



DEVELOPMENT OF LOW CARBOHYDRATE, FIBRE RICH MULTIGRAIN CAKE RUSK FOR OWEWEIGHT ADOLESCENTS AGED 10-15 YEARS IN INDIA

Bharmal Fatema¹, Karim Zainab¹, Patel Urmi¹, Patil Kalyani¹, Sengupta Rupali²

^{1, 2} Smt. Manjulaben Gunvantrai Shah Department of Post Graduate Studies, MSc Clinical Nutrition and Dietetics. Dr. Bhanuben Mahendra Nanavati College of Home Science (Autonomous) Affiliated to SNDT Women's University. 338, Rafi Ahmed Kidwai Rd., Matunga, Mumbai, Maharashtra 400019

Corresponding Author: Fatema Bharmal, Smt. Manjulaben Gunvantrai Shah Department of Post Graduate Studies, MSc Clinical Nutrition and Dietetics, Dr. Bhanuben Mahendra Nanavati College of Home Science (Autonomous), Mumbai, Maharashtra 400019. e-Mail address: fatemahuseinbharmal@gmail.com Phone number: +9819703416

Abstract

Jowar and Bajra are both gluten-free millets grown primarily in India. Both cereals are high in phytochemicals, antioxidants, polyphenols, and dietary fibre all of which are known for contributing to optimal human health in various ways.

AIM & OBJECTIVES: The aim of the study was to 'develop a low carbohydrate, fibre dense, millet based Indian snack' for overweight adolescents aged 10-15 years. The objective is to standardise the cake rusk, evaluate its sensory characteristics, determine the cost and to analyse nutritional composition of the developed product.

METHODOLOGY: It includes A) Development of the product B) Sensory evaluation of the product C) Analysis of the Nutritive value of the ingredients used to develop the product based on IFCT, 2017

RESULTS AND DISCUSSION: Multigrain cake rusk are nutritious snack alternatives compared to regular refined flour rusks. Both jowar and bajra flour are rich in various phytochemical components including dietary fibre which has various health benefits, including weight loss and improved digestive health. Along with this, the incorporation of psyllium husk, flax seeds and sesame seeds further improve the fibre profile of the product.

CONCLUSION: This version of multigrain cake rusk is more nutritious having low carbohydrates and high fibre than the regular refined flour cake rusk and is an interesting way of incorporating millets and seeds in the diet.

Keywords: Multigrain, Millet based, Fiber rich, Gluten free, Phytochemicals, Nutritious snack.

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INTRODUCTION

Millets are traditional grains, grown and eaten in in the Indian subcontinent for the past thousand years. They are highly nutritious, rich in fibre and gluten-free, making them easy for the body to absorb. They are also rich in a variety of

micronutrients, including calcium, iron, phosphorus. Generally, Pearl millet (*Pennisetum glaucum*; Bajra) and Sorghum (*Sorghum bicolor*; Jowar) are the two millets which are majorly consumed. Jowar and Bajra are both gluten-free millets high in beneficial plant chemicals like antioxidants, polyphenols, and phytochemicals, all of which are known for contributing to optimal human health in various ways. Though millet production and consumption in India was decreased post green revolution period, but due to recent prevalence of diabetes, it has made people rethink about adding millets to their diet because of its high dietary fiber and other nutritional advantages (Raidu and Vahini, 2013). High dietary fiber content of jowar (compared with that of wheat, rice, and maize) may contribute to better glucose and insulin response in the body (Thomas et al, 2016). Meanwhile, bajra is also rich in fiber containing 5 g/100 g of insoluble and 3 g/100 g soluble dietary fibers. (Krishnan and Meera, 2018)

Fibre is considered important for gut health and moderate intake of high fibre in foods could result in an improvement of gut health. Along with that, it is important in the prevention of heart disease, colon cancer and diabetes. The high dietary fibre content in millets improves bowel movement, increases the transit time reducing the rate of glucose in the blood. Moreover, fibre in millets may help to reduce harmful cholesterol as well. (Hasan et al, 2021)

Psyllium Husk (*Plantago Ovata*), a polysaccharide that has both soluble and insoluble fiber is very beneficial for humans. It helps in reducing obesity, lowering the cholesterol and triglycerides level in the body (Khan et al, 2021). Flaxseed also contains good amount of α -Linolenic Acid (ALA), omega-3 fatty acid, proteins and dietary fiber. Researchers reported that flaxseed incorporated food products can have good consumer acceptability along with its nutritional benefits (Soni et al, 2017)) In addition to that, sesame seeds (*Sesamum indicum* L.) also have high nutritional value due the significant amounts of dietary fiber, protein, natural antioxidants, unsaturated fats, vitamins, and mineral composition (Barbosa et al, 2017). Rapid urbanization and eating habits of the new generation has led to the development of ready-to-eat convenience foods. The nutritional importance of millets especially high fiber content influences the development of new millet-based products. Therefore, the present study comprised of developing a low carbohydrate, fibre dense, millet based Indian snack' which can be enjoyed by all age groups.

OBJECTIVES

1. To develop a low carbohydrate, fibre dense, millet based Indian snack' for overweight adolescents aged 10-15 years.
2. To standardise the cake rusk, evaluate its sensory characteristics and to analyse nutritional composition of the developed product.

MATERIALS AND METHODS

3.1 Plant materials: The materials for the study comprised of two millet flours: Jowar and Bajra. Due to the gluten-free nature of the product; Psyllium Husk (Brand: Isabgol) was used as a binding agent. The fat and sweetener used is Rice Bran Vegetable oil and jaggery, respectively. To increase the fibre content, flaxseeds and sesame seeds were used. Curd was used as an acidic reagent to activate baking soda.

3.2 Preparation of multigrain cake rusks: For the rusks, the batter was prepared by mixing of various ratios of jowar and bajra as well as type of fats, milk product and seeds used. The ingredients used for the rusks is given in table 1. the fat and sweetener were melted and creamed together first, then the psyllium husk was added, followed by milk product (curd/buttermilk), millet flours, baking soda and the seeds. It was mixed till a homogenous batter was formed that resembled thick cake batter. The batter was baked in a loaf tin in a conventional home-grade oven in a preheated oven at 170°C for 55 minutes or until a toothpick inserted in the centre of the cake came out clean. The cake was then allowed to cool off completely and cut into 1 cm thick slices. The slices were placed on a rack and dehydrated at 100°C for 5 hours till crisp.

Table 1: Ingredients used for the preparation of Multigrain Cake Rusks

Ingredients	Sample A (g)	Sample B (g)	Sample C (g)
Jowar	30	30	45
Bajra	30	10	15
Psyllium husk	10	10	10
Butter	30	30	-
Vegetable oil	-	-	30
Jaggery	20	20	20
Buttermilk	75	-	-
Curd	-	75	75
Flaxseeds	10	5	5

Sesame Seeds	-	5	5
Fennel seeds	-	5	-
Baking Soda	2	2	2

3.3 Sensory evaluation: The developed rusks were subjected to a sensory evaluation by four panel members. The evaluation was done on domains such as 'Appearance', 'Taste', 'Aroma', 'Texture' and 'Overall Acceptability'. Scoring was based on 5-Point Likert Scale, where '1' represented 'extreme dislike' and '5' represented 'extreme like'.

3.4 Microbial analysis: The bacterial plate was prepared using the Pour Plate Method.

3.5 Shelf-life study: A sample of the rusk was sealed in an air-tight glass jar container and subjected to ambient temperature till visible changes were observed.

RESULTS AND DISCUSSION

4.1 Product yield, nutrient composition and standardisation: The recipe made 6 small 1 x 1.5-inch rusks. The weight of the final product decreased due to subjected moisture losses. The nutrient composition of raw ingredients and standardisation of the recipe and product is shown in Table 2, 3 and 4

Table 2: *Nutrition Content of Sample-C according to IFCT-2017:*

Ingredients	Amount (g/ml)	Energy (kcal)	CHO (g)	Protein (g)	Fat (g)	Fibre(g)
Jowar flour	45	150	30.46	4	0.7	4.6
Bajra flour	15	52	9.27	1.64	0.8	1.72
Vegetable oil	30	270	0	0	30	
Jaggery	20	71	16.9	0	0	
Curd	75	45	2.25	2.33	3	
Flaxseeds	5	22	0.5	1	1.7	1.4
Sesame seeds	5	26	0.5	1.09	2.1	0.85
Psyllium husk	10	-	-	-	-	10
TOTAL	215	636	59.88	10.06	38.3	18.57

Table 3: *Standardised Quantity*

Ingredients	Amount (g/ml)
Jowar flour	15
Bajra flour	5
Vegetable oil	10
Jaggery	6.5
Curd	25
Flaxseeds	1.6
Sesame seeds	1.6
Psyllium husk	3.3
TOTAL	68

The raw weight was 68 g. once baked and dehydrated, the cooked weight was shown to be 40 g

Table 4: *Nutritive Value per serving:*

Macronutrient	Amount	Amount (per serving = 2 rusks = 40 g)
Energy (kcal)	636	212
Carbohydrate (g)	59.88	19.96
Protein (g)	10.06	3.35
Fat (g)	38.3	12.76
Fibre (g)	18.57	6.2

The carbohydrate percentage of one serving, that is, 19.96 g imparting 79.84 kcal, is shown to be 37.6% of total calories. The fibre, that is, 6.2 g/ serving shows that fibre carries 15.5% of the product weight in grams.

4.2 Sensory evaluation: Table 5 shows the sensory evaluation mean score of the rusks




Table 5: Sensory Evaluation of Multigrain Cake Rusks

Different compositions of rusk	Appearance	Taste	Aroma	Texture	Overall Acceptability
Sample-A	2.25±0.5	2.37±0.47	1.75±1.25	0.75±0.86	2.00±0.00
Sample-B	3.00±0.00	3.00±0.00	2.5±0.00	1.5±0.70	2.00±0.00
Sample-C	3.25±0.25	4.25±0.35	4.75±0.35	3.00±0.00	3.25±0.35

Evaluation of organoleptic attributes by a naïve panel showed that, Sample-C had the best scores in all attributes and hence the highest acceptability.

4.3 Microbial Analysis of Multigrain Cake Rusk: The bacterial count was enumerated by manually counting the colonies. The results are shown in Table 6 (Fig. 1, 2, 3)

Table 6: Microbial Analysis

Figure	1	2	3
Result			
Colony-forming units/ml	109	103	>300
Interpretation	Acceptable	Acceptable	Too numerous to count

4.4 Shelf-Life Study: The result showed that there was no contamination for the period of 87 days. Thus, it can be concluded that the rusk can be stored up to 3 months without any deteriorative changes.



Fig. 4 showing the appearance of the rusk on the 87th day

CONCLUSION

1. The main aim was to develop a low carbohydrate, fibre dense, millet based Indian snack which can be enjoyed by all age groups.
2. This is a low carb (37.6%), gluten free snack best suited as a mid-morning or teatime snack.
3. The fibre content per serving can satisfy the Indian RDA-2020 of Adults for Fibre (30-40 g) by 20%
4. Currently in the market, these are not available which makes our product unique and new.
5. This product was tested for sensory evaluation on a naïve panel, the shelf-life study showed that the product had a high shelf life of >2 months in ambient temperatures.

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