Nutritional and Sensory Evaluation of Dark Chocolate incorporated with Arjuna Chaal (Terminalia Arjuna)

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Abstract-*The present study was aimed to conduct nutritional and sensory evaluation of dark chocolate incorporated with Arjuna Chaal (Terminalia Arjuna). Arjuna chaal is well known for its cardio protective properties and is rich in antioxidants compounds like flavones, arjunoic and arjunic acid. For this study, dark chocolate incorporated with Arjuna chaal was developed and evaluated for its acceptability. The developed chocolate was evaluated for colour, flavour, taste, texture and overall acceptability by six trained panel members using composite scoring and by 50 untrained panelists using 9 point hedonic rating scale. Results of acceptability of dark chocolate incorporated with arjuna chaal by trained panelists revealed that overall acceptability of dark chocolate was more (93.3±3.8) than that incorporated with Arjuna chaal (91.7±3.33) but no significant difference was seen between the two samples (p>0.05). Similarly, the mean acceptability score of dark chocolate incorporated with Arjuna Chaal by untrained panelists was 7.4. On finding out the nutritive value of the developed chocolate it was observed that it contained 228kcal of energy. The protein content was found to be 1.6 grams and the total phenolic content was 150mg whereas flavonoid content was noted to be 9.89 mg.*

Keywords-Arjun Chaal, Dark chocolate

I. INTRODUCTION

Medicinal plants play an essential role in health care and are the major raw materials for both traditional and conventional medicine preparations; still most of the people choose herbal medicines than conventional medicines. [1] They expanded attention due to their effectiveness, lack of current medical alternatives, increasing cost of modern medicines and cultural preferences.[2,3]

Ethnobotanical studies are most important to expose the ancient times and current culture about plants in the world and reserving original knowledge of medicinal plants. The quantitative ethnobotanical studies are used to identify the plant uses as food [4]. During the last few years, use of herbal supplements increased from 2.5% to 12%.[5] In recent years, there has also been an increasing demand for nanoparticles derived from medicinal plants like *Terminalia* family due to their applications in various fields of research like medicine, catalysis, energy and materials.[6,7]

Terminalia arjuna is a tree having an extensive medicinal potential. The plant is used in the treatment of various ailments. *Terminalia arjuna* is a very good hypocholsteremic, hypolipidemic, anticoagulant, antihypertensive, antithrombotic, antiviral, antifungal and antibacterial agent. Various parts of plant have been investigated for the presence of phytoconstituents and pharmacological activities. Many useful phytoconstituents have been isolated from *Terminalia arjuna*. Triterpenoids are mainly responsible for cardiovascular properties. Tannins and flavonoids are responsible for its anticancer properties. [8] Polyphenols, flavonoids, tannins, triterpenoids, saponins, sterols and minerals are the major constituents of *T. arjuna*. Such amino acids like tryptophan, tyrosine, histidine and cysteine are also the main ingredients in *T. arjuna*. [9, 10, 11, 12]

II. METHODOLOGY

Arjuna bark powder chocolate was developed for standardization. One gram of arjuna bark powder was mixed to 40 grams of dark chocolate. Dark chocolate was melted on a double boiler. After the chocolate completely melts, Arjuna bark powder was added to it. The mixture was poured into silicon moulds and refrigerated for 2 hours. The chocolate pieces were then wrapped in chocolate wrapping papers. For the sensory evaluation of developed Arjuna bark chocolate, a panel of 6 judges was selected on the basis of threshold test. Coded samples were presented to the panelist with score cards for evaluating the degree of acceptability of each characteristic that was being tested. By using composite score card, various attributes like colour, flavour, consistency were evaluated. The quality in terms of sensory attributes was assessed by using 9 point hedonic scale by untrained panel members. Nutritional composition of dark chocolate incorporated with Arjuna chaal included the assessment of carbohydrates, proteins, fats, polyphenols and flavanoids.

III. RESULTS AND DISCUSSION

Figure 1 depicts the results of sensory evaluation conducted by six trained panelists. It depicts the mean acceptability score of attributes between the two samples by composite scoring test. With reference to taste, sample A had greater mean value (28.6±1.34) as compared to sample B (27.8±1.47) although no significant difference was observed ($p>0.05$). Regarding texture, the mean value of sample A was observed to be (22.9±1.85) which was higher than mean value of sample B (22.6±1.64) without any significant difference ($p>0.05$) between the two samples. In appearance, mean value of sample A was higher (22.2±1.75) than mean value of sample B (21.8±1.75) but no significant difference was seen. With reference to colour, sample A mean value was (19.6±.84) whereas mean value of sample B was (19.5±.84) with no statistical difference between the samples. The overall acceptability of sample A was more (93.3±3.8) than that of sample B (91.7±3.33) with ($p>0.05$) showing no significant difference between the overall acceptability of sample A and sample B. Table 1 depicts the acceptability of Arjuna chaal dark chocolate on the basis of 9 point hedonic rating scale. Fifty subjects performed the test out of which 16 per cent extremely liked Arjuna chaal dark chocolate whereas 56 per cent of them liked it very much and 24 per cent liked it moderately and 2 per cent of them like it slightly and 2 per cent of them neither liked it nor disliked it. The mean acceptability score of dark chocolate incorporated with Arjuna chaal using 9 point hedonic rating scale was 7.4.

A study done by Misnawi et al. (2011) also revealed that sensory attributes like polyphenol concentration affected flavour, astringency and viscosity. Bitterness was increased however properties like appearance and colour were not affected thus showing no significant effect on both. Similar results are obtained in the present study as there is a difference in taste of the dark chocolate incorporated with Arjuna chaal which could be due to the increase in its polyphenol concentration. [13]

Similar study done by Miriam et al. (2011) showed that chocolate acceptability was slightly affected by processing and long roasting time of cocoa and had low acceptability when reheated but showing no significant difference.[14]

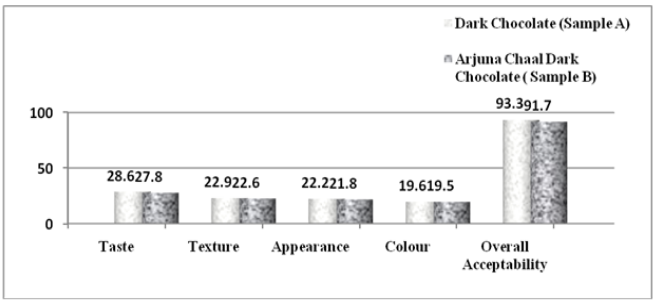

Figure 1: Acceptability of Dark Chocolate and Arjuna Chaal Chocolate by Trained Panelists

Table 1: Percent Acceptability of Chocolate incorporated with Arjuna Chaal by Untrained Panelists

9 point Hedonic Scale	Variables	Number of Panelists
9	Like extremely	8 (16%)
8	Like very much	28(56%)
7	Like moderately	12(24%)
6	Like slightly	1(2%)
5	Neither like nor dislike	1(2%)

Table 2 depicts the Nutritive value of dark chocolate incorporated with Arjuna Chaal (per 41 grams of chocolate). The assessment of nutritive value revealed that the dark chocolate contained 228kcal of energy. The protein content was found to be 1.6 grams. Fat content was 14.4 grams and the total phenolic content was 150 mg whereas flavanoid content was noted to be 9.89 mg.

Table 2: Nutritive Value of Dark Chocolate incorporated with Arjuna Chaal

Nutrients	Total Amount per 41 grams
Energy	228 Kcal
Protein	1.6 grams
Fat	14.4gms
Total Phenolic Content	150mg
Total Flavanoid Content	9.89mg

IV. CONCLUSION

Terminalia Arjuna has been known widely for its beneficial effects on heart and cardiovascular functions. It is proved to be rich in polyphenols and flavonoids and is helpful in reducing blood pressure, elevated blood glucose levels, and oxidative stress. Development of food products with the incorporation of herbal ingredients is important. Herbs are non-woody plants or plant parts claimed to have medicinal,

therapeutic, or performance-enhancing values. Herbs can be used as fresh or dried products, liquid or solid extracts, tablets, capsules, powders, in drinks, in energy bars, or in tea bags. Herbs contain chemicals called phytochemicals that presumably account for any effects they may have. Among the phytochemicals thought to be the active ingredients in herbs are flavonoids, phenols, saponins, and terpenes. Therefore, since the herbal products do not produce any side effects and are safe to consume also keeping in mind the doping issues of sportspersons, more studies can be carried out to strengthen the fact that use of herbs in place of artificial supplements for performance enhancement in sports and therapeutic use might be of some help to the human community.

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