

Development and Evaluation of a Nutraceutical Herbal Summer Drink

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Abstract---In the past few years, high consumption of soft drinks has attracted negative attention world-wide due to its possible adverse effects, leading the health conscious people to find alternative nutraceutical or herbal health drinks. In the present study, a nutraceutical soft drink was developed utilizing some easily available and well known traditional herbs having nutritional potential. The key ingredients were selected as bael, amla, lemon juice, ashwagandha and poppy seeds based on their household routine use in the summer with proven refreshing, cooling and energetic feeling since ages. After several trials made, the final composition of nutraceutical summer soft drink was selected as most suitable combination based on the taste, physicochemical, microbial and organoleptic point of view. The physicochemical analysis of the prepared drink found to contain optimum level of titratable acidity, total soluble solids and pH which were in accordance of the commercial recommendations. There were no bacterial colonies found in the product therefore found within limits. During the nine point's hedonic scale sensory evaluation, the drink was strongly liked for colour, taste, flavour and texture. The formulation was found to contain flavonoids (80mg/100ml), phenolics (103mg/100ml), vitamin C (250mg/100ml) and has antioxidant potential (75.52%) apart from providing several other essential vitamins, minerals and healthy components. The developed nutraceutical drink provides an economical and feasible option for the consumers with very good taste combined with potential health benefits. The present drink is potentially capable to replace the synthetic soft drinks available in the market.

Keywords---Herbal drink, nutraceuticals, summer drink, antioxidant.

I. INTRODUCTION

THE term nutraceutical is a hybrid term of nutrition and pharmaceutical. Reportedly it was coined in 1989 by DeFlice and foundation for innovation in medicine. Restated and clarified in a press release in 1994, its definition was "any substance that may be considered food or part of a food and provides medical or health benefits, including the prevention and treatment of disease. Such products may range from isolated nutrients, dietary, supplements and diets to genetically engineered 'designer' foods, herbal products, and processed foods such as cereals, soups, and beverages [1]. Functional foods or nutraceuticals are the best treatment regime for curing or managing of various lifestyle diseases like diabetes, obesity, cancer, arthritis, hypertension, etc. [2]. Nutraceuticals

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are gaining the important position in growing health market of India as well in world. By giving complementary benefits it will play an important role in the 21st therapeutic scenario [3].

The Indian nutraceutical market valued at \$ 1480 million in 2011 and could grow to \$ 2731 million in 2016 at Compound Annual Growth Rate (CAGR) of 13%. Factors supporting growth of nutraceuticals in India are, increasing obesity in the population, rising instances of diabetes and cardiovascular diseases as government funding in vitamin fortification [4].

Beverages are considered to be an excellent medium for the supplementation of nutraceutical components for enrichment such as soluble fiber or herbal extract [5]. It is always more convenient to consume a beverage providing health benefits rather than swallow vitamins or pills for the same health benefits. Nutraceutical beverages originate primarily from fruits and vegetables sources, but also include those from other plants such as tea, coffee, cocoa, soybean as well as animal products like milk and dairy-based and alcoholic drinks [6].

In the past decade, several attempts have been made regarding development of nutraceutical drinks using herbs as main ingredients. The attempts were successful and several patents have already been made in this direction. A list of patents is presented here in Table I.

TABLE I
LIST OF PATENTS GRANTED IN FIELD OF NUTRACEUTICAL DRINKS

Year	Title	Patent No
2003	Fermented herbal health drink from plant andrographis	US 6,616,950 B2
2003	Cactus fruit drinks and food products	US 6576286 B1
2003	Recovery drink formula and method	US 2003/0143311 A1
2004	Healthy alternative ready to drink energy beverage	WO 2004/ 045313 A1
2005	Fiber nutritional drink	US 2005/0013902 A1
2006	Ayurvedic herbal soft drink	US 2006/0147554 A1
2006	Nutraceutical moringa composition	US 2006/0222682 A1
2006	Improved nutraceutical composition	WO 2006/053379 A1
2006	Carbonated protein drink	US 2006/ 0083844 A1
2009	Soft drink based on Indian gooseberry extract	WO 2009/054002 A3
2009	Herbal soft drink	US Patent 7550163 B2
2010	Functional drink	US 2010/0254962 A1
2011	Method for preparation of herbal beverage	US 8,012,515 B1
2012	Nutraceutical beverage	US 2012/0213756 A1
2013	Health tea and method of preparing the same	EP 1 997 500 B1

Soft drinks are consumed as routine snack in India but due to increasing health issues associated with them, demand of healthy soft drinks is on rise among people of all age groups.

A large number of traditional herbs have nutraceutical potential and are consumed in summer for refreshment and nutrition by common people. Use of traditional herbs in soft drinks, is supported by the aura of health benefits of herbs. Botanical kingdom of India offers endless possibilities for new innovations in nutraceutical soft drinks [7]. Keeping in view the increasing demand of innovations in soft drink category, and the potential of some easily available herbs as nutraceuticals, the objective of present research work was set to develop a nutraceutical soft drink from some easily available herbs which possess the taste and cooling effect of a drink along with several health benefits.

II. MATERIALS AND METHODS

A. Selection and Collection of Herbs

The main ingredients selected for the preparation of nutraceutical soft drink in the present study were as bael fruit, amla fruit, lemon juice, ashwagandha root and poppy seeds. These commercially available fruits and herbs were collected from local market of Rohtak, India. Other raw materials like sugar, spices and citric acid were procured from the local market.

B. Preparation of Extracts and Juices

Ashwagandha was subjected to cold maceration for a period of seven days using Hydro alcoholic solvent. Fresh fruits of bael were taken for juice extraction because fresh fruits are more nutritious than dried fruits. Also, heating of crushed fruit pulp before juice extraction facilitated pressing and colour fixing. Juice extraction after heating of bael pulp at 80°C has shown considerable stability in colour and more acceptability. Fresh amla was crushed to get juice. Poppy seeds were soaked in water overnight and then squeezed and filtered to get extract.

C. Preparation of Nutraceutical Soft Drink

The drink was prepared by trying combinations of various ingredients and taste enhancers in different concentrations for an acceptable formulation. The composition of extracts and juices mixed was on the basis of their daily consumption values. A preliminary trial was conducted to study the acceptability of the soft drink with different combinations and concentration of taste enhancers. The most acceptable combination was processed and carbonated with the help of carbonator machine. In carbonated drinks, mould and bacterial growth is very unlikely as they are very sensitive to carbon dioxide (CO₂). The prepared drink was bottled and stored for further evaluation and stability studies.

D. Quality Evaluation

Quality evaluation of prepared nutraceutical soft drink was essential for the efficacy, safety determination. Both physicochemical and phytochemical evaluation was carried out by comparing it with the standard parameters. Sensory evaluation was also performed in terms of sight, smell, taste, touch and hearing. The freshly prepared drink was also evaluated for the presence of any microbial contamination

while processing. This is done by specify the total count of yeasts and molds, and the absence of specific objectionable bacteria. This is suitably determined using pharmacopoeial procedures.

E. Sensory Evaluation

Consumer awareness concerning beverages has increased the number of positive attributes desired for these products, apart from refreshment. However, no matter how nutritious the beverage, the taste must be acceptable or it will not be consumed. Sensory analysis was performed by using nine points hedonic rating scale by a panel of five people. The parameters for evaluation includes appearance, colour, taste, flavor, consistency and overall acceptability of nutraceutical summer soft drink.

F. Physicochemical and Phytochemical Evaluation

Various physicochemical parameters like pH, titrable acidity, total soluble solids, and total sugars were performed. Moreover, the prepared drink was analyzed for the presence of carbohydrates, proteins, glycosides, tannins, polyphenol and flavonoids using standard procedures. The phenolics content was determined by Folin Ciocalteu's assay/ gallic acid equivalence method. The total flavonoid content was determined by aluminum chloride method.

G. Determination of Antioxidant Activity

Antioxidants are agents which scavenge the free radicals and prevent the damage caused by them. The antioxidant potential of the soft drink was measured in vitro by 1, 1-diphenyl-2-picryl-hydrazyl (DPPH) assay. Free radical scavenging activity was measured by a slightly modified method [8].

H. Stability Studies

The prepared drink was analyzed for organoleptic attributes, physicochemical parameters and phytochemical parameters at an interval of 15 days for any change during storage period of three months.

III. RESULTS AND DISCUSSION

A. Preparation of Extracts and Juices

The extracts prepared as mentioned resulted in varying yields as detailed in Table II.

B. Preparation of Nutraceutical Soft Drink

The final formula for nutraceutical summer cold drink was developed as per the preliminary trials mentioned. Rose flavor was found to be acceptable. Fennel flavor was unacceptable due to its strong aroma which was not found to be compatible with aroma of other fruits. Addition of salt was found to enhance the taste and to lower the sourly flavor of fruits. On the basis of preliminary sensory evaluation, compositions of final nutraceutical soft drink with sugar as sweetener was developed (Table III).

TABLE II
EXTRACTIVE YIELD/ JUICE YIELD OF HERBS

Herb	Extractive yield/Juice yield
Bael	80ml/100g fruit pulp
Amla	30ml/100g fruit pulp
Ashwagandha	40mg/g of powder

TABLE III
FINAL COMPOSITION OF NUTRACEUTICAL SOFT DRINK

Bael juice	80%v/v
Amla juice	15%v/v
Lemon juice	2.5% v/v
Poppy seeds decoction	2.4%v/v
Ashwagandha extract	0.08%w/v
Sugar	12%w/v
Salt	0.001%w/v

C. Sensory Evaluation

Sensory evaluation parameters observed in fresh soft drink. The observed parameters like color, taste, flavor, texture, overall acceptability at room temperature of the formulation is presented in Table IV. On the basis of paired comparison evaluation the drink has very good taste, flavor and overall acceptability. Change in sensory characters during storage was also analysed.

TABLE IV
SENSORY SCORES OF NUTRACEUTICAL SUMMER SOFT

Parameters	Formulation (sugar)
Color	8
Taste	8
Flavor	7.5
Texture	7.5
Overall acceptability	8

1= extremely dislike, 2= strongly dislike, 3= moderate dislike, 4= slight dislike, 5= neutral, 6= slight like, 7= moderate like, 8= strongly like, 9= extremely like

D. Physicochemical and Phytochemical Analysis

In order to evaluate the suitability of formulation for nutritional purpose physicochemical and phytochemical parameters were carried out. The pH of freshly prepared nutraceutical soft drink was 4.5. The value of total soluble solids for fresh nutraceutical soft drink was found to be 20 %. The refractive index value was converted to degree brix value using refractive index brix conversion chart. Dissolved sugar changes the value of refractive index. Also the citric acid present in drink increases the brix value. Total sugars calculated as per formula for fresh nutraceutical summer soft drink is 29%. The vitamin C content in fresh nutraceutical summer drink was found to be 2.5mg/ml of drink. High vitamin C content is due to the amla and lemon which are rich sources of vitamin C. Vitamin C is an essential antioxidant needed by the human body. The National Academy of Sciences has established the threshold of 60 mg/day for adults as the Recommended Dietary Allowance (RDA). Phytopharmaceuticals are always mixtures of many constituents and are therefore vary variable and difficult to characterize. The active principles in phytopharmaceuticals are not always known. Preliminary phytochemical analysis of

fresh nutraceutical summer soft drink showed the presence of alkaloids, carbohydrates, proteins, tannins, flavonoids and phenolics. The total phenolics content of fresh nutraceutical summer soft drink was found to be 103mg/100ml as gallic acid equivalent. High content of phenolics represents a characteristic parameter regarding their nutritional and physiological role as bioactive substances in human nutrition. The total flavonoid content of fresh nutraceutical summer soft drink as determined from standard curve was found to be 80mg/100ml as rutin equivalent. The average daily intake of flavonoids is between 70-170mg/day [9]. Thus the 100ml of drink will be sufficient to meet average daily requirement of flavonoids to fight from chronic diseases.

E. Antioxidant Activity

DPPH was a free radical that was used to measure the free radical scavenging activity of drink. The drink was found to be a rich source of phenolics and flavonoids which imparts more antioxidant potential to drink. The free radical scavenging activity of fresh nutraceutical summer soft drink by DPPH assay was found to be 75.52%. There was no significant decrease found in the antioxidant activity during the storage period of three months.

F. Stability Studies

There was slight decrease in pH below 4 during storage interval. The pH of most of the soft marketed soft drinks is below 4. The pH of medium has a profound effect on the heat resistant bacterial spores which becomes maximum at pH values 6 and 7. Products are effectively preserved at low pH [10]. The decrease in pH might be due to increase in acidity of drink due to conversion of organic acids. No significant decrease was found in the TSS during storage period. The microbial count of prepared drink after 15 days, 45 days, and 90 days was less than 30 cfu/ml which is in the acceptable range as according to APHA guidelines for microbial limits. Thus the prepared drink was stable without any chemical preservative for period of three months in refrigerated conditions. The herbs used such as bael and lemon have antimicrobial properties and thus act as preservatives. Acidity of drink also helps in prevention of microbial growth. No chemical preservative is required to store the drink for a period of up to three months.

IV. CONCLUSION

The prepared nutraceutical soft drink in the present study is a natural option to the synthetic drinks along with several health benefits. Important to mention here is that, all the herbs used in this preparation are easily available during summer season and are not costly thus the product is economically feasible also.

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