffering from gluten intolerance. All the blends of flours (rice, corn, soy, flaxseed) and had improved both sensory and nutritional qualities of gluten-free muffins whereas the mixing of rice flour and soy flour RF: SF: CF: FS (10:4.9:5.07:5), had improved some parameters like hardness, springiness, chewiness, gumminess and overall acceptability and gives highest desirability. During the present research no significant difference was found in the moisture content for the gluten-free muffins. The moisture content of the gluten-free muffins ranged between 20.19% and 31.64%. The moisture content of the muffins increased with the increase of the soy flour, due to the fact that soy flour and rice flour absorb higher quantity of water. A high level of moisture content may be indicate short shelf life of composite muffins as they encourage microbial growth leads to spoilage. The protein content and fat content of the gluten -free muffins is high in which soy flour is 10%. The protein content ranged from 7.12% to 9.06% and the fat content varied from 13.25% to 15.06% while the protein content of controlled muffin ranges from 6.48% to 8.68% and the fat content varied from 12.75% to 14.31% . From the analysis of the gluten-free muffin, it is verified that the muffin developed in this project work presented greater quantities of protein and fat. A larger amount of protein is originated from the use of eggs and soybean extract.

REFERENCES

1. <http://www.amul.com/products/amul-tablebutter-info.php>
2. http://wikipedia.org/wiki/Cocoa_solidss://en.
3. Singh R, Singh G, Chauhan G, Nutritional evaluation of soy fortified biscuits, J. Food Sci. Technol., 2007, 37, 162-164.
4. Tsuji, H., Kimoto, M., & Natori, Y., Allergens in major crops, Nutrition Research, 2001, 21, 925–934.

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5. Sudha, M.L.R., K. Vetrmani and K. Leelavathi, Influence of fibre from different cereals on the rheological characteristics of wheat flour dough and on biscuit quality, *Food Chem.*, 2007, 100, 1365-1370.
6. Best D., Building fiber into foods, *Prepared Foods*, 1987, 156(7), 112-5.
7. Gopalan, C. Sartri, B. V. R., Balasubramanian, S.C., Nutritive value of Indian Foods, National Institute of Nutrition. Hyderabad, 2001, India
8. Neha Mishra, Ramesh Chandra, Development of functional biscuit from soy flour & rice bran, *International Journal of Agricultural and Food Science* 2012, 2(1), 14-20
9. Simona Man, Adriana Păucean*, Sevastița Muste, Anamaria Pop, Studies on the formulation and quality characteristics of gluten free muffins.
10. Mialon, V. S., et al. "The effect of dietary fibre information on consumer responses to breads and "English" muffins: a cross-cultural study." *Food Quality and Preference* 13.1 (2002): 1-12.
11. Baixauli, R., et al. "How information about fibre (traditional and resistant starch) influences consumer acceptance of muffins." *Food Quality and Preference* 19.7 (2008): 628-635.
12. Tosh, Susan M., et al. "Glycemic response to oat bran muffins treated to vary molecular weight of β -glucan." *Cereal Chemistry* 85.2 (2008): 211-217.
13. Hahn, Fred. "How to Lose Fat Successfully."
14. Dean, M., M. M. Raats, and R. Shepherd. "Consumers and functional cereal products." *Technology of Functional Cereal Products* (2007): 3-22.
15. Zuercher, Jennifer L., and Sibylle Kranz. "Toddlers and preschoolers consume more dietary fiber when high-fiber lunch items are served." *Childhood Obesity (Formerly Obesity and Weight Management)* 8.1 (2012): 71-75.
16. Mendosa, David. "Revised International Table of Glycemic Index (GI) and Glycemic Load (GL) Values—2008." *Living With Diabetes* (2008).
17. Vee, S. C. "Chemical And Physical Properties Of Muffin Prepared From Different Levels Of Mango (*Mangifera Indica*) Variety Chokanan Pulp Flour." (2009).
18. Mehta, Kinjal R., Samrudhi M. Shivkar, and Anuradha Shekhar. "A Study of Multigrain Gluten Free Groundnut and Edible Gum Biscuits." *International Journal of Food and Nutritional Sciences* 3 (2014): 201-206.
19. Mendosa, David. "Revised International Table of Glycemic Index (GI) and Glycemic Load (GL) Values." (2008).
20. Grigor, John M., et al. "The sensory acceptance of fibre-enriched cereal foods: a meta-analysis." *International Journal of Food Science & Technology* 51.1 (2016): 3-13.
21. Umashankar, K., Jyotsna Rajiv, and P. Prabhasankar. "Development of hypoimmunogenic muffins: batter rheology, quality characteristics, microstructure and immunochemical validation." *Journal of food science and technology* 53.1 (2016): 531-540.
22. Singh, Narpinder, et al. "Diversity in quality traits amongst Indian wheat varieties II: Paste, dough and muffin making properties." *Food chemistry* 197 (2016): 316-324.
23. Wilkes, Ann Przybyla. "Flax use up as health benefits better realized."
24. Stevens, Laci, and Mohsin Rashid. "Gluten-free and regular foods: a cost comparison." *Canadian Journal of Dietetic Practice and Research* 69.3 (2008): 147-150.