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ORIGINAL ARTICLE

Preparation of Composite Flour Biscuits using Fasting Food Materials

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Abstract

The composite flour based fasting biscuits were prepared as ready to use, consumer friendly, best option and being presently not available in the market. Amongst various available fasting food materials, composite flour was made using sago, peanut, banana, potato, foxtail millet, barnyard millet in different proportions. Colouring and flavouring additives and sugar was thoroughly mixed. Dough was prepared incorporating hydrogenated oil. Upon rolling, dicing and baking at 150 to 180 °C for 20 minutes, the biscuits were prepared. The biscuits prepared out of 100 g sago, 50 g peanut, 30 g boiled potato mash and 20 g barnyard millet attains good sensory and textural properties with maximum consumer index of 8.32.

Keywords: Composite flour, millet, banana, potato, biscuit.

Introduction

The word "biscuit" is derived from the Latin *panisbiscoctus*. Though, "Biscuit" covers a wide range of flour baked products, it is generally an unleavened cake or bread, crisp and dry in nature, it is in a small, thin, and flat shape. A small cake of shortened bread leavened with baking powder or soda, a biscuit is a flat sweet or savoury snack.

Biscuits are normally crisp when prepared but go soft if exposed for longer time to environment or when go stale. In contrast, cakes are normally moist when prepared but go hard when they are stale. Many early physicians believed that most medicinal problems were associated with digestion. Hence, for both the sustenance and avoidance of illness, a daily consumption of a biscuit was considered good for health. There is wide scope for biscuit because it is long lasting and easily available in market.

It is made from different ingredients like refined wheat flour (RWF), millets flour, multigrain flour, full fat soy (FFS) flour which contain carbohydrate, protein, vitamin, minerals, fiber, lipids and mixed with colouring and flavouring agent along with baking powder and sugar. Due to attractive colour, flavour and shape, these biscuits are the first choice of children.

The healthier biscuits are prepared from whole grain or multi grain like cereals and fortified with soya and millets. These are high in fibre content and nutrition value. Cashew kernel meal is also used for enrichment of biscuit. It contains protein, ash, fats and crude fiber. There are different types of biscuit available in market as cream biscuit, *khari* biscuit, *nankatai* and luxury biscuits. Dogan (2005) studied the effect of oven types on the characteristics of biscuits made from refrigerated and frozen dough. Dough colour was not affected by storage time and temperatures. Biscuit characteristics did not change significantly during storage. Spread ratio was significantly lower for the biscuits baked in the gas oven than for the biscuits baked in the electric oven. For sugar snap cookies and hazelnut biscuits the electric oven without air circulation was better, while for chocolate chip cookies gas oven with air circulation was more suitable. Boobier *et al.* (2005) developed a healthy biscuit: an alternative approach to biscuit manufacture. The purpose of this study was to modify the traditional biscuit by the addition of vitamin B6, vitamin B12, Folic Acid, Vitamin C and Prebiotic fibre, while reducing salt and sugar. Vitali *et al.* (2007) revealed soy flour to be riches source of phosphorous (1.671 g/kg). Kumar *et al.* (2010) studied effect of incorporation level of millet flour in soya based biscuit on the physical characteristics such as spread ratio; % spread factor, weight, density and moisture content increased whereas diameter, thickness, volumetric expansion ratio and volume decreased with increasing incorporation level of millet flour. Gayas *et al.* (2012) found the mean overall sensory acceptability scores of more than 8.50 for biscuit samples upto 5% carrot pomace powder, indicating the commercial scope for manufacturing good quality vegetarian biscuits with carrot pomace powder. Khan *et al.* (2012) found that the whey protein enriched biscuits containing 10% whey protein concentrate were having high sensory characteristics. Mishra and Chandra (2012) found that supplementation of soy flour (15 %) and rice bran at

15% level each, would improve the nutritional quality of biscuit prepared without adversely affecting the sensory parameters. Shrestha *et al.* (2012) found that "over baking" of the biscuit likely to be responsible for the loss of the vitamin as well as less desirable physical properties of the biscuits.

Consumption of high energy and fat containing food leads to obesity, now a days most health problems are observed in children and growing age as well old people. Doctors do advise them for morning and evening walk besides a break in regular meals, at least in a week. However, many ready-to-eat (RTE) snacks and prepared dishes are being consumed on break meal / fasting days which pose problem for digestive system. Different fasting foods available in market are potato chips, banana chips generally prepared using oil and hence not health friendly. However, baked product like biscuits are not harmful to human health. At present there is no ready option for fried snacks during fasting days. Moreover, in transit period, easily caring and safe for consumption, the best alternative is the biscuits. As it is not available in market there is a growing need to develop a technology to prepare the biscuit suitable for fasting days.

Therefore, the work was undertaken to prepare the biscuits using sago flour, peanut, potato, banana, barnyard millet, foxtail millet etc. suitable for fasting days with the objectives to develop convenient biscuit (food) suitable during fasting days, to assess suitable material and there proportions for nutritious biscuits and to evaluate sensory and textural quality of biscuit.

Materials and Methods

Preparation process of biscuits: The biscuits were prepared as shown in Fig 1. The unit operations involved were as below.

Mixing: In this process all ingredients like flour, fat, sugar etc. are put together in the right proportion for dough formation. The ingredients are fed into the mixers, where they are mixed properly to prepare the dough. Here the dough temperature and mixing time play an important role in the manufacturing of biscuits. Normally mixing time is between 10-15 min, but it usually depends upon flour characteristics

Additives: Baking powder, baking soda, colour, essences were used as additives.

Moulding: Mixing is followed by moulding, in which the dough is laminated into sheets and is passed down to gauge rollers and appropriate sheet thickness is achieved for cutting. It is here that biscuits are given a variety of shapes and sizes using cutter or moulder. The speed of moulding or the cutting depends on the variety of the biscuit.

Baking: It is the third stage in biscuit making process, where the moulded biscuits are put into the baking oven on required temperatures. There are various baking options with different kinds of ovens available like direct fired, indirect fired and hybrid ovens, which is used as per temperature requirement, convenience and cost. Various methods of heating like conduction, convection and radiation are used in the ovens. Generally, the ovens are classified as zones. Temperature in this will maintained at 180-200°C. In this process, biscuits are put in the aluminum tray and inserted into oven for a certain period of time upto complete baking is done.

Cooling: After baking biscuits, natural cooling prior to packing. The temperature is brought down to room temperature. Natural cooling is preferred over the forced cooling as it maintains the texture quality of biscuit. Cooling time will be 15 min.

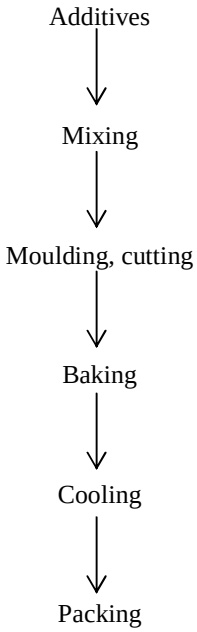

Fig 1: Flow chart for making biscuit

Treatments and ingredients:

T1= sago (100g) + peanut (50g) + barn yard millet (20g) + banana pulp (30g)

T2= sago (100g) + peanut (50g) + barn yard millet (20g) + boiled potato mash (30g)

T3= sago (100g) + peanut (50g) + foxtail millet (20g) + banana pulp (30g)

T4= sago (100g) + peanut (50g) + foxtail millet (20g) + boiled potato mash (30g)

Apparatus and instrument used: The baking oven, food grade stainless steel (SS-304) Tray, butter paper, rolling pin, aluminum trays were utilized to perform the process. Texture analyser (TPA) was used to measure hardness and crispness of biscuits prepared.

Quality evaluations: Food quality refers to textural and sensory properties. The texture of a product is required to define food's total physical characteristics that are evaluated by resistance to mastication and accompanying sensations of total mouth feel. Preliminary evaluation of texture may be consciously or unconsciously made from visual appearance of the food (*viz.*, roughness or stratification, orientation etc.) or by actually tearing apart, a product to see its structural fabrication. It may be evaluated by more scientific means using instrumentation obtaining objectively some index, which co-relates with the mastication process.

Sensory evaluation: In this case, sensory impression of the test panel was considered to assess the quality of the material in order to make the use of test panel more effective, physiological, psychohlogical and mechanical aspects of the food quality (Hussain, 2011).

Physiological aspects: These aspects involve the organs of the body which are responsible for control and performance of such process as evaluating firmness by fingers or chewiness by mastication.

Psychological aspects: The sensory qualities from psychological experiments are correlated with the physical measurements, for instance, the sensory evaluation can be correlated with physical parameter as

$$\text{Log } Y = \text{Log } m + n \text{ Log } x$$

Where, Y= sensation, x= stimulation, m and n are the constants.

Mechanical aspects: This aspect includes the mechanics of human organs in the textural evaluation such as chewing apparatus involved in texture evaluation. In this case, the chewing sound for different foods and different people is correlated with the textural quality of the food. The act of chewing involves the teeth, jaws, muscles, motions surface contacts and forces and this act can be measured by chewing apparatus. The sensory attributes including taste, colour, texture, flavour and overall acceptability were evaluated by a trained 20-member panel. The evaluation was held either 10 am for the morning session and at 3 pm for the afternoon session. The Nine-point hedonic scale was used to evaluate the degree of liking and disliking for preference of the biscuits.

The organoleptic evaluation of the biscuit revealed that there were significant differences between the treatments for the organoleptic qualities such as taste, colour, texture, flavour and overall acceptability. Taste is the primary factor which determines the acceptability of any product, which has the highest impact as far as market success of product, is concerned. The texture of the crust was related to the external appearance of the biscuit top, which implies smoothness or roughness of the crust. Overall acceptability includes many implications, which is the important parameter in organoleptic estimation

Results and Discussion

The biscuits (Fig 2) were prepared as per the procedure as mentioned in Fig 1. The changes were observed after baking in regards of its appearance, colour, surface roughness or smoothness etc. The quality was judged by sensory evaluation carried out by a panel of 5 judges (the academic staff of department of post harvest technology) using 10 point hedonic scale. Textural properties (i.e. hardness and crispiness) were evaluated by texture analyzers, which are described below.

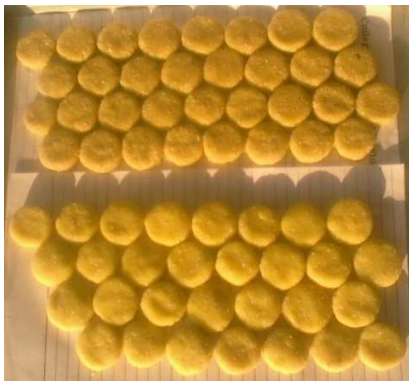

Fig 2: Composite flour fasting biscuits

Variation in surface appearance due to baking: Dry powders of all the material as per treatments T1 to T4 were thoroughly mixed. Colouring and flavouring ingredients were mixed and dough was prepared by

incorporating hydrogenated fat in liquid form. The biscuits were formed and were baked in baking oven at 150 to 180°C for 15 to 20 minutes. After cooling, biscuits were packed in 400 gauge polythene bags.

Details of physical changes observed are given in Table 1. Surface appearance of the biscuits were not changed much due to baking in case of treatments T1, T2 and T4, however in T3 colour was changed from yellow to creamy.

The shape and size of biscuits formed also remained unchanged. However, slight increase in thickness was observed due to baking in all cases except in treatment T3. The slight increase in thickness may be due to puffing of ingredients. In case of T3, the shape was spread a little and thus slight decrease in thickness was observed.

Quality evaluation of biscuits: Principle quality parameter i.e. hardness was measured using texture analyzer and shearing source i.e. resistance offered to break was measured in kgf along with crispness, measured by counting number of +ve peaks on the force-deformation curve obtained while measuring hardness. The average value of hardness and crispiness is tabulated in Table 1. Hardness of biscuit prepared by treatments T1, T2, T3 and T4 was found to be 18.15 (± 3.60), 16.67 (±2.23), 20.32 (±5.86) and 22.14 (±5.04), respectively whereas its corresponding crispness were 8 (±2.44), 19.6 (±4.72), 31.6 (±13.57) and 7.4 (±4.56), respectively. The hardness was 16.67 to 18.15 kgf for barnyard millet based biscuits (treatments T1 and T2) whereas it was 20.32 to 22.74 kgf for foxtail millet based biscuits (treatments T3 and T4). However, the foxtail millet based biscuits prepared by incorporation of banana pulp along with other ingredients showed very high crispness as compared to that prepared by incorporating boiled potato mash. On other hand, crispness was more for barnyard millet based biscuits prepared by incorporation of boiled potato mash along with other ingredients as compared to that prepared by incorporating banana pulp.

Sensory evaluation of biscuits: Taste of biscuit was evaluated by sensory evaluation. Different attribute considered were appearance, colour, hardness, crispiness and taste. Average values of each attribute for respective treatment is given in Table 2 and consumer index was calculated. It was observed that the average score of appearance for biscuit prepared by treatments T1, T2, T3, T4 was 8.8, 8.8, 7.8 and 7.6, respectively indicating goodness for appearance of biscuits prepared by treatments T1, T2 and T3.

Table 1: Variation in physical appearance due to baking

Properties	Types	T_1	T_2	T_3	T_4
Appearance	Formed	Good	Good	Good	Good
	Baked	Good	Good	changed	Good
Colour	Formed	Creamy	Creamy	Yellowish	Yellowish
	Baked	Creamy	Creamy	Creamy	Yellowish
Shape and size	Formed	Round and firm	Round and firm	Round and firm	Round and firm
	Baked	Round and expanded in its thickness	Round and expanded in its thickness	Shape changed and contracted in its thickness	Round and expanded in its thickness
Hardness (kgf)	Baked	18.15 (±3.60*)	16.67 (± 2.23)	20.33 (± 5.86)	22.14 (± 5.04)
Crispiness	Baked	8 (± 2.45)	19.6 (± 4.72)	31.6 (± 13.57)	7.4 (± 4.56)

Table 2: Average value of sensory score and consumer index for quality evaluation of biscuits

Treatment	T1	T2	T3	T4
Appearance	8.8	8.8	7.8	7.6
Colour	8.2	8.4	7.8	7.4
Hardness	7.2	8.2	8.2	7.4
Crispiness	7.0	7.8	7.8	6.8
Flavour	7.8	8.4	8.4	7.6
Total marks	39.0	41.6	40.0	36.8
C.I.	7.80	8.32	8.0	7.36

The average score for colour was 8.2, 8.4, 7.8 and 7.4, respectively for biscuits prepared by T1, T2, T3 and T4, showing acceptable range. Hardness was observed 7.2, 8.2, 8.2 and 7.4 kgf, respectively for biscuits prepared by treatments T1 to T4. Crispiness score was found 7.0, 7.8, 7.8, and 6.8 for biscuits prepared by treatments T1, T2, T3 and T4, respectively. Flavour score was observed 7.8, 8.4, 8.4 and 7.6 respectively for biscuits prepared by treatments T1 to T4. This indicates that the biscuits were quite consumer acceptable.

The consumer index was calculated from the sensory score data and it was found to be 7.80, 8.32, 8.00 and 7.36, respectively for biscuits prepared by T1, T2, T3 and T4. Overall acceptability of biscuits prepared by T2 was found maximum (8.32).

In sensory evaluation of biscuits prepared by T2 was found superior over other treatment. The average score for appearance, colour, hardness, crispiness and flavour of biscuits prepared using treatment T2 was found to be 8.8, 8.4, 8.2 and 7.8 and 8.4, respectively. It had maximum consumer index value of 8.32.

Conclusions

Using composite flour made of sago, peanut, banana, potato, foxtail millet, barnyard millet in different proportions and added with colouring, flavouring additives and sugar, the thoroughly mixed dough prepared incorporating hydrogenated oil and upon rolling, dicing and baking at 150 to 180°C for 20 minutes, the good quality ready to eat fasting biscuits could be prepared. The biscuits prepared out of 100 g sago, 50 g peanut, 30 g boiled potato mash and 20 g barnyard millet attains good sensory and textural properties with maximum consumer index of 8.32.

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