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Short Communication

Utilization of *Terminalia arjuna* for development of herbal multi-grain biscuits

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Abstract

In the present scenario, with increasing technology and competition humans are facing various health issues that is why today's generation is turning towards healthy option in food which will not only satisfy their appetite but is also healthy as well as tasty and provides some or the other benefits. Out of all the health problems faced by the consumers in this high paced world cardiac issues capture the majority which in return affects the functionality of other vital parts of the human body. Therefore, the aim of the present study is to develop multi-grain herbal biscuits by utilization of 2, 4, and 6% *Terminalia arjuna* bark powder which acts as a cardio tonic. This study also involves investigation of physiochemical properties and sensory quality of the developed biscuits. The results demonstrated that 2% *Terminalia arjuna* containing biscuits had lower ash content, normal diameter, lower spread ratio, higher thickness, lower moisture than biscuits which don't contain *Terminalia arjuna*. Sensory evaluation results indicated that biscuits incorporated with *Terminalia arjuna* up to 2% level did not affect the overall acceptability of biscuits. Thus, it can be concluded that 2% *Terminalia arjuna* can be incorporated for multi-grain biscuits to improve the nutritional quality, shelf life and providing desired benefits for people with cardiac issues without affecting the sensory acceptability of composite biscuits. Thus present study was first in its kind to determine the overall acceptability and physico-chemical properties of multi-grain herbal biscuits developed by incorporation of *Terminalia arjuna* at different levels.

Keywords: *Terminalia arjuna*, cardiac issues, multigrain, herbal

Introduction

There are many reasons why we consume food, the obvious and most important one being to obtain nutrition for a healthy and happy body. However, in a society where food supply, safety and nutrition are more than adequately provided for by most major manufacturers, other issues relating to the consumer's food choice have grown in importance is that humans usually enjoy food (Aziah *et al.*, 2012) [5]. In fact, many foods are consumed almost entirely for the pleasure value they impart. As consumers, we may expect the healthy alternative to taste better than the standard recipe. There are many factors that affect the food product development, some are as follows: sensory experience, taste and flavor, consumer expectations, beliefs and attitudes, economical and social factors, product optimization (Arshad *et al.*, 2007) [3].

Biscuits represent the largest category of snack item among bakery product (pratima *et al.*, 2000) [14]. It has become one of the popular snack foods for both young and elderly people due to their affordable price, convenience, shelf-stable, and nutritive value as compared to any other category of foods (Hurrell *et al.*, 2011). Biscuits often refer to a baked product that is generally prepared using three major ingredients: wheat flour, sugar, fats, and some minor ingredients such as additives and emulsifiers. They are widely accepted and consumed by almost all profiles of consumers from many countries (Ramarathinam *et al.*, 2007) [15] and therefore offer a valuable supplementation vehicle for nutritional improvement (Cardello *et al.*, 1992) [6]. It provides an excellent means of improving the nutritional quality (protein, minerals, vitamins, and bioactive compounds) of foods through incorporation of less expensive wheat flour for food product enrichment (Meilgaard *et al.*, 1999) [10].

The idea of utilizing *Terminalia arjuna* in developing of herbal biscuits emerged from the fact that bakery products are relatively low moisture food with long storage life, they are easily available and can be consumed without any mess, they go handy as well as are palatable enough to keep you full but won't steal away your meal time. Biscuits incorporated with *Terminalia arjuna* will not only provide different taste and appeal but will also deliver certain

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health benefits. This medicinal plant possesses certain phytochemicals which when consumed in appropriate dosage will do excellent wonders (children-1-3g and adults 3-6 g per day after 2 hours of meal). The key motive for using medicinal plant in biscuit is to furnish the consumers with outmost benefits with the help of a food product which will improve your health in a positive manner which medicines won't be able to supply. So, why not prevent ill-effects with something luscious and healthy and let medicines rest. As said, food is magical to people who find it.

Terminalia arjuna is a tree of the genus *Terminalia*. It is commonly known as arjuna or arjun tree in English. The *Terminalia arjuna* is about 20–25 meters tall; usually has a buttressed trunk, and forms a wide canopy at the crown, from which branches drop downwards (Aslam *et al.*, 2014) [4]. It has oblong, conical leaves which are green on the top and brown below; smooth, grey bark; it has pale yellow flowers which appear between March and June; its glabrous, 2.5 to 5 cm fibrous woody fruit, divided into five wings, appears between September and November (Akubor *et al.*, 2003) [2]. The arjuna is usually found growing on river banks and near dry river beds in Bangladesh, Uttar Pradesh, Madhya Pradesh, south and central India (Karthikeyan *et al.*, 2003) [18]. The

active components in the herb are phenolic compounds-terminic acid and arjunolic acid, phenolic acids-ellagic acid and gallic acid, glycosides-arjunetin and arjunosides IV, flavones and Tannins, oligomeric proanthocyanidins, lactones and B-sitosterol and casuarinin (Gupta *et al.*, 2018) [8]. The present study was thus taken up to determine physico-chemical properties and overall acceptability of multi-grain herbal biscuits developed by utilization of *Terminalia arjuna* at different levels.

Materials and Methods

Terminalia arjuna barks were procured from M.A.U.U.P section, CCS HAU Hisar. The bakery ingredients such as wheat flour, sugar, semolina, gram flour, baking powder, sodium chloride salt, pearl millet flour, clarified butter and curd were procured from local grocery store of Jaipur. Barks of Arjuna were cleaned, washed and dried in cabinet dryer at 50°C. Dried barks were ground to fine powder in a hammer mill, packed in LDPE bags and stored at room temperature for use in herbal biscuits. The formulation for development of different variants of biscuits is given in table No 1 and procedure for biscuit preparation is shown in Flow sheet (Fig. 1).

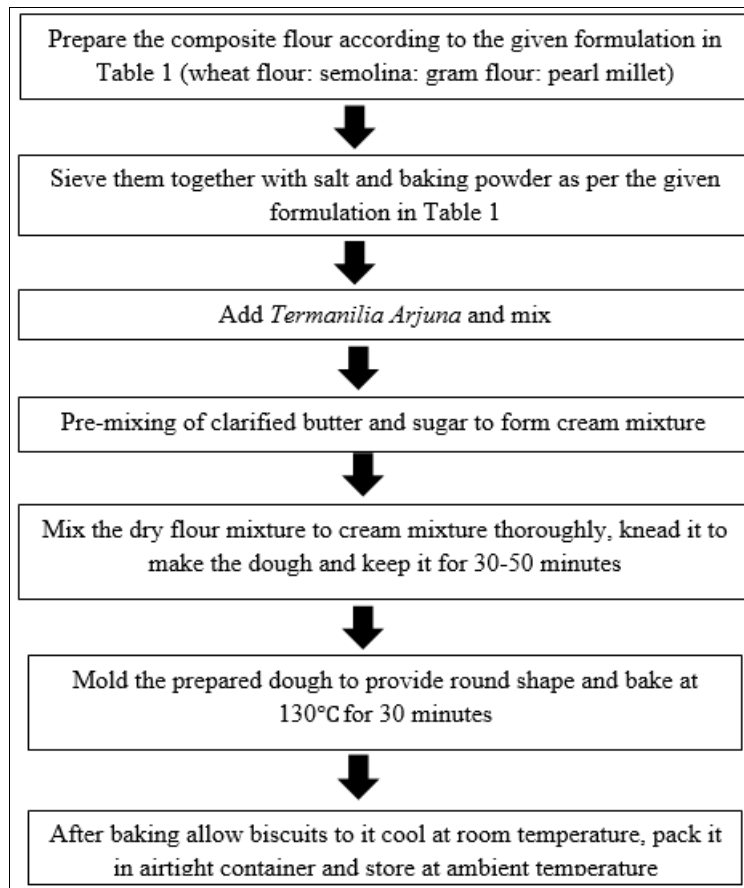


Fig 1: Process Flow Chart for Herbal Biscuits.

Analysis

The biscuits were analyzed according to different parameters such as moisture content, ash content, weight loss, spread ratio, thickness and diameter. Moisture content was carried out by the forced draft-oven method (AACC method 44–15A). Dry ashing was carried out by the AOAC method 9002. The weight of the biscuits before and after baking was taken to calculate weight loss. The diameter was measured with a

caliper before and after baking. To determine the diameter of biscuits, five samples were placed next to another and the diameter was measured. Thickness of the five biscuits was measured by caliper one by one. The spread ratio was calculated by dividing diameter of biscuits with thickness of biscuits (Cauvain *et al.*, 2009) [7].

The sensory evaluation was conducted using the nine-point hedonic scale as described by Rangana (2004). The food

samples were prepared in identical sample containers, coded with two-digit numbers and each sample was presented with different number. The series of sample was presented once at a time to each panelist. Panelists were asked to evaluate the coded samples for each sensorial parameter.

3. Result and discussions

3.1 Compositional value

The compositions of biscuits (S1, S2, S3, and S4) are shown in Table 2. The moisture content decreases with increase in *Terminalia arjuna* amount incorporated in biscuits. The moisture content of biscuits should range between 1 to 5%. Thus, S3 and S4 variant in the preparation of biscuits will produce more shelf-stable product due its lower moisture content. The ash content was found for all samples (Table 2). Ash content of biscuits ranges from 1.05 to 1.42%. The highest value of ash content (%) was observed in S2, while lowest value for ash content (%) was reported in S4 than in control (S1) (Bala *et al.*, 2015). The ash content remains constant with increasing the *Terminalia arjuna* amount but there is relative decrease in ash content in S4 variant of biscuit which may be associated with the presence of lesser ash content with increase in the *Terminalia arjuna* multi-grain biscuit.

3.2 Physical properties of biscuits

The physical properties of biscuits are tabulated in Table 2. Results of these studies suggest that weight loss increased from control (S1) to S4 which is proportional to increased concentration of *Terminalia arjuna*. The diameter of control

(S1) and S2 are relatively similar, and the diameter of S3 and S4 vary by 1.73mm. The highest diameter is possessed by S3 biscuits with 2% of *Terminalia arjuna* powder. Results of thickness measurement include increment of thickness from control (S1) to S4 which concludes that thickness of the product is increased when there is an increase in *Terminalia arjuna* amount. Spread ratio analysis indicates the reduction of spread ratio from control (S1) to S4 which results in proportionality of spread ratio with reduction in *Terminalia arjuna* powder quantity.

3.3 Sensory score of biscuits

Sensory evaluation of multigrain herbal based biscuits was performed using 9 point hedonic scale described by Ranganna (2008) [12]. The overall acceptability of the biscuits was based on the mean scores obtained from all the sensory characters (color, appearance, flavor, taste, mouth feel and overall acceptability) (Kaushik *et al.*, 2017) [11]. The scores of sensory evaluation were obtained from semi-trained panelists are tabulated in Table 3. Results obtained from the present study indicated that consumers expect the biscuits to have light color and may reject biscuits with the dark color which would be reddish brown in color. Aroma, texture, tastes and color of S2 is of highest score of 8. Overall acceptability of S2 is of highest score of 7. There were no significant differences in overall acceptability for S1 and S2 (7.18-7.85) as compared with S3 and S4 (4.57-5.85) (Watts *et al.*, 1989) [17]. The biscuits with S2 variant with 2% *Terminalia arjuna* have been chosen best due to its preferred taste, color and appearance score as shown in below pictures named as Fig. 2.

Table 1: Formulation for different variants of herbal biscuits

Ingredients(g)	S1	S2	S3	S4
Wheat flour	60	58	56	54
Semolina	10	10	10	10
Gram flour	25	25	25	25
Pearl millet flour	5	5	5	5
Powdered sugar	66	66	66	66
Clarified butter	80	80	80	80
Curd	2	2	2	2
<i>Terminalia arjuna</i>	-	2	4	6
Baking powder	3.5	3.5	3.5	3.5
Sodium chloride salt	1	1	1	1

Table 2: Physico- chemical characteristics of herbal biscuits

Treatment	Characters					
	Moisture content	Ash content	Weight loss	Diameter	Thickness	Spread ratio
C	1.11±0.47	1.37±0.27	0.88±0.4	5.33±0.12	0.93±0.08	5.80±0.55
S1	0.59±0.31	1.21±0.009	1.68±0.26	5.80±0.06	1.27±0.03	5.77±0.55
S2	0.44±0.07	1.09±0.003	1.36±0.15	6.60±0.15	1.40±0.06	4.53±0.15
S3	0.34±0.11	1.04±0.003	1.38±0.26	5.73±0.41	1.80±0.06	3.13±0.18
C.D.	N/A	N/A	N/A	N/A	±0.233	±1.635

Table 2: Sensory evaluation of herbal biscuits

Treatment	Characters				
	Color and appearance	Aroma	Taste	Texture	Overall Acceptability
C	8.00±0.37	7.85±0.85	7.61±0.93	7.36±0.80	7.84±0.70
S1	7.28±0.77	7.02±0.69	7.02±0.52	6.12±0.63	7.43±0.60
S2	7.05±0.69	6.28±0.74	6.12±0.57	6.01±0.42	6.96±0.42
S3	6.75±0.69	5.88±0.84	5.89±0.81	5.69±0.84	5.88±0.68
C.D.	N/A	N/A	N/A	N/A	N/A

Data analysis

Data using completely randomized design was analyzed using OPSTAT (statistical pack-age for agricultural workers). The

data reported in all tables are an average of triplicate observations subjected to one way analysis of variance (ANOVA).

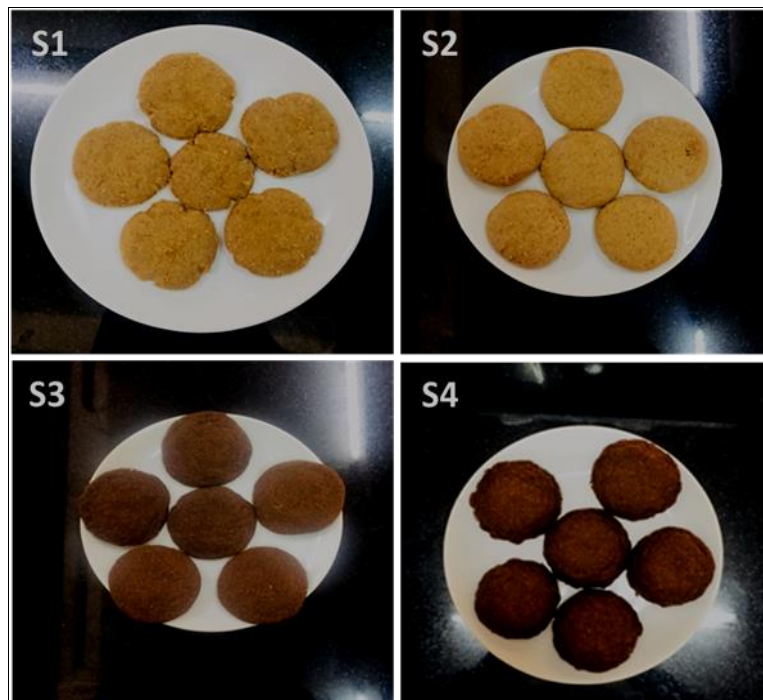


Fig 2: Biscuits after baking with different *Terminalia arjuna* percentage

Conclusion

The product has been developed with incorporation of *Terminalia arjuna* (Ubbor *et al.*, 2009) ^[16] in different concentrations as *Terminalia arjuna* is beneficial for cardiac health (Meghwani *et al.*, 2017) ^[19]. The product went under several analyses and the result obtained helped in reaching to a satisfied ratiocination. The biscuits prepared with *Terminalia arjuna* of 2% have optimum ash content. The moisture content of S4 is lower than S3 and S2 and control. However, it has higher spread ratio as compared to S4 variant with 6% *Terminalia arjuna*. An increase in the amount of *Terminalia arjuna* in biscuits results in an increase in diameter and spread ratio without affecting the texture (Aziah *et al.*, 2011) but not much change in thickness in variants as compared to control (S1) was observed. The weight loss and moisture content was found to be lower in S4 variant of 6% *Terminalia arjuna* which results in low water absorption capacity of TA. However, all the *Terminalia arjuna*-containing biscuits were not comparable to the control biscuits in term of the overall acceptability, because higher amount of *Terminalia arjuna* (4-6%) results in darker color and undesirable flavor which brings unsatisfied score in sensory analysis. Therefore, S2 variant holds the appropriate qualities as a biscuit with higher shelf-life, low moisture and ash content, low spread ratio, good color, flavor and desirable sensory score and most importantly provides good cardiac health in required daily amount as RDI (recommended daily intake) value (okafor *et al.*, 2002) ^[13].

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