

Study on Physico-Chemical Properties of Developed Ready to Use Health Beverage Containing Coffee

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Abstract:- A ready to use health beverage was developed by replacing part of doubled toned milk with cheddar cheese whey (30 %) and adding various functional ingredients such as stevia (0.01 %), walnut oil (2 %) and coffee decoction (15 %). The various physico-chemical properties of the developed healthy coffee beverage such as specific gravity, viscosity, pH, acidity, moisture, total solids, fat, protein, total sugar and ash content were determined against control beverage. It was observed that there was a decrease in specific gravity and pH values and an increase in acidity and viscosity of developed health beverage compared to control beverage. Also, an increase in fat, protein and ash content was observed with simultaneous decrease in total solids and sugar content in health beverage compared to control.

Keywords:- Health Beverage, Walnut Oil, Coffee, Physical Properties, Chemical Composition.

I. INTRODUCTION

The fast growing population, changing lifestyle of the consumer, are now looking for a product that provide value additions beyond the nutrition. This value may be of specific health benefit such as disease risk reduction ability, the general well-being or the other health benefits. An increase in trend is seen towards developing low calorie/ low fat / skimmed products or a products with healthy fats (PUFA), essential proteins (BCAA), low calorie carbs because of health consciousness of the consumers. Dairy forms a better platform for developing and providing various functional health beverages to such group of individuals to maintain their overall wellbeing.

Milk which is derived from cattle species which acts as an important source of nutrition. Milk is rich many nutrients such as carbohydrates (lactose), proteins (casein and whey proteins) and additional supply of fat, essential vitamins and minerals which forms a vital source of nutrition due to positive impact on the human physiology and metabolism. In this contemporary-modern grab and go era, ready-to-drink or ready-to-serve or ready-to-use functional and nutraceutical beverage are the latest breakthrough in the dairy beverage industry. Milk beverages are considered as one of palpable thirst quenching and health-giving product.

There different varieties of milk based beverages such as fat free, low fat, flavoured milks either enriched or supplemented with some nutrients such as whey proteins,

fruit pulps, herbs and certain micro and macro nutrients etc. Hence, different types of functional beverages are growing promptly in the beverage market because of their health reimbursements such as immune enhancing, promoting health benefits for digestive or heart health, sporting drinks etc.

Whey contains nearly 50 % of milk solids, which represents a heterogeneous pool of protein with wide range of physicochemical and functional properties. Proteins that constitute whey protein concentrate include β -lactoglobulin and α -lactalbumin, protease peptone, immunoglobulins, bovine serum albumin, lactoferrin, lactoperoxidase, and some peptides such as glycomacropeptide, which is the source of Branched-Chain amino acids. Whey proteins are rich in essential amino acids and have high Protein Efficiency Ratio (PER-3.6), Biological Value (BV-104) and Net Protein Utilization (NPU-95) (Rebaca, 2013). Functional properties of protein in food systems are those organoleptic or textural characteristics on the product in which they are used. Whey proteins could be used as component of foods for functional, nutritional and economic benefits.

Stevia (*Stevia rebaudiana bertonii*) is a herb of the 950 genera of *Asteraceae* family well known locally as a sweet herb or honey leaf, widely used by herbalists as sweetener to sweeten local drinks, with medicines or as a sweet treat. Stevia is found to be 300 times sweeter than sucrose and hence can be used as a sugar substitute in low calorie beverages. The leaves of stevia contains 6.2 % protein and 5.6 % lipid on a dry-weight basis, as well as diterpene, triterpenes, sterols, flavonoids and other compounds Stevia has been awarded the GRAS status with 4 mg/kg body weight ADI and extracted stevia product has found its application in food preparation as non-nutritive and high-intensity sweetener (Kuntz *et al.*, 2010).

Walnut (*Juglans regia L.*) is a member of Juglandaceae family, one of the finest nuts of the temperate regions. Ripe walnut are eaten as dessert nuts or used in cakes, desserts and confectioneries. Walnuts contain about 52 - 70 % fat, 3.2 - 4.4 % water, 12.0-19.6 % protein, 61.3 - 73.8 % fat, 1.8 - 2.3 % ash and 2.2 - 4.5 % sugars (Gecgel *et al.*, 2017). Walnuts are rich good fat, is also rich i.e. 100 g of walnut contains approximately 6.5 g of saturated fat, 47 g of polyunsaturated fat and 9 g of monounsaturated fat (Linda *et al.*, 2004).

The major fatty acids in walnut oil especially polyunsaturated fatty acid shown enhance shelf life with potential health benefits. It is also reported that walnuts have many health beneficial properties such as antifungal activity, antiviral activity, antioxidant activity, antidiabetic activity, antidepressant activity, antityrosinase activity, hypotriglyceridemic activity, anticancer activity and many other medicinal uses (Fukuda *et al.*, 2004 and Taha *et al.*, 2011). As a matter of fact, human body cannot metabolize the essential fatty acids on its own, hence it require an external source to meet the requirement. Walnut oil, being rich in PUFA forms a source of omega-3 fatty acid which is essential for normal functioning of nervous system, retina and brain. Hence, fortification of milk beverage with walnut oil can deliver substantial amount of omega 3 fatty acids.

Coffee (*Coffea arabica or robusta*) is the biggest source of antioxidants in the diet. Coffee is generally a brewed drink prepared from roasted coffee beans, which are the seeds of berries from the coffee plant. The global production of coffee in 2017 was approximately 158.93 million kg where in India it was accounting around 5.84 million kg. A 100 g of coffee consists of caffeine (40 mg), potassium (49 mg) and sodium (2 mg) (International coffee organization, 2018).

The consumption of coffee has been associated with several health benefits, including a reduced risk of diabetes and cardiovascular disease. Clinical and epidemiological studies have found the consumption of coffee found to be associated with risk reductions for the development of diabetes, Alzheimer's disease, several cancers, liver diseases and cardiovascular disease due to its bioactive constituents, which include phenolic compounds, caffeine, diterpenes, melanoidins, and trigonelline (Loader *et al.*, 2017).

In order to increase the assortment of functional beverages, whey added can be a source of proteins (BCCA), stevia as a low calorie- sweetening agent, walnut oil as a source of essential fatty acid (ω -3) and coffee as flavour enhancer and health promoting substance. Thus, the aim of this study is to evaluate the physico-chemical characteristics of developed ready-to-use health beverage.

II. MATERIALS AND METHOD

Ingredients: Fresh double toned milk was obtained by separating the cow's milk using cream separator, skim milk powder and cream was used for standardization. Cow's milk procured from the student experimental dairy plant (SEDP) was used for the preparation of cheese and the whey separated out was used for the research work. Good quality cane sugar, stevia-natural sweetener (8 times sweeter than sucrose), walnut oil and coffee powder were procured from local market. Coffee decoction was prepared by using 100 ml demineralized water and coffee powder in filter coffee machine and obtained decoction was used in this research work.

Preparation: Control beverage was prepared by using double toned milk with 8 % sugar addition (Singh., 2004). Ready to use health beverage was prepared by replacing 30 % of double toned milk with whey, complete replacement of sugar with stevia and 2 % walnut oil was added. Coffee decoction was added at the rate of 15 % and the ingredients were blended together and pasteurized at 72°C/5-6 sec, later bottled and stored at refrigeration condition until used for analysis.

Analysis of physical properties:

pH: The pH was measured using a digital pH meter (Elico Pvt. Ltd.) at 25 °C. About 20ml of representative samples were used.

Specific gravity: Specific gravity was estimated at 30 °C by using a standard specific gravity bottle of 50 ml capacity, taking distilled water as the standard liquid.

Viscosity: Viscosity of samples was estimated using U-tube viscometer by taking distilled water as standard liquid.

Relative viscosity can be calculated by multiplying average time for flow and specific gravity of product divided by average time for flow of water.

Analysis of chemical properties: The standard method mentioned in ISI: SP 18 (Part XI) 1981 was followed for estimation of moisture, total solids, lactose (Lane Eynon method), fat (Gerber method), protein (Micro-Kjeldhal protein), ash and tritrate acidity.

Statistical analysis: Results obtained were average of three replications which was statistically analysed by subjecting to statistical analysis (R Programme, R-Version, Ri386 3.4.3) for accurate interpretation that helped in discussion (Zar, 2003).

III. RESULT AND DISCUSSION

Effect of addition of whey, stevia, walnut oil and coffee on the physical properties of ready to use health beverage: The specific gravity, viscosity, pH and acidity of control were 1.034, 1.76 cP, 6.67 and 0.14 % LA, respectively whereas the health beverage containing coffee showed 1.0301, 1.88 cP, 6.59 and 0.15 % lactic acid, respectively (Table 1). It was observed that there was a decrease in specific gravity and increase in viscosity of developed health beverage compared to control beverage. This could be due to the incorporation of walnut oil blend as increase in fat content increases the viscosity. Also the developed health beverage showed a slight increase in the acidity and decrease in pH compared to control beverage which could be due to the addition of whey (0.05 % LA), tea (pH 6.2) and coffee (pH 5.3) decoction which are acidic in nature.

These results were in agreement with that of Singh *et al.*, 2005 where carrot flavoured milk beverage showed

specific gravity in the range of 1.061-1.065, viscosity of 27.-27.4 sec, pH in range of 6.44-6.69 and acidity in range of 0.13-0.14% LA.

Parameter	B ₁	B ₂	CD (P=.05)
Specific gravity	1.034 ^a	1.031 ^b	0
Viscosity (cP at 25 °C)	1.54 ^a	1.88 ^b	0.009
pH	6.67 ^a	6.59 ^b	0.031
Acidity (% LA)	0.14 ^b	0.15 ^a	3.05

Table 1:- Effect of addition of whey, stevia, walnut oil and coffee on the physical properties of ready to use health beverage

Note

- All values are average of three trials
- Superscripts – a & b indicate significance difference at the corresponding critical difference
- B₁ & B₂ : Control and developed ready to use health beverage, respectively

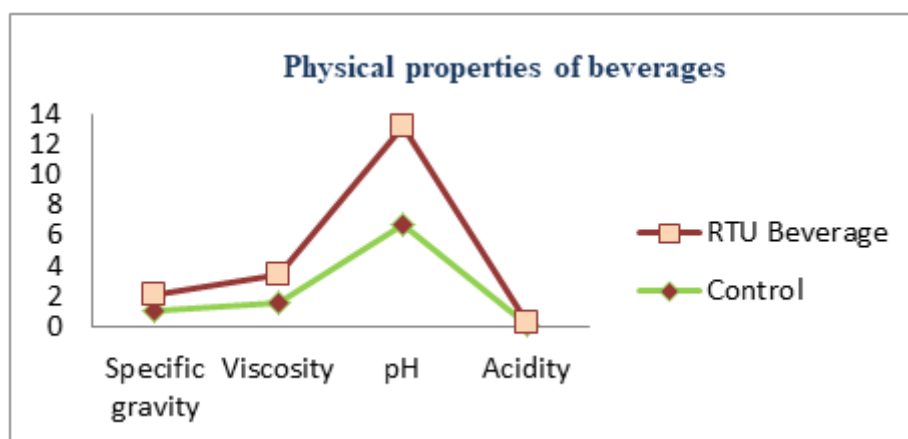


Fig 1:- Effect of addition of whey, stevia, walnut oil and coffee on the physical properties of ready to use health beverage

Effect of addition of whey, stevia, walnut oil and coffee on the chemical properties of ready to use health beverage: The chemical composition of control beverage and developed ready to use health beverages are tabulated in Table 2. It was observed that there was a decrease in total solids and total sugar content in developed health beverages than control beverage, which clearly shows the effect of stevia on the total sugar content. The addition of biosweetener significantly effected total sugar content which forms an important attribute. Also there was increase

in per cent fat which could be due to addition of walnut oil (2 %), protein content was increased due to contribution of added whey (0.60 %) and increase in ash content can be attributed due to addition of whey (0.5 %) and coffee (0.02 %) in developed health beverage which was similarly reported by Chatterjee *et al.* (2015) were 3:2 ratio for concentrated liquid whey and orange juice added with 8 % sugar had moisture, total soluble solids, fat, protein, total sugar and ash of 85.5 ± 0.79, 14.43 ± 0.25, 0.73 ± 0.4, 1.05 ± 0.22, 4.52 ± 0.35 and 0.67 ± 0.06 %, respectively.

Parameter	B ₁	B ₂	CD (P=.05)
Moisture	81.35 ^b	87.31 ^a	0.00
Total solids	18.30 ^a	12.69 ^b	0.00
Fat	1.55 ^b	3.74 ^a	0.03
Protein	3.28 ^b	3.53 ^a	0.04
Total sugar	12.76 ^a	4.50 ^b	0.10
Ash	0.71 ^b	0.92 ^a	0.02

Table 2: Effect of addition of whey, stevia, walnut oil and coffee on the chemical properties of ready to use health beverage

Note

- All values are average of three trials
- Superscripts – a & b indicate significance difference at the corresponding critical difference
- B₁ & B₂ : Control and developed ready to use health beverage, respectively

IV. CONCLUSION

It can be concluded from the results that the ready to use health beverage prepared by the addition of whey, natural sweetener stevia, walnut oil and coffee have shown lesser effect on the physico-chemical properties. Hence, development of ready to use health beverage containing essentials nutrients such as whey protein, zero calorie stevia, addition of healthy fat such as ω -3 fatty acids rich walnut oil and coffee as an antioxidant and flavour enhancer can act as an interesting opportunity to manufacture low calorie health beverage that will be considered satisfactory by consumers.

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