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DEVELOPMENT AND QUALITY EVALUATION OF MILLET BASED SANDWICH CAKE

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Abstract
The growing demand for nutritional, sustainable and gluten-free food options has spurred the use of alternative components in conventional foods. The current study focused on the development of a millet-based beetroot cake sandwich, which combined the health benefits of millet and beetroot in this novel food product. The said cake was developed utilizing nutrient-rich components namely ragi flour (22%), wheat flour (15%), beetroot puree (25%) and banana pulp (11%). In addition to this, cocoa powder (5%) and other ingredients such as, powdered sugar (18%), baking agents and preservatives were also incorporated. The cake was processed using a conventional baking method at a controlled temperature of 180°C for 30 min, followed by layering with white chocolate. The nutritional evaluation of this product revealed a nutritional balance in terms of carbohydrate (58.2%,) protein (7.8%), fat (12.4%) and dietary fiber (6.2%). The shelf life was estimated to be around 10 days (at ambient temperature) in terms of microbiological results. The addition of calcium propionate (0.7%) resulted in enhancing the microbial stability of the cake. The findings suggest that the millet beetroot cake sandwich represents a nutritious substitute for traditional cakes.

Key words: Millet, beetroot, nutrition, cake, sustainable

Introduction

The increase in consumer awareness on healthy and nutritious food products has resulted in increased manufacture of such foods. Consequently, the food manufacturers are focusing in creating novel healthy food products that can replace the conventional ones. Among the bakery products, cake is traditionally prepared from refined wheat flour that lacks of nutrients like fiber, minerals and bioactive compounds. Being a very popular food commodity, several research works have been done to replace the health debilitating refined flour with whole wheat flour. However, cakes developed with whole wheat flour is still rich in gluten making it unsuitable for consumers with gluten intolerance. Thus, to circumvent this, millet flours are utilized to formulate this popular bakery product i.e. cake.

The use of millet flour to formulate cakes reportedly enhance the nutritional quality of the food product without compromising the characteristics sensory properties (Saha et al., 2011). Millets, such as finger millet (Eleusine coracana) and pearl millet (Pennisetum glaucum), are decent sources of protein, dietary fiber and micronutrients. In addition to millet flour, incorporation of natural constituent namely beetroot (Beta vulgaris) pulp would enhance the nutritional quality of the bakery product. Beetroot is reportedly a good source of antioxidants that contribute in improved health benefits and aesthetic appeal of a food product. Several food products formulated with beet root pulp or extract have reportedly exhibited therapeutic properties owing to its high antioxidant efficacy. Moreover, the natural pigment of the beet root pulp would enhance the aesthetic appeal of the cake.

Therefore, the present study aims to develop a millet-based cake followed by evaluation of its quality parameters. The developed cake will be investigated for its nutritional parameters in terms of protein, fat, carbohydrate, fiber and ash contents. It is envisaged that this novel product would be a potential alternative of the conventional cakes made with wheat flour only.

Materials and Methods

Materials

Beetroot, finger millet (Eleusine Coracana), pearl millet (Pennisetum Glaucum), wheat flour and banana and cocoa powder were obtained from local market in Pune, India. All chemicals used in this work were of AR grade and were procured from HiMedia Ltd.

Formulation of the millet-based sandwich cake

Finger millet and pearl millet were washed, dried, and ground into fine flour. Beetroot pulp was prepared by grinding fresh beetroots. The dry materials (finger

millet flour, pearl millet flour, wheat flour, cocoa powder) were sieved and blended together. After preliminary trials, the cake was formulated using 25% beetroot pulp, 22% finger millet flour, 15% pearl millet flour,15% wheat flour and 5% cocoa powder. In another vessel, banana pulp (11%), sugar and vegetable oil were blended to smooth consistency. The dry material was added slowly to the wet mixture while continuously mixing until a homogenous batter was formed. The batter was transferred into oiled cake pans and baked at 180°C for 30-35 min. The cakes were then cooled at room temperature and cut horizontally to create layers. A layer of white chocolate compound is added in between the layers. The stacked cake was coated with wafer biscuits for texture and appearance enhancement.

Analysis of the millet-based sandwich cake

Sensory analysis

The sensory analysis of of the product in terms of its colour, appearance, mouth feel, taste, flavour and overall acceptability has been conducted by trained panellists on a 9-point Hedonic scale. The average score was estimated for each of the aforesaid parameter to find out the most appreciated quality parameter of the cake.

Proximate analysis

The developed cake subjected to analyses of its proximate in terms of moisture, fat, protein and carbohydrate. The said parameters were evaluated in accordance with the standard AOAC methods (AOAC, 2000).

Determination of moisture content

The determination of moisture content in samples involves the principle of heat-induced evaporation, leading to the loss of moisture, with the remaining dry matter representing the substance's quantity after moisture removal. This process requires an oven set to 105°C, Petri plates, and desiccators. The method involves washing dishes with detergent, drying them overnight in the oven, weighing them in a desiccator after cooling, and then weighing 5.0 g of sample into a dish. The sample is placed in the oven overnight, with periodic weighing until a constant weight loss is achieved. The moisture percentage is calculated using the formula

% Moisture = (W1-W2) x 100 / W1,

where W1 represents the initial weight of the sample and W2 the final weight.

Determination of fat content

The determination of fat content is based on the principle of extracting fat-soluble components using petroleum ether in a Soxhlet apparatus. After extraction, vessels are dried, weighed, and the fat percentage calculated using

% Fat Content = (W2-W1) / W,

where W2 is the weight of the vessel with oil, W1 the weight of the empty vessel, and W the weight of the sample.

Determination of protein content

Protein content determination comprises digesting samples with concentrated sulfuric acid, steam distilling and titrating the ammonia present. Titration is performed with standard sodium hydroxide solution, and protein percentage is calculated using

% Protein = 0.625 x % N2

$$\%N_2 = \frac{(87.5 \times \text{Normality of } H_2SO_4 \times \text{Titre value})}{\text{Weight of sample} \times 0.1}$$

Determination of carbohydrate content

Carbohydrate determination relies on the Anthrone reaction for identifying hexoses and aldopentoses. Equipment includes a water bath, centrifuge, and spectrophotometer, with materials such as test tubes and beakers. Reagents include hydrochloric acid and Anthrone reagent. The procedure involves hydrolysis, neutralization, centrifugation, analysis of supernatant, and preparation of standards. Absorbance is measured at 630nm, and carbohydrate content is calculated using a standard graph formula.

Amount of CHO present (%) = [Sugar value from graph* Total vol. of extract *100]/ Aliquot sample used *weight of sample

Results and Discussion

Chemical Analysis

The proximate composition of the formulated cake indicated an improved nutritional profile compared to conventional wheat-based cakes. The moisture content was measured at 28.5%, ensuring an acceptable shelf life. The protein content was found to be 9.8%, primarily contributed by the finger millet and pearl millet flours. The fat content was 12.4%, derived from the added butter/oil and cocoa powder. The dietary fiber content was significantly higher (6.7%) compared to standard cakes, which is attributed to the inclusion of millet flours and beetroot powder. The carbohydrate content was measured at 55.6%, ensuring an energy-rich formulation suitable for consumption. These findings align with previous studies that highlight the nutritional benefits of incorporating millet and beetroot into bakery products (Devi et al., 2014; Reddy et al., 2013).

Sensory Evaluation

The sensory evaluation results suggested that the developed cake was well accepted by the trained

panel. Panelists appreciated the appealing color of the cake attributed to the beetroot pulp along with its mild sweetness. The addition of banana pulp enhanced the cake's natural sweetness and moisture content. However, the firmness of the cake did not significantly affect the overall acceptability. These findings are in agreement with previous research revealing high sensory acceptability of millet-based bakery products (Singh & Srivastava, 2006; Usha et al., 2018).

Conclusion

The development of a millet-based sandwich cake combined with beetroot pulp gave rise to a nutritionally higher substitute to the existing wheat-based cakes. The incorporation of finger millet, pearl millet and beetroot pulp enhanced the protein and dietary fiber contents of the product suggesting improved health benefits for the consumers. The sensory evaluation indicated acceptability of the sandwich cake made with millet flours. These findings strongly suggest that millet-based beetroot cake could be a potential substitute for traditional wheat-based cakes. Future studies may focus on investigating the in vitro as well as in vivo functional properties of this novel food product.

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