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Development and Sensory Evaluation of Ragi-coca Powder-Jaggery Based Energy ball crunch: A Nutritious Snack Option

Dr Komal Singh
Assistant Professor, Department of Food and Nutrition, BBAU Satellite Campus Amethi
Email: komalsingh16037@gmail.com

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Abstract
One of the most well-liked traditional and healthful dishes in India is ragi balls. Ragi balls were created by combining ragi, jaggery, mixed seed, and coco powder in various ways. For the investigation, a total of four sample variants were created: the control sample, sample A, sample B, and sample C. Balls took between thirty and fifty minutes to prepare. The control sample and all four modifications were subjected to sensory evaluation in order to determine which mixtures from each sample were most acceptable. Nutritional and chemical characteristics were assessed for both the control sample and the whole sample. In addition to having a larger percentage of nutritious qualities than the other sample, sample B was approved. Sample B of ragi balls' nutritional value had a moisture content of 9.1%, fat content of 10.1%, protein content of 10.5%, carbohydrate content of 67.6%, ash content of 1.3%, and an energy value of 408.9 Kcal/100gm. Sample B demonstrated that spherical balls were preferred on scale and had more crunch than flattened balls.

Keywords: Ragi millet, Mixed Seed, Jaggery, Cocca powder, Ragi balls

Introduction

Grasses like finger millet (*Eleusine coracana* (L.) Gaertn), pearl millet (*Pennisetum glaucm* (L.) R.Br), and foxtail millet (*Setaria italica* (L.) P.) are examples of millet crops. Beauvois), proso millet (*Panicum miliaceum* L.), barnyard millet (*Echinochola crusgalli* (L.) P.), tiny millet (*Panicum sumatrense* Roth ex Roem. & Schult.), bahiagrass (*Paspalum notatum* Flugge), and kodo millet (*Paspalum scorbiculatum* L.). Beauv), elephant grass (*Pennisetum purpurium* Schumach.), and guinea grass (*Panicum maximum* Jacq), all of which are members of the *Poaceae* family of the monocotyledon group (Taynath et al., 2018). Finger millet, also referred to as ragi and mandua in India, is a minor cereal that is native to Ethiopia but is widely grown throughout India and Africa. It is a staple food that provides a significant amount of calories and protein to a large portion of the population in these countries, particularly those from low-income groups (Kennedy et al., 2006). Of all the small millets grown in India, finger millet takes up the most land. Among cereals like barley, rye, and oats, finger millet is distinct due to its higher nutritional content and exceptional qualities as a crop for subsistence (Taynath et al., 2018). The amino acid methionine, which is deficient in the diets of hundreds of millions of impoverished people who eat starchy mainstays like cassava, plantains, polished rice, or maize meal, makes finger millet particularly beneficial (Dissanayake et al., 2016). Because of its fibrous seed coat, ragi is regarded as a coarser grain than rice. Compared to other minerals

like phosphorus, iron, magnesium, and fibre, ragi is a particularly rich source of calcium, with 0-3 to 0.4 g. Because Ragi has more enzymes like lysine, threonine, and valin than other millets, its protein is comparatively more balanced (Ravindran, 1991).

Finger millet's high calcium (0.38%), protein (6%–13%), dietary fibre (18%), carbohydrates (65%–75%), minerals (2.5%–3.5%), phyates (0.48%), tannins (0.61%), phenolic compounds (0.3–3%), and trypsin inhibitory factors contribute to its nutraceutical significance. It is known to have anti-diabetic, anti-diarrheal, anti-inflammatory, anti-diabetic, antioxidant, and antimicrobial qualities (Devi et al., 2014). Ragi is often turned into flour and used in a number of recipes, including salty porridge, ladoo, and cheela. In southern India, it is traditionally used as a weaning meal for infants (Meera, 1997). Typically, finger millet is used to make roti, flour, pudding and porridge. Finger millet has become more significant due to its useful components, such as resistant starch and slowly digesting starch, as the usage of processed foods has changed and consumers have become more conscious of the health advantages. Ragi and wheat composite flour seems to enhance both nutritional quality and health advantages (Muktar et al., 2018).

In addition to its astringency and bitter aftertaste, cocoa powder is a plant product that has not been well accepted by Nigerian consumers. It has recently gained international recognition for a variety of uses as a functional food product or ingredient in the food and confectionery industries (Adeoti et al., 2023). According to reports, cocoa powder improves cardiovascular health, lowers low-density lipoprotein (LDL) cholesterol, and oxidises LDL to prevent atherosclerosis or the development of plaque. Due to its high natural antioxidant content, it also raises HDL cholesterol. Studies have shown that it has a higher antioxidant capacity than many other flavanol-rich foods and food extracts, such as red wine, blueberries, garlic, strawberries, and green and black tea (Taubert et al., 2007; Corti et al., 2009). Protein, vitamin A, riboflavin, nicotinic acid, and minerals like iron, calcium, copper, magnesium, phosphorus, potassium, sodium, and zinc are all abundant in cocoa powder, which may have the dual benefit of enhancing food with essential nutrients and health-promoting bioactive compounds (Lee et al., 2003).

Gur in India, Desi in Pakistan, Panela in Mexico and South America, Jaggery in Burma and Africa, Hakuru in Sri Lanka, and Naam Taan Oi in Thailand are common names for jaggery. In North India, jaggery is referred to as "Gur," but in South India, it is called "vellum" or "bellam." By definition, jaggery is a naturally occurring sweetener that is produced by concentrating sugarcane sweet juices into a solid or semi-solid condition, either with or without previous juice purification and without the addition of any artificial or chemical additives or preservatives. Despite being referred to as the poor man's sugar, Gur is consumed by the majority of Indians in one way or another. Of them, jaggery is regarded as a dietary item since it is ingested directly as a sweetener and in other preparations, such as animal feed combinations, and it includes a significant amount of minerals in addition to calories (Singh, 2011). Gur is a high-calorie sweetener that is recognised to be healthier than white sugar since it includes minerals, protein, glucose, and fructose. More than 70% sucrose, less than 10% glucose and fructose, less than 5% minerals, and less than 3% moisture are characteristics of high-quality Gur (Nath et al., 2015).

Material and Method

One delicious food made by combining roasted ragi flour with roasted groundnuts, dates, and

jaggery as a sweetener is called ragi balls. Groundnuts, dates, jaggery, and ragi flour are combined and processed to make the ragi balls. The sample was made with a layer of powdered coconut. The ingredients of ragi balls, 1. Ragi 2. Jaggery 3. Mixed Seed 4. Coca- Powder.

Creation and composition of Ragi Balls

In order to determine the proper ratios of components, sample combinations, and cooking, preliminary investigations were carried out. The percentage of supplementation was then determined by sensory assessment, and chosen samples were examined for additional processing and analysis.

Table 1: Formulation of ragi balls.

Sample	Ragi	Jaggery	Mixed Seeds	Coco powder
Control	45	45	---	10
Sample A	35	25	25	15
Sample B	35	30	20	15
Sample C	35	35	15	15

Control – Ragi: jaggery: coco powder (45:45:10)
Sample A- Ragi: jaggery: Mixed Seeds: coco powder (35:25:25:15)
Sample B- Ragi: jaggery: Mixed Seeds: coco powder (35:30:20:15)
Sample C- Ragi: jaggery: Mixed Seeds: coco powder (35:35:15:15)

Preparation of Ragi enriched balls

All ingredients should be dry roasted on a hot skillet for a few minutes before being allowed to cool. After cooling, put them in a blender and process until they are a fine powder.

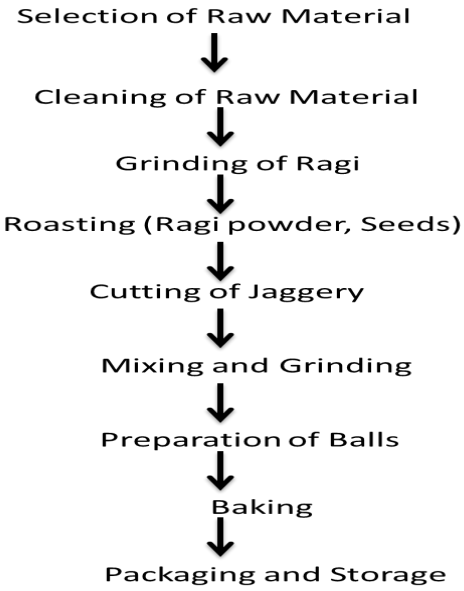

Fig 1: Process Flowchart of Ragi Ball

Result and Discussion

Various mixtures of ragi, jaggery, peanuts, dates, and coco powder were used in several experiments. As a result, 25–35 percent ragi, 25–35 percent jaggery, 15–25 percent peanuts, 15–25 percent dates, and 10–15 present coconut powders were used to make the ragi ball. Ragi (45%), jaggery (45%), and coco powder (10%) were used to make the control ragi ball. Panellists assessed several ragi balls made from various formulations in the primary sensory

assessment test.

Sensory evaluation of ragi balls

Using a nine-point hedonic scale (1-dislike extremely, 2-dislike very much, 3-dislike moderately, 4-dislike slightly, 5-neither like nor dislike, 6-like slightly, 7-like moderately, 8-like very much, and 9-like extremely), a panel of fifteen trained judges assessed the sensory quality characteristics of the ragi balls made from various ingredients. The panellists were given a code number to identify the samples. Table 2 shows the sensory evaluation of ragi balls made from various ragi ball formulations (Fig. 2 and 3).

Table 2: Sensory evaluation of ragi balls.

Sample	Appearance and Colour	Taste	Texture	Flavour	Overall acceptability
Control	8	9	9	9	8.7
Sample A	8	7	7	8	7.5
Sample B	9	8	9	8	8.5
Sample C	8	8	7	8	7.7

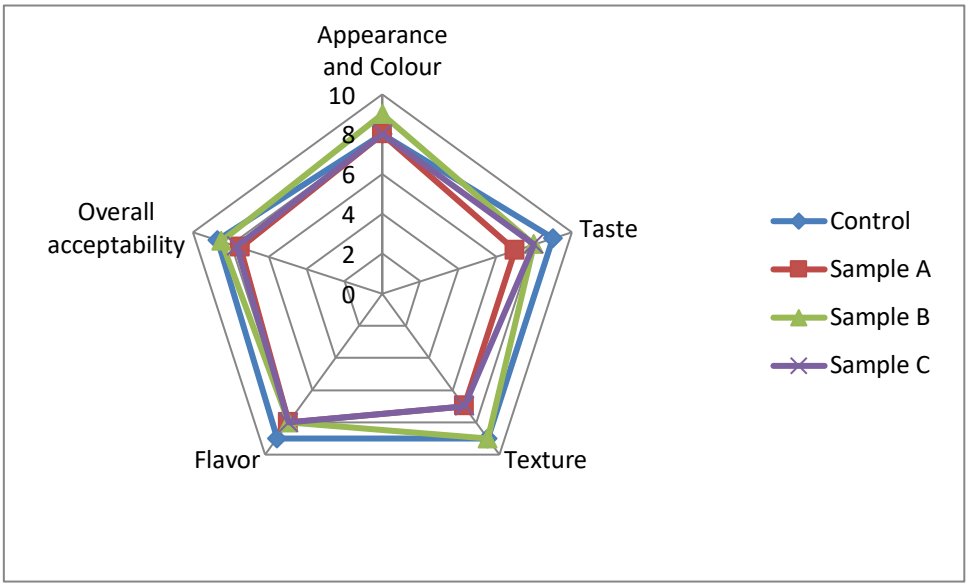

Fig 2: Sensory evaluation of ragi balls.

Fig 3: Spherical and flat ragi balls.

Proximate Analysis of ragi balls

Table No. 3's proximate analysis of ragi balls revealed that the ragi ball control sample The control sample had a moisture content of 9.01 percent, fat content of 8.14 percent, protein content of 8.1 percent, carbohydrate content of 66.29 percent, ash content of 1.2 percent, and an energy value of 366.5 Kcal/100g. Samples A, B, and C had moisture contents of 9.7, 9.1, and 10.1 percent, respectively, according to the various formulations of ragi proximate composition. Samples A, B, and C had fat contents of 9.11, 10.1, and 10.5 percent, respectively. Samples A, B, and C had protein contents of 9.4, 10.5, and 9.6 percent, respectively. Samples A, B, and C had respective carbohydrate contents of 66.9, 67.6, and 68.45 percent (Fig. 4). Samples A, B, and C had ash contents of 1.5, 1.3, and 1.7 percent, respectively, and their energy values were 384.4, 408.9, and 396.9 Kcal/100gm, respectively (Fig. 5). According to Avadhut P et al. (2020), the moisture content, lipid content, protein content, carbohydrate content, and ash content of instant ragi ball mixes were 8.24, 1.09, 8.69, 72.47, and 0.96, respectively. Sample B demonstrated that spherical balls are crunchier than flattened balls.

Table 3: Proximate Analysis of ragi balls.

Sample	Moisture Content (%)	Fat Content (%)	Protein Content (%)	Carbohydrate Content (%)	Ash Content (%)	Energy Value (Kcal/100gm)
Control	9.01	8.14	8.1	66.29	1.2	366.5
A	9.7	9.11	9.4	66.9	1.5	384.4
B	9.1	10.1	10.5	67.6	1.3	408.9
C	10.1	10.5	9.6	68.45	1.7	396.9

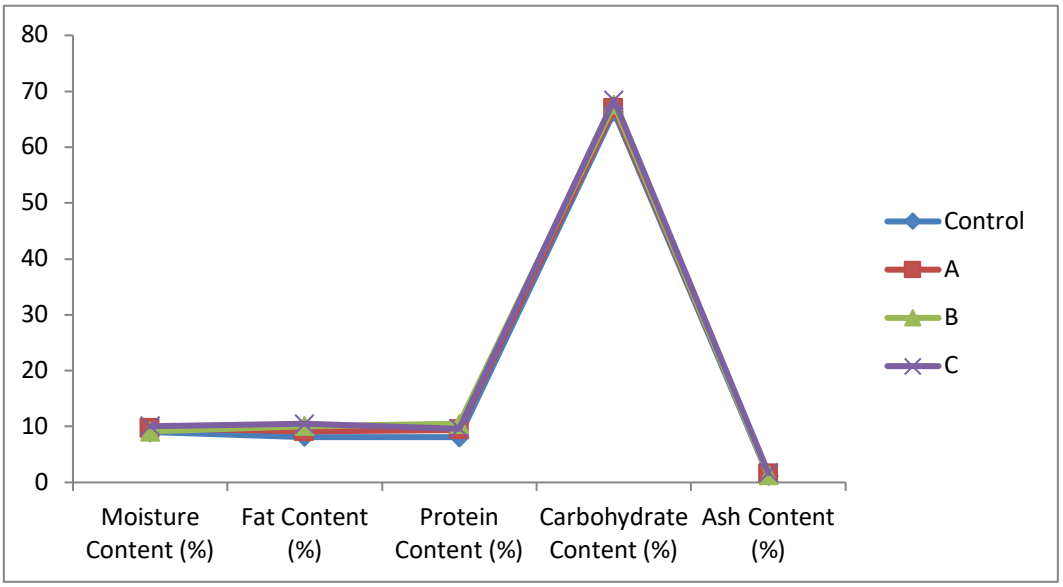

Fig 4: Proximate Analysis of ragi balls

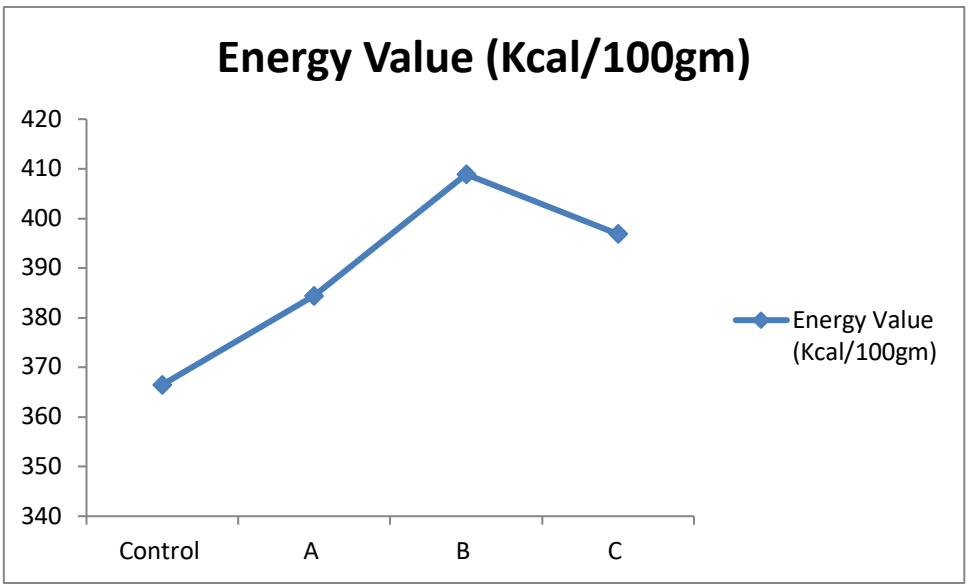

Fig 5: Energy Value (Kcal/100gm)

Conclusion

According to the results of the current study, the ragi balls made with peanuts were determined to be more organoleptically acceptable than the control sample, which did not include peanuts. Additionally, all of the nutritional qualities of the peanuts used are higher than those of the control sample. In addition to having a larger percentage of nutritious qualities than the other sample, sample C was approved.

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