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THE EFFICACY OF AFRICAN LOCUST BEANS IN THE PRODUCTION OF SHORTBREAD BISCUITS

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ABSTRACT: *African Locust bean (Parkia Biglobosa) fruit pulp "Dozim" was investigated and used in producing shortbread biscuits. The study examined the possibility of combining "Dozim" and wheat flour to produce shortbread biscuits. "Dozim" currently is being used minimally in Northern parts of Ghana where it grows in abundance. The investigation was in search for local nutritious food options to address the myriad of food scarcity and acute malnutrition issues affecting rural people in the Northern part of Ghana. To explore the feasibility of producing shortbread biscuit with "Dozim", samples of Dozim flour were sourced across the five regions of Northern Ghana where the African Locust bean tree species is pronounced. A composite "Dozim" wheat flour was produced from which the shortbread biscuit was prepared after homogenization. A random selection of 50 untrained panelists carried out the sensory evaluation of the product, which included color, texture, flavor, mouth feel and overall acceptability. Ninety percent (90 %) of the respondents liked the "Dozim" shortbread biscuit for its taste, texture, color, flavor and appearance. The research encourages caterers especially school feeding caterers in Ghana to use "Dozim" in the production of nutritious shortbread biscuits and other confectioneries to increase its use and consumption.*

KEYWORDS: "Dozim", shortbread biscuit, African Locust beans *(Parkia Biglobosa),* school feeding program

INTRODUCTION

"Dozim" which literally means African Locust Bean flour (ALB) in 'Dagbani' is the sweet yellow powdery pulp of (*Parkia biglobosa*) It is a widely distributed tree species of most West African countries and remains one of the commonest trees in Northern Ghana (Zakari et al., 2015; Orwa et al 2009). In Ghana, the tree is mostly found in the Northern, Upper East, Upper West and some part of the Southern sector such as Keta Karachi (Volta Region), Ejura (Ashanti Region) and Kwahu (Eastern Region). ALB is a perennial, deciduous tree that ranges in height from 7 m to 20 m and bears a large crown with branches that spread wide and which typically are attached low down onto the stout bole. It has brownish grey bark, and longitudinal gaps,

green leaves at flowering and reddish-brown during fruiting stages (Leaky, et al 1999: Musa et al.2005).

The ALB grows from the natural environment and it is recognized for the food value of its fruits (Koura et al 2011). A single fruit consist of a number of branches of pods and remains the most valuable part of the plant (Koura et al. 2011). Within each pod is a seed covered with a yellow, fruity powdery pulp called "Doori" the seeds are used in the preparation of "dawadawa" a local seasoning, used in many traditional dishes in enhancing flavour (Adeyeye 2013). The yellow pulp has been underutilized and minimally used for preparation of porridge and eaten as fresh food (Campbell-Platt 1980; Felker, 1981), it also eaten or mixed with water to make a sweet and refreshing drink rich in carbohydrates (Akoma 2001). The powdery fruit pulp contains more carbohydrate than the seeds, the carbohydrates being primarily reducing sugars (19.00%), non reducing sugars (9.00%) and other complex carbohydrates (36.00%) (Uwaegbute, 1996). The nutritional sufficiency of the African locust bean seeds has proximate composition of 30.00% protein, 15.00% fat, 4.00% crude fiber, 2.00% ash and 49.00% carbohydrate as stated by several researchers (Gernah, et al. 2007). In view of its availability, nutrition and health benefits, it is important that, the yellow powdery fruit pulp which is used sparingly be incorporated into most of our food products (Orwa et al. 2009). Hence, this research used the dried fruit powdery pulp in producing shortbread biscuits as means of improving the nutritional needs of people especially children in poor areas of Northern Ghana. The fruit pulp is used in Africa in times of food crises and when the grain stores are empty, which is an indication it editability and non toxicity (Gernah et al. 2007).

Consumers demand for quality, organic and nutritious foods in resent times is increasing (Gernah, et al.2007), hence the need for food manufacturers to develop new nutritious and affordable products to meet their increasing demand. Combining underutilized local fruit to popular recipes will enhance their consumption. A typical example of such initiation is the use of leguminous seeds and other cereals because of the high cost of animal proteins and their economic value. This has been demonstrated in the production of cookies such as cake using rice and soya beans (Bond, 2004).

A biscuit is a small thin crisp cake made from unleavened dough and is regarded as a form of confectionery, dried to very low moisture content (Zakari et al., 2015; Agu et al., 2007). In a more detailed assessment, biscuit is a mixture of flour and water, often with the addition of fat, sugar and other ingredients, mixed together into dough which is rested for a period of time and then rolled out into a sheet that is cut in smaller pieces and baked (Okaka, 1997). Biscuits are ideal for nutrient availability, palatability, compactness and convenience and there are many different kinds of biscuits on the market. They differ from other baked products like bread and cakes because of low moisture content, comparative free from microbial spoilage and long shelf-life (Mian et al., 2009). Biscuits may be classified either by the degree of fortification and processing or by the method adopted in shaping them (Zakari et al. 2013).

Biscuits are non-fermented aerated mix variety of flour confectionary products which are eaten as snack or dessert (Zakari et al. 2013). The fundamental ingredients mostly used in their production include flour, butter, sugar and eggs. It is suitable for special occasions like birthday parties and wedding receptions and school feeding. Thus, the main objective of the study was to use composite ALB fruit pulp and wheat flour in the preparation of shortbread biscuits. Specifically, the research sought to develop standard recipe for the production of the shortbread biscuit using composite ALB fruit pulp or "Dozim" and to examine consumer acceptability of the shortbread biscuit. Therefore, knowledge of a wider understanding and use of "Dozim" fruit pulp has been documented in the current research.

Most biscuits extensively eaten globally are produced from wheat flours which is the main constituent. But in recent times there has been a growing awareness of the importance of non-timber forest products, for the role they play in the economy of many indigenous industries, and also for their potential and importance to the economies of many developing countries. One such good example of a tree is African Locus bean tree. According to Popoola and Maishanu, (1995), there is considerable interest concerning the optimal utilization of forest resource base while at the same time protecting biodiversity and ensuring sustainability. Knowledge of the potential utilization of these products and their transformation and commercialization, would favour their promotion.

MATERIALS AND METHODS

Material Source

The "Doori" the fruit of ALB and the rest of the ingredients were bought from a Tamale Central Market. The equipment used for the product development was from the department of Hospitality and Tourism, Tamale Technical University, Tamale.

Production of "Dozim"

The African locust bean fruit flour from the mesocarp was prepared in accordance with Gernah et al. (2007). The brown exocarp covering the yellow mesocarp was manually stripped open. The pre-dried mesocarp was then separated from the endocarp or the seeds embedded within the mesophyll by pounding with a motor and pestle. The yellow flour was allowed to dry under the sun for two days until a constant mass was obtained. The dried powder was then sieved using a 0.5 mm mesh screen and packaged in low density polythene bags. The flour was stored in air-tight container at room temperature from where samples were taken for processing and analysis.

Preparation of "Dozim" biscuit

All dry ingredients such as "Dozim", sugar, baking powder, nutmeg was mixed together according to Ceserani and Kinton (1995) with some modifications. The ingredients were then rubbed in with the fat for 10 min during which time it looked like bread crumbs. Milk, eggs and

vanilla essence was added and mixed to form a dough. It was rolled out on a sheeting board and cut into 4 mm x 5 mm x 2 mm in shape. The cuts biscuit was placed on greased baking trays, covered, rested for about 15 minutes and allowed to bake at oven with temperature of 180 ^{o}C for about 40 - 50 min. After baking, it was allowed to cool in aluminum trays for 4 hours before being packaged in polythene bags and stored tightly in sealed containers.

There were two recipe trials and the better of the two was selected by sensory analysis. The approximate amounts of the various compositions of the biscuit for both first and second trials are shown in **Table 1**. Following the assessment and recommendations made about the outcome in the first trial, some adjustments were made in the production process which then constituted the second trial.

Table 1: Ingredients and their quantities of first and second preparation trials

Serial No.	**Ingredient**	**Quantity**	
		First Trial	**Second Trial**
1	Sugar	200g	50g
2	Margarine	100g	50g
3	Baking powder	½ teaspoon	½ teaspoon
4	"Dozim"	100g	400 g
5	Wheat flour	200 g	50g
6	Vanilla essence	1 teaspoon	2 teaspoons
7	Nut meg	1 whole	1 whole
8	Milk	4 table spoons	4 tablespoons
9	Eggs (raw)	4	4

Sensory Analysis

The samples were evaluated by using untrained panelists of fifty (50) made up of staff and students. The panelist evaluated the organoleptic quality i.e. color, texture, flavor, mouth feel and overall acceptability using a five-point hedonic scale where five represents like extremely and one represent dislike extremely. Consumer testing was conducted at the Catering department of Tamale Technical University. The products were served to each panelist in similar sample retaining plate. The panelist rinsed their mouths with warm water before and after testing a product to avoid carry over effect.

Study Design

The research employed a descriptive study design, that is, a cross-sectional survey of sampled participants (consumers) to ascertain their opinions or preferences for the "Dozim" biscuit. The study was designed to address the taste, texture, appearance, color and flavor of the product.

Data Collection Procedure

The study used both primarily and secondary data sources. A questionnaire was used to obtain primary source information on the sensory analysis of the biscuits. whereas the secondary sources were from books, journals, articles and the internet. Reliability and validity of the data from the research was ensured with pretesting of the questionnaire.

Data Analysis

The data gathered in the study was analyzed using the Statistical Package for Social Sciences (SPSS) package. The analyses were simply exploratory and as such, it was not intended to make generalized inferences about the larger population but limited to only the samples taken. Simple frequency distribution tables were the main means by which the data was presented and trends across the variables interpreted and discussed.

RESULTS AND DISCUSSION

Demographic Characteristics of respondents

The basic demographic characteristics of respondents were shown in table 2. The gender of the respondent was assessed, the results in table 2 above reveals that twenty (20) of the respondents were males and thirty (30) were females representing 40% and 60% respectively.

Table 2: Analysis of respondents' demographic information

Characteristic	Frequency	Percentage (%)
Gender		
Male	20	40
Female	30	60
Total	**50**	**100**
Age		
≤ 18	5	10
19 – 30	30	60
31 – 60	15	30
Total	**50**	**100**

The age of the respondent was another basic demographic characteristic that was assessed. Five (5) respondents representing 10%, were 18 years or below. Whereas thirty (30) respondents representing 60%, fell within 19-30 years, fifteen (15) respondents or 30 % fell within the age range of 31-60 years.

Standard recipe for the production of the biscuit from "Dozim"

The "Dozim" shortbread biscuit was first produced using the recipe shown in **Table 1**. Forty-eight percent (48%) disliked the taste very much (table 3) concluding it was too sugary this might be due to the sweetness of the fruit pulp. Although a similar number of respondents liked the biscuit much, in general 52 % did not like the taste of the shortbread biscuit because of its high sugar levels. The outcome of the first trial process was used to improve on the second and final recipe with a reduce sugar. The respondents recommended the product but advice that the sugar levels in the biscuit was high making it taste too sugary. Besides, the 52 % respondents who thought the sugar content was high observed that the "Dozim" could not be felt much and thus suggested the sugar quantity be reduced and the Dozim increased. The table below (Table 2) was the general sensory analysis and acceptability of the first trial of the Dozim shortbread biscuit.

Table 3: General attributes of the Dozim shortbread biscuit produced from first trial production

Attribute	**Appearance**		**Colour**		**Flavour**		**Taste**		**Texture**		**General Acceptability**	
Rating	F	%	F	%	F	%	F	%	F	%	F	%
Disliked very much	1	2	0	0	1	2	24	48	1	2	1	2
Disliked much	3	6	51	10	2	4	2	4	1	2	23	46
Like much	25	50	82	36	25	50	24	48	26	52	24	48
Liked very much	21	42	7	54	22	44	0	0	22	44	2	4
Total	**50**	**100**	**50**	**100**	**50**	**100**	**50**	**100**	**50**	**100**	**50**	**100**

Second Trial "Dozim" shortbread biscuit production

The outcome from the second trial process received satisfactory comments from the more experienced panel staff members of the catering department and school feeding program caterers. Therefore, the final or standard recipe after making adjustments in fulfillment of the recommendation is presented below.

Table 4: Recipe for "Dozim" Biscuit **(**final trial)

Ingredient	**Quantity**
Sugar	50g
Margarine	100g
Baking powder	½ teaspoon
"Dozim" power	400g
Wheat flour	50 g

Vanilla essence	
Nut meg	1 whole
Milk	4 tablespoons
Eggs	4

Consumer Acceptability

This section examines the responses of panelists with regards to the variables set to measure the quality of the biscuit. The variables include; appearance, taste, texture, color and flavor of the "Dozim" shortbread biscuit.

Appearance

It is very vital to access the general appearance of the "Dozim" shortbread biscuit. This includes its packaging and eye appeal, it is important for consumers seeing the product from afar even without tasting it develops some interest in the product, and hence will want to purchase the product. This is a very vital attribute to look for in order to enhance and ensure that the "Dozim" shortbread biscuit acceptability commercially. As a result, the shortbread biscuit appearance was examined as presented in table 4 below.

Table 5: Sensory Assessment on Appearance

Attribute	**Appearance**		**Colour**		**Flavour**		**Taste**		**Texture**		**General Acceptability**	
Rating	F	%	F	%	F	%	F	%	F	%	F	%
Disliked very much	1	2	0	0	1	2	0	0	1	2	1	2
Disliked much	3	6	5	10	2	4	2	4	1	2	2	4
Like much	25	50	18	36	25	50	24	48	26	52	24	48
Liked very much	21	42	27	54	22	44	24	48	22	44	23	46
Total	**50**	**100**	**50**	**100**	**50**	**100**	**50**	**100**	**50**	**100**	**50**	**100**

The general appearance of the shortbread biscuit in terms of packaging and color was very satisfactory and appealing. The responses from the participants ascertain this claim. Majority (50%) of the respondents liked the appearance of the biscuit very much, 42% liked the product much, 6% disliked the product much and 2% dislike the Dozim shortbread biscuit very much.

Taste

The crucial and major means of appreciating the quality of the "Dozim" biscuit is through using the sense of taste. Hence the taste of the shortbread biscuit was accessed. Respondents rating of the taste of the "Dozim" shortbread biscuit is presented in **Table 5** above

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The taste of the "Dozim" shortbread biscuit was unanimously valued by the respondents as 48% and 46% rated the product like very much and like much respectively, 4% dislike the taste of the

product. This suggests that the "Dozim" shortbread biscuit was accepted in respect to its taste which is the major factor for consumer purchasing decision.

Assessing the quality of the texture

The texture of the product is considered in consumer purchasing decision. Texture of a food product can affect the general quality of the entire food after production. Hence the texture quality of the "Dozim" shortbread biscuit was accessed. The respondents rating on the texture of the product is presented in **Table 5** above.

Texture

It is evident that the product was undeniably good in terms of its texture; it is shown that 52% of the respondent likes it very much, 44% like it much 2% dislike the texture and 2% dislike the texture of the "Dozim" shortbread biscuit.

Colour

The color appeal of the product goes a long way in influencing consumer purchasing decision. The attractiveness of the product can influence the consumer purchasing decision either positively or negatively. Hence an assessment was made on the quality of color of the product. The respondent rating of the quality of color is presented in **Table 5** above.

The appealing color of the "Dozim" shortbread biscuit was greatly liked by the respondents, since color plays a vital role in the consumer purchasing decision, because first impression always counts in view of this, about 54% of the respondents liked the color of the "Dozim" shortbread biscuit very much, 36% liked the color much, 10% of the respondent did not like the color of the shortbread biscuit.

Flavour

The flavour of a product also contributes to the overall quality of that product, flavor is one attribute most consumers look out for when patronizing a product. In view of this the flavour of the "Dozim" shortbread biscuit as an attribute was assessed to know the respondent views on the flavour of the biscuit. The respondent rating of the quality of flavour is presented in **Table 5.**

It is evident that the "Dozim" shortbread biscuit was acceptable in terms of its flavour; it is shown that 44% of the respondent like it very much 40 % like it much, 4 % dislike the flavor and 2 % did not like the flavor of the "Dozim" shortbread biscuit.

CONCLUSION AND RECOMMENDATIONS

Based on the methodology, findings and analysis discussed in this work, this final chapter presents a brief summary on the previous chapters and makes recommendations for further action and studies. The objectives of the research were reviewed as to whether they were achieved or not. The main objective of the study was to produce "Dozim" shortbread biscuit.

Thus, the main objective of this study was achieved together with the specific objectives. The results of the sensory evaluation conducted on the appearance, taste, texture, color and flavour of the shortbread biscuit give credence to this assertion.

Recommandations

- "Dozim" flour is recommended for the preparation of shortbread biscuits, cakes, and other confectionaries to increase the use and consumption of "Dozim".
- "Dozim" products and by-products can be commercially exploited for multiple purposes hence more attention should be put on ways by which "Dozim" can be used to develop new products to the market.
- Awareness should also be made on the various ways by which "Dozim" can be used for various culinary products.
- Effective marketing strategies need to be adopted to make the shortbread biscuit marketable.

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