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Nutritional analysis of cereal bars formulated using *Morinda citrofolia* and *Bacopa monnieri*

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Abstract
The present formulation of both herbs with amalgamated food ingredients has been found to be beneficial for health. Cereal bars are products which are manufactured with cereal grains and the other ingredients such as fruits, legumes, dehydrated or crystallized fruits, nuts, chestnuts, almonds, candies, chocolates, sugar, etc. So, the fortified herbal cereal bars are the new way to provide a synergistic effect. It contains high protein, low carbohydrates, high fiber, vitamins, minerals, low sodium, and antioxidants. The bars were prepared using Noni and Brahmi herbal extracts and other ingredients like puffed rice and chocolate. Brahmi has a marked ability to enhance memory power and also it has many beneficial health effects and noni has high rich source of antioxidants and it also has beneficial neural effects and other disease prevention properties. These herbs are sources of bioactive phytochemicals. The bars were formulated in three different formulations. One is standard with no herbs and other two containing herbal mixture with 2% and 4% formulation. Estimation of antioxidants, total flavonoid, total phenolics and saponin content were also done. Formulated bars were also tested for various sensory and nutritional components and were found to be a good source of energy. The fiber content for cereal bar containing 2% herbal mixture and 4% was 2.03±0.65 and2. 43±0.26 percent. It was also found that these bars contain high amount of carbohydrate (Standard: 50.50±0.34, F-I50. 63±0.43, F-II 50.45±0.80) and fats (Standard: 29.25±0.06 F-I 27.34±0.81, F-II 25.26±0.04). The overall acceptability of three selected formulations was evaluated and it was found to be acceptable.

Keywords: formulated bars, nutritional analysis, sensory analysis, phytochemical analysis

1. Introduction
In today's world, people are more health conscious and keep safety limits in eating habits. These modern lifestyle are big contributors for causing illness and poor health (Shridhar G, *et al*., 2015) [1]. In fact, for teenagers and school going children too it is seen to be affected. Basically, these foods contain artificial coloring and preservatives which cause ill health affects (Iriti M *et al*., 2010) [2].

Organic agricultural products and herbs have been used in foods and edible items since ancient times (Gottardi, N *et al*., 2016) [3]. Food items mixed with herbal extracts or formulations have gained popularity for its taste, health benefits, detoxifying properties and formulations. As a result of the lifestyle changes foods are being changed to ready-to-eat form so that in one bite one can get a healthy diet.

In lieu of the above discussed things a formulation of herbs with chocolate bar is prepared and checked for various nutritional analysis and chemical tests to determine the presence of useful components in bars.

The two herbs are as follows:
1. *Bacopa monnieri*
2. *Morinda citrofolia*

1.1 *Bacopa monnieri*: *Bacopa* is a plant of the kingdom Plantae with small oval shaped leaves (Veena S Kasture *et al*., 2016) [4]. It has been used for various types of diseases and as traditional medicine from ancient times (Yuan, M *et al*., 2016) [5]. Basically the plant herb has no aroma and is bitter in flavor and taste if consumed at high dose. It supports to provide *in vitro* antioxidant and cell protective effects (Mukherjee A *et al*., 2017) [6]. *Bacopa* is mainly known for its activity to increase and improve memory enhancing power. It is also beneficial for respiratory diseases. *Bacopa* is mixed in combination with ghrita and in ayurvedic medicine it is known Brahmi ghrita. (Yadav KD and Reddy KRC, 2015) [7]. Brahmi marmalade is also available as food products in the market.

1.2 *Morinda citrofolia*: (Noni)
Morinda citrofolia is an herb of the native of southeast Asia and Australia commonly known as

Noni, Great *Morinda*, cheese, fruit, etc. and it bears small fruit in the shape of mulberry and is usually green in color with a fishy odor (Wang MY *et al*., 2002) [8]. Noni is mainly used for therapeutic and pharmacological functions. Mainly it consists of active compounds shown to inhibit antibacterial and immunological functions (Krishnakumar NM *et al*., 2015) [9]. Roots of Noni contain anthraquinone compounds which are proven to have shown antibacterial agents along with it consists of 1-methoxy -2 –formyl-3-hydroxy anthraquinone which can suppress the cytopathic, effect of HIV infected MT-4cells, without inhibiting cell growth (Umezawa K, 1992) [10].
The proposed formulated cereal bar consists of dark chocolate and puffed rice as a base material.

Dark Chocolate: Chocolate is good for the heart. It contains 70% cocoa. Chocolate is a favorite compound for all ages, especially children and also it has enough beneficial factors in terms of health concerns. It is highly rich in antioxidant and has cardiovascular benefits and is proved to reduce heart diseases, stroke, etc. Cocoa derived products and chocolate has suggested to play an important role in various kinds of severe diseases due to its high flavanol containing compounds (Engler *et al*., 2004) [11]. It contains high calories approximately in a range of 225-325 kcal (1000-1500kJ).

Puffed Rice: Puffed Rice is known as murmure is derived by heating rice kernels under high pressure in the presence of steam. It imparts a crispy, white in color, appearance and is used in many Indian Dishes. There are many useful benefits of using puffed rice as it increases and keep the shelf life extended. It increases the volume of projects and also there are less chance of growing microbes in puff rice. Yukwa a dish prepared in Korea has found out that the oil, puffed rice kernels has much extended shelf life than those puffed with air (Shin. *et al*., 1990) [12].

2. Materials & Methods

2.1 Reagents
The analytical grade reagents and solvents used in the sample preparation were purchased from local suppliers of Indchemie Pharma, Mumbai.

2.2 Main Ingredients
All the ingredients- Dark Compound Chocolate, Puffed Rice, butter were procured from the local market of North Delhi (India). Upon arrival all these ingredients were stored in refrigerator until usage.

2.3 Herbal extract
Bacopa monnieri and *Morinda citrofolia* herbal extracts were obtained from Kisalaya herbals limited, Indore.

2.4 Formulation of Cereal Bars
2.4.1 Cereal bars were prepared in three different formulations

Table 1: The formulations of cereal bars

Formulation	Puffed Rice (g)	Chocolate (g)	Herbs (g)
Standard	100	200	_
F-I	50	200	2
F-II	50	200	4

2.4.2 Procedure for formulation
All the ingredients were weighed in right proportions. The compound chocolate was melted at 50 ◦ C in a water bath and mixed with the herbs. The melted chocolate was poured into a plain vessel and puffed rice was spread over it one more layer of the melted chocolate was poured over the puffed rice grains to make a double layer. The prepared bar was refrigerated till further usage

2.5 Determination of nutritional constituents
For nutritional analysis the formulated bars were crushed in mortar and pestle.
Moisture and total ash content were determined by AOAC methods (AOAC, 2000) [13]. The determination of Fat content and total protein content was done by following the methods described by S. Ranganna, S. (Ranganna, 1999) [14]. Crude fibre content was assessed using the AOAC method (AOAC, 2000). Total Carbohydrate was estimated by Phenol-Sulphuric acid method described by Brand-Miller J and Holt S (Brand-Miller J, Holt, 2010) [15].

2.6 Antioxidant activity evaluation
2.6.1 DPPH free radical scavenging activity
DPPH free radical scavenging activity was analyzed by the method of Blois, (2000) [16] with slight modification as described in the paper.

2.7 Sensory Evaluation of formulating Biscuits
The sensory qualities, particularly the flavor attributes, are essential to be measured subjectively (S Ranganna, 1999) [14]. The main objective behind the sensory analysis is to check the overall acceptability of the formulated biscuits. The samples were evaluated for color, flavor, crisp and general acceptability using a 9 point hedonic scale where 9 was equivalent to like extremely 1 meant dislike extremely as described by Ihekoronye and Ngoddy (1985) [17].

Table 2: Sensory analysis chart

Score	Hardness scale
9	Like extremely
8	Like very much
7	Like moderately
6	Like slightly
5	Neither like nor dislike
4	Dislike slightly
3	Dislike moderately
2	Dislike very much
1	Dislike extremely

2.8 Stability evaluation
Cereal bars are kept under refrigerated cold conditions for days and their stability evaluation was checked under both normal and low temperature conditions.

2.9 Statistical analysis
All the experiments were carried out in triplicate and replicated at least twice. Results are expressed as average ± standard deviation (SD).

2.10 Microbial analysis
Total plate count agar Media was prepared and autoclaved at 121 ◦ C for 15 mins at 5 psi. Meanwhile 10gm sample was crushed and dissolved in 90ml saline water. Further dilutions were made 10^{-9} concentration. Further 1ml of sample from the concentration of 10^{-3} and 10^{-6} of was plated and incubated in bacteriological incubator for 24 hours at 37 ◦ C. There after the results were recorded according to the number of microbial colonies appeared on the plate. (FSSAI Manual. 2015) [18].

3. Results

3.1 Nutritional Analysis OF Cereal Bars

Table 3: The nutritional composition of formulated bars

Composition	Standard	F1 – 2%	FII -4%
Protein (%)	2.2±0.15	3.1±0.28	3.2±0.34
Fat (%)	29.25±0.06	27.34±0.81	25.26±0.04
Carbohydrate (%)	50.50±0.34	50.63±0.43	50.45±0.80
Crude fibre (%)	1.39±0.36	2.03±0.65	2.43±0.26
Moisture (%)	15.62± 0.58	17.03±0.43	19.01±0.54
Ash (%)	1.03 ±0.36	1.02±0.45	1.33±0.36

3.2 Energy Value

Table 4: Energy value of formulating cereal bar

Composition	Energy value (k Cal/ 100gm)
Standard	474.05
F-I	460.98
F-II	438.86

3.3 Determination of antioxidant activity

Table 5: DPPH assay of various herbal extracts and bar

Herbal extracts	% Inhibition
Herbal mixture	74.40±0.08
Standard	85.00±0.09
F-I	85.23±1.22
F-II	88.56±0.06

3.4 Sensory analysis

Table 6: Sensory analysis chart

Formulation	Appearance	Taste	Flavor	Texture	Overall acceptability
Standard	6±0.57	8±0.81	8±0.57	7±1.29	7±0.5
F-I	6±0.57	8±0.5	8±0.57	7±0.67	7±0.5
F –II	6±0.67	7±0.56	7±0.67	7±0.34	7±0.5

4. Discussions

4.1 Sensory analysis

The cereal bars were formulated using mixtures of Brahmi and Noni extract in different concentration (2gm and 4gm). These bars were evaluated on the basis of various sensory parameters. The analysis showed that the cereal bars of 2% herbs had different taste as compared to those containing 4%. It was also observed that all cereal bar formulations did not differ as far as sensory parameters. In most of the cases, the scores for the sensory attributes were in the range of 6 to 8 hedonic scale, which shows their moderate acceptability. Thus, both the formulations were found suitable for consumption. These formulations were then analyzed for different physico-chemical characteristics.

4.2 Discussions on nutritional analysis

The different physicochemical characteristics of the various formulations are reported in the table.

4.2.1 Total protein

From the results it is observed that the protein content was in the range of 2-3%, which is very less. Most of the cereal bars that are available in the market have a relatively very high amount of proteins. The less amount of protein in our formulations may be due to less use of puffed rice (25% only). Brito *et al*. (2004) [19] formulated cereal bars with oat flakes, corn glucose and sucrose and obtained higher protein values in between (7- 8).

4.2.2 Crude fiber

It is found that the total crude fiber of cereal bars formulated with an herbal mixture (2%) and (4%) was 2.03 and 2.43 times respectively higher than the cereal bar standard. According to Mattos and Martins (2000) [20], the value found for fibers in their formulated bars were in between 4.10 and 4.60 g/100gm and they considered these bars as a product of moderate fiber content Therefore, the cereal bars formulated in this work contain less fiber.

4.2.3 Carbohydrate

The formulated cereal bars presented a higher carbohydrate content (50-51), if compared to other bars (Santos *et al*., 2011) [21]. This may be due to the addition of dark compound. The incorporation of herbs along with cocoa allows an increase in the amounts of carbohydrates.

4.2.4 Fat

The fat content in the formulated bars is found to be higher due to the incorporation of dark chocolate. As compared with other cereal bars formulated with a jackfruit (Santos. *et al*) the fat content is found to be much higher in the formulated herbal cereal bars.

4.2.5 Moisture

The moisture content in the formulated bars is found to be in the range of 15-20. Torres *et al* 2011 [22] used exotic fruits to produce cereal bars, that resulted in 23.46% of moisture in the formulated bars and Freitas and Moretti *et al*. 2006 [23], produced cereal bars on the basis of textured soy protein and wheat germ, toasted, with values of 10.71% moisture and ash 2.20%. In comparison to these the formulated herbs show less amount of moisture and ash content which indicates that the product can absorb less moisture and is stable. Lima *et al* [24]., using cashew to produce cereal bars, reported 7.40% of moisture, 9.73% of protein, 1.63% of ash, 9.70% of lipids and 5.84% of the fiber. Freitas and Moretti *et al*. 2006 [23], produced cereal bars with textured soy protein and wheat germ verified10. 71% moisture. Compared these levels are close to those obtained with the bars formulated in this work, except for protein content.

4.2.6 Energy Value

The energy value found in the bars is between (400-475) kcal/100gm.

5. Antioxidant activity

Antioxidants have free radical scavenging properties. Free radicals are highly reactive oxygen species are capable of oxidizing bio-molecules viz. Nucleic acids, proteins, lipids and DNA and can initiate the process of different degenerative diseases like neurological disorders, cancer, emphysema, cirrhosis, atherosclerosis, arthritis etc.

The result indicated that water alcoholic extract and formulated bars exhibited potent antioxidant activity by inhibiting DPPH free radicals, which indicates that they are rich in antioxidant phytochemicals specially saponins, phenols flavonoids etc.

6. Antimicrobial Activity

The Results of antimicrobial activity were found to be too less to count. Antimicrobial activity was done both for 15 days and

a 22 day period. The results of both showed negligible microbes.

7. Conclusion

The Cereal bars are easy to manufacture and keeping in view the cost of ingredients, the nutri bars can be sold at a low price. These products can be conveniently added to a packed lunch or eaten as a snack. The growth of functional foods may expand the options for curing health disorders and for providing health benefits (Lobato, LP *et al*.,2011) [25]. The herbal nutri bars formulated in this study were well accepted in the sensory analysis. Although during storage, however, the bars became dry in appearance and there was an increase in hardness when kept in refrigerator. While at normal temperature they retained the normal texture. Slight modifications in formulation may prevent these kind of problems. The antioxidant activity of the bars is found to be high. It signifies that they are good in free radical scavenging activity. Incorporation of herbs provides the bars a different taste along with the herbal benefits. Brahmi and Noni both help protect our bodies against many diseases and especially Brahmi is good for mental health. The formulated cereal bars are found to be rich in phenolic content, flavonoids, and also they have a better shelf life.

Finally the fortification process helps food to enrich their quality along with a great value of micro and macronutrients.

7. References

1. Shridhar G, Rajendra N, Murigendra H, Shridevi P, Prasad M, Mujeeb Arun S *et al*. Modern Diet and its Impact on Human Health. Journal of Nutrition & Food Sciences. 2015; 5:6.
2. Iriti M, Vitalini S, Fico G, Faoro Franco. Neuroprotective Herbs, and Foods from Different Traditional Medicines and Diets: Molecules, 2010, 15.
3. Gottardi D, Bukvicki D, Prasad S, Tyagi AK. Beneficial Effects of Spices in Food Preservation and Safety. Frontiers in Microbiology. 2016; 7:1394.
4. Veena Kasture S, Seema Gosavi A, Rohit Ajage K, Shraddha Deshpande G, Shekhar Inamke R, Jyoti Kolpe B. Comparative Study of Brahmi and Brmhamanduki: A review. World journal of pharmacy and pharmaceutical sciences. 2014; 3(6):2217-2230.
5. Yuan H, Ma Q, Li Ye, Guangchun Piao. The Traditional Medicine and Modern Medicine from Natural Products. Molecules. 2016; 21:559.
6. Mukherjee A, Gombar V, Shamsi Y, Gupta M, Sinha S. Effectiveness of Brahmi in Various Illnesses: Review Paper. Review Paper. Herb Med. 2017; 3(2):10.
7. Yadav KD, Reddy KRC. Nephro-protective effect of Brahmi Ghrita. Journal of Medicinal Plants Studies. 2015; 3(2):05-07.
8. Wang MY, West BJ, Jensen CJ, Nowicki D, Su C, Palu AK *et al*. *Morinda citrifolia* (Noni): A literature review and recent advances in Noni research. Acta Pharmacol. 2002, 23:1127-41.
9. Krishnakumar NM, Latha PG, Suja SR, Rajasekharan S. A Review on the Ethnomedicinal, Therapeutic and Nutraceutical Importance of Noni (*Morinda citrifolia* L.). International Journal of Medicinal Plants and Natural Products (IJMPNP). 2015; 1(3):1-14.
10. Umezawa K. Isolation of 1-methoxy-2-foremyl-3-hydroxyanthraquinone from *M. citrifolia* and neoplasm inhibitors containing the same. Japan Kokai Tokyo Koho (JP). 1992; 736:87-94.
11. Engler MB, Engler MM, Chen CY, Malloy MJ, Browne A, Chiu EY *et al*. Flavonoid-rich dark chocolate improves endothelial function and increases plasma epicatechin concentrations in healthy adults. J Am. Coll. Nutr. 2004; 23(3):197-204.
12. Shin DH, Kin MK, Chung TK, Lee, HY. Effect of some additives for yukwa (popped rice snack) quality improvement and process modification trials. (In Korean). Korean J Food Sci. Technology. 1990 22:272.
13. AOAC. Official methods of analysis. Association of Official Analytical Chemistry, 2000.
14. Ranganna S. Hand of Analysis and Quality Control for Fruits and Vegetable Products, 2nd ed., Tata McGraw-Hill Publishing Co. Ltd.: New Delhi, 1986, 8-229.
15. Brand-Miller J, Holt S. Testing the glycaemic index of foods: *in vivo* not *in vitro*. Eur J Clinical Nutrition. 2004; 58:700-701.
16. Blois MS. Antioxidant determinations by the use of a stable free radical. Nature. 1958; 26:1199-1200.
17. Ihekoronye AI, Ngoddy PO. Integrated Food Science and Technology in the Tropics. Macmillan Publishers, London, 1985, 18.
18. Food Safety & Standards Authority of India (FSSAI), Manual of Methods and Analysis Of Foods- Beverages (Coffee, Tea, Cocoa, Chicory), Sugar and Sugar Products & Confectionary Products, Ministry Of Health and Family Welfare, Government Of India, New Delhi, India, 2015.
19. Brito IP, Campos JM, Souza TFL, Wakiyama C, Azeredo GA. Elaboration and global evaluation of a home-made cereal bar. 2004; 22(1):35-50.
20. Mattos LL, Martins IS. Dietary fiber consumption in an adult population. Journal of Public Health. 2000; 34(1):50-55.
21. Santos CT, Bonomo RF, Fontan RdCI, Bonomo P, Veloso CM, Fontan GCR. Characterization and sensorial evaluation of cereal bars with jackfruit. Acta Scientiarum. Technology, Maringá. 2011; 33(1):81-85.
22. Torres ER, Castro ES, Santana RF, Cardoso JC, Soaresa, CMF, Lima ÁS. Cereal bar Development Using Exotic Fruit. Proceedings of 11th ICEF Conference on Engineering and Food, Food Process Engineering in a Changing World, Athens, Greece, 2011.
23. Freitas GC, Moretti RH. Characterization and sensory evaluation of functional cereal bar high content protein and vitamin. Food Science and Technology. 2006; 26:318-324.
24. Lima AC. Study for the aggregation of heat to cashew products: preparation of formulations of fruits and brown bars. Ph.D. Thesis, Brazil: UNICAMP, Campinas SP, 2004.
25. Lobato LP, Anibal D, Lazaretti MM, Grossmann VE. Extruded puffed functional ingredient with oat bran and soy flour. LWT Food Sci Technol. 2011; 44(4):933-939.
26. Sharma R, Jain N, Rani D, Jaitawat A, Kantwa SM. Role of *Emblica officinalis* and *Foeiniculum vulgare* during pregnancy and lactation: A Review. International Journal of Advanced Multidisciplinary Research. 2015; 2(4):103-113.