JETIR.ORG ISSN: 2349-5162 | ESTD Year : 2014 | Monthly Issue
JOURNAL OF EMERGING TECHNOLOGIES AND INNOVATIVE RESEARCH (JETIR)
An International Scholarly Open Access, Peer-reviewed, Refereed Journal

"Nutritional Profile of Value AddedFood Products Derived from Tamarind Seeds (*Tamarindus indica*)"

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***Abstract*:** The present study aimed at investigating the potential of tamarind seed powder as a viable material for the development of variety of food products. The study objectives was to explore the feasibility of utilizing other properties of tamarind seed powder, along with other nutritious ingredients, to develop an ideal alternative to peanuts which can cause allergic reactions.

The research began with the collection and processing of tamarind seeds to make the kernel powder. The next step involves the formulation of tamarind seed butter spread and peanut-tamarind seed burfi. The primary ingredients used in the formulation included tamarind seed powder, butter, salt, palm jaggery and peanuts. The combination of these ingredients optimized to achieve the desired texture, flavor, mouth feel, aroma which was essential to prepare exquisite food products. The developed products were subjected to nutritional analysis. The results states that the underutilized tamarind seeds have valuable composition to develop functional foods.

***Index Terms* -** Tamarind seed, Peanut allergy, Spreader, Burfi

I. *INTRODUCTION*

Breakfast spreads (defined as margarine and spreads, butter, spreadable processed cheese, nut and seed spreads, and yeast extracts) had a global market volume of 46.6 million tonnes and a value of US$56 billion in 2016 (Euro monitor International, 2017). Margarine is the most popular product (5.2 million tonnes), followed by butter (3.2 million tonnes), spreadable process cheese (2.1 million tonnes), nut and seed spreads (688 million tonnes), and yeast extracts (16.2 K tonnes). However, the butter category has the highest retail value (US$17.5 billion), followed by processed cheese (US$15.2 billion), margarine and spreads (US$14.3 billion), nut and seed spreads (US$3.4 billion), and yeast extracts (US$0.2 billion). Since 2011, the overall volume and retail value have decreased by 8.9% and 9.7%, respectively, throughout the entire category. The drop in total volume is attributable to the margarine and spreads (4.5 per cent) and yeast extract (6.6 per cent) categories.

Tamarind can tolerate five-six months of drought conditions; hence tamarind crop can grow in any type of climate. Tamarind pod contains 30% pulp, 40% seed and 30% shell by weight. Conventionally, tamarind pulp is used for preparing different food products and medicated products. Tamarind seed and shell occupies 70% of the pod weight. Tamarind pod shell can be used as fuel, absorbent for the removal of methylene blue and amaranth dyes from aqueous solutions. Tamarind seed can be used after processing, i.e. after removing outer layer of the seed in food industries, textile industries, craft industries, furniture industries.

The study was taken with the objective to explore the possibility of developing value added food products form Tamarind seed powder and analyze the nutritional composition of the developed products.

II.*MATERIALS AND METHODS*

Based on the available data, it was found that there is no butter spread available in the market developed using Tamarindus indica seed powder. In the present study, spread and burfi, the traditional sweet was formulated using tamarind seed by replacing the peanut in the standard recipe. The ingredients were chosen keeping in mind their nutritional profile and availability, to formulate a spread and traditional Indian sweet- Burfi. The ingredients chosen were done based on the recipes used for the formulation of food products. Three different variations were developed with selected ingredients by replacing the peanut with tamarind seed in the standard recipe. The tamarind seed and peanut were taken in the ratio of 3:1. 2:1. 1:1. The developed recipes were subjected to sensory evaluation using 5 point hedonic scale by expert panel. The most accepted variation was chosen for the further analysis.

III.*RESULT AND DISCUSSION*

1. Sensory Analysis

The following table 1 and figure 1 give the sensory analysis of the most accepted tamarin-based butter spread -TSS and burfi -TBS

Table 1: Sensory analysis of most accepted tamarind based food products (TSS & TBS)
Out of 10

Sl. no.	Colour		Appearance		Flavor		Taste		Texture		Overall acceptability	
	TSS1	TBS2	TSS1	TBS2	TSS1	TBS2	TSS1	TBS2	TSS1	TBS2	TSS1	TBS2
1	7	8	8	8	7	8	6	8	8	8	8	7
2	8	8	8	7	8	8	8	7	8	8	8	6
3	8	9	8	7	6	7	7	8	8	8	7	7
4	8	8	8	7	7	8	7	7	8	7	8	7
5	8	8	7	8	6	8	6	8	7	8	9	8
6	8	7	9	8	8	7	8	8	7	8	8	7
7	8	7	8	8	7	8	7	8	8	7	8	8
8	8	8	8	7	7	9	7	8	8	8	8	7
9	7	8	8	8	7	9	7	9	7	8	9	7
10	8	7	8	8	7	8	8	8	8	9	8	8
11	8	8	9	8	9	8	9	9	8	8	8	8
12	8	7	9	7	8	8	8	8	9	8	7	7
13	9	8	9	8	9	8	8	8	9	9	8	8
14	8	8	9	7	7	8	8	8	8	8	9	7
15	7	8	9	8	7	9	8	8	9	8	8	8
MEAN	8	7.61	8.46	7.76	7.61	8.07	8.07	8	8.5	8.07	8.06	7.33

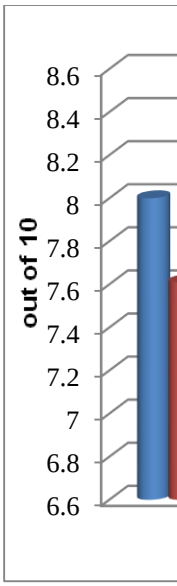

Figure 1: Sensory analysis of most accepted TS food products

2. Composition of most accepted samples

The sample S1 was most accepted among the samples in butter spread. The following table 2gives the composition of the Tamarind Seed Based butter spread -TSS1.

Table 2: Composition of the most accepted productbutter spread -TSS1

Ingredients	Amount of ingredients(grams)
Tamarind kernel powder	200
Butter	250

Table 3: Composition of most accepted burfi -TSB2

Ingredients	Amount of ingredients(grams)
Tamarind seed powder	250
Palm jaggery	150
Peanuts	200

3. **Nutrition profile of the most accepted food products**

a. Carbohydrate content

The following table 4 provides the carbohydrate content of the Tamarind Seed based food products (TS Food Products) in comparison with the standard peanut based food products (SP Food Products).

Table 4: Carbohydrate content of TS food products andSP Food Products

S. No.	Sample	Carbohydrate content/ 100g
1	Tamarind butter spread TSS1	59
2	Tamarind seed Burfi TBS2	60.1
3	Standard Peanut butterspread SPS	20
4	Standard peanut burfi SPB	52.43

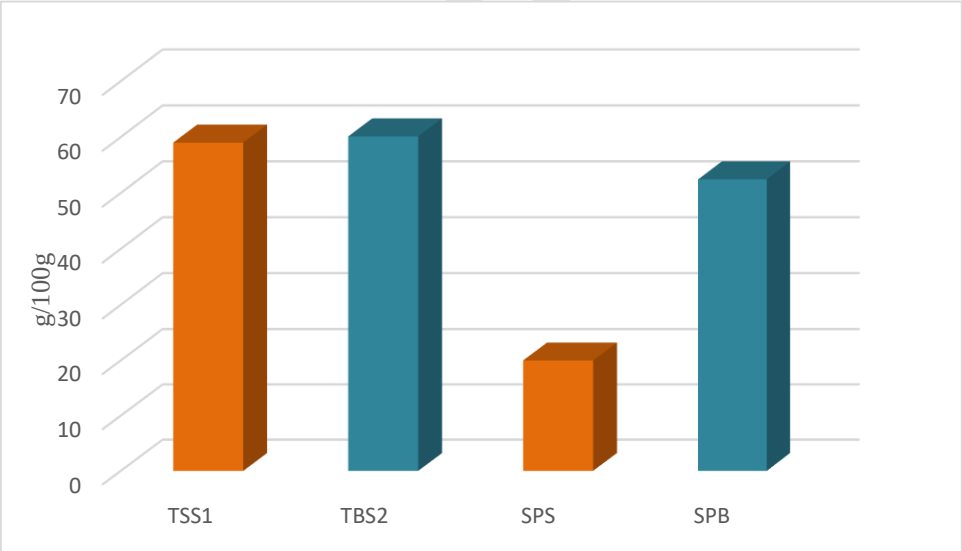

Figure 2: Carbohydrate content of TS food products and SP Food Products

The carbohydrate content of the tamarind seed based butter spread was found to be 59g and burfi was 60.1g. It was found to be more than the standard burfi. It might be due to the high carbohydrate content of the tamarind seed.(Gitanjali, 2020)

b. Moisture content

The following table 5 gives the moisture content of the Tamarind Seed based food products (TS Food Products) in comparison with the standard peanut based food products (SP Food Products).

Table 5 :Moisture content of TS food products and SP Food Products

S. No.	Sample	Moisture %
1	Tamarind butter spread TSS1	1.68
2	Tamarind seed Burfi TBS2	3.1
3	Standard Peanut butter spread SPS	1.49
4	Standard peanut burfi SPB	2.9

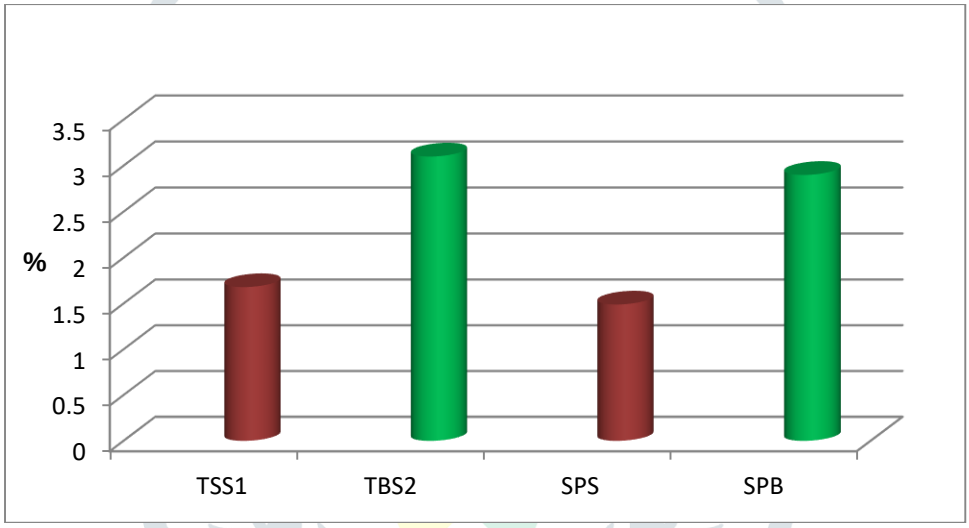

Figure 3: Moisture content of TS food products and SP food products

Moisture content ofTSS1 and TSS2 was found to be 1.68% and 3.1% respectively. The moisture content of bothTSS1 and TSS2 are similar to their standards. The moisture content in Tamarind kernel powder was recorded as 4.67 per cent.The moisture content in tamarind seeds as 8 and 10.75 per cent respectively; whereas, the moisture content in tamarind kernel in the range 11.40 to 22.70 per cent. The lower moisture content obtained in the present study may be due to the evaporation of moisture from the kernel as a result of heat treatment given to process them to tamarind kernel powder.(Gunasena and Huges et al.,2018)

c. Ash Content

The following table 6 illustrates the Ash content of TS food products and SP food products

Table 6 : Ash content of TS food products and SP food products

Sl.no	Sample	Ash%
1	Tamarind butter spreadTSS1	3.26
2	Tamarind seed Burfi TBS2	1.06
3	Standard Peanut butter spread SPS	3.16
4	Standard peanut burfi SPB	1.03

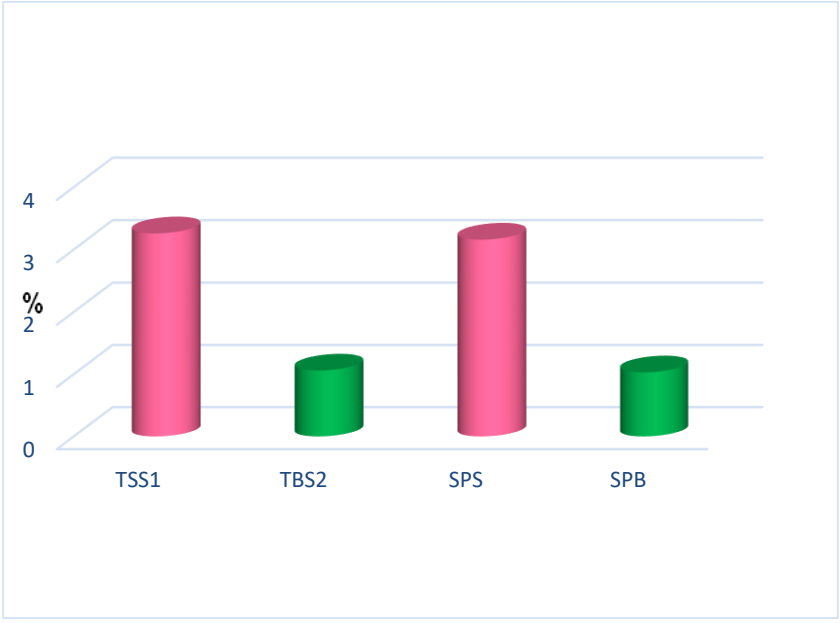

Figure 4 :Ash content of TS food products and SP Food Products

Ash content in S1 is 3.26% and S2 is 1.06%. The ash content of bothTSS1 and TBS2 are similar to their standards.Total ash which represents the total mineral content of the food stuff was found to be 2.50 per cent in Tamarind kernel powder.. Similar results were obtained for tamarind seeds .However, Gunasena and Huges reported that the ash content ranged from 3.90 to 16.20 per cent in tamarind kernel. Crudeprotein content of Tamarind kernel powder was estimated to be 24.61 per cent. It is in accordance with the previous studies in which the crude protein content was found to be 26.93 g and 24.28 g respectively. The crude protein content ranging between 15 to 20.90 percent which was slightly lower than the values obtained in present study. The protein content in Tamarind kernel powder was quite higher in comparison to the common cereals like rice and wheat and fall in the range of protein content of most pulses. Therefore, it is considered to be a cheap source of protein.(Gunasena and Huges et al.,2018).

IV.CONCLUSION

In conclusion, the development of butter spread and burfi by incorporating tamarind seed powder shows promising results in terms of taste, texture and flavour. The composition of the developed products shows that it can be used as an alternative to peanuts which cause food allergy to many consumers. Additionally, this can be used as a novel idea which can be turned into a business idea. However, more preferable product is tamarind seed butter spread which gives unique flavor and texture which is very similar to peanut butter spread. A limitation is that tamarind seeds should be obtained in bulk quantities and shell should be removed but this can be easily done when it is applied in an industrial level.

Further research and development are necessary to address the processing of tamarind seeds and improve the overall performance of the tamarind seed powder-based butter spread and burfi.. Exploring alternative additives or modifying the formulation could potentially enhance the physio-chemical properties without compromising the product's flavor and other properties.Further in depth studies are needed to provide a clear insight into the antinutritional factors of tamarind seeds if any. Despite the current limitation, this study highlights the potential of utilizing tamarind seed powder as a renewable resource for butter–spread production.

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