

Studies on Formulation and Organoleptic Evaluation of Golden A2 Milk with Soymilk and Turmeric Rhizome Juice

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ABSTRACT: The study was carried out to develop golden A2 milk with soymilk and turmeric rhizome juice. Sensory evaluation, physical properties, proximate composition and mineral composition of prepared product were assessed. Formulations for manufacture of golden A2 milk were optimized on the basis of their sensory as well as nutritional properties. Optimized samples were thereafter blended for the preparation of different ratios as T₁ (80% cow milk + 15% soymilk + 5% turmeric rhizome juice), T₂ (70 % cow milk + 20 % soymilk + 10 % turmeric rhizome juice), T₃ (60% cow milk + 25% soymilk + 15% turmeric rhizome juice), while cow milk (T₀) served as control. On the basis of sensory evaluation, it is observed that sample T₂ scored highest (8.5) for overall acceptability. Jaggery powder was used as sweetener which was in equal quantity for all samples. The study revealed various physical properties as pH, acidity, specific gravity, TSS, density and viscosity. Chemical composition as moisture content 80.6%, protein 1.28 %, fat 4.96 %, carbohydrate 9.58 %, ash 0.93%, crude fiber 0.65% and curcumin 1.85 %. Prepared drink is rich in calcium, sodium and iron. This finding revealed that golden A2 milk can be a nutrient source for people.

Keywords: Soymilk, turmeric rhizome, sensory evaluation, A2 milk.

INTRODUCTION

The Indian food processing trend is shifting toward processing, preservation, and value addition. Value addition encompasses the production of high-quality products through the addition of functional ingredients via the fortification and enrichment method.

The beverage industry is one of the fastest growing in food processing sector. People want healthy and nutritional drinks that will provide them health benefits and nutrition because of their hectic schedules.

Milk is recognized as a "Complete Food" since it contains nearly all of the key nutrients required for our bodies' normal growth. Milk not just to nourishes the body but it also keeps the fluid balance in check. Although milk has immense nutritional value, some people regard it as inappropriate for ingestion because it is obtained from animals (Nakade *et al.*, 2020).

Turmeric milk, also known as "haldidoodh" in India, is an example of a traditional drink used to treat sore throats and as a home remedy for fever. Boiled turmeric milk can be used to treat a variety of ailments including duodenal ulcers, asthma, malaria, cough, and cold. Furthermore, consumers' growing preference for natural and healthy foods has contributed to the global popularity of turmeric milk, also known as "golden milk." Because golden milk is widely consumed and its popularity is growing globally, the antioxidant and nutritional assumptions must be genuine (Idowu *et al.*, 2022).

Milk has long been one of the most popular foods among humans because of its versatility in meeting needs (Kundu *et al.*, 2018). Milk and dairy products are the best source of proteins, lipids and variety of essential vitamins and minerals. A2 milk is produced by cows with a specific genetic trait (Callaghan, 2020). A2 milk producers claim that A1 protein causes gastrointestinal pain and bloating. The major forms of beta-casein in animals are A1 and A2, depending on their genetic background. Proline is found at the 67th position of the beta-casein amino acid chain in A2 milk (Behera *et al.*, 2018).

Milk that is high in A2 beta-casein is mainly found in breeds that originated in the Channel Islands and Southern France. This includes breeds like the Guernsey, Jersey, Charolais and Limousin. Regular milk contains both A1 and A2 beta-casein, but A2 milk contains only A2 beta casein. Betacasomorphin 7 (BCM7) is the reason why regular milk is believed to be less healthy than A2 milk. BCM 7 is an opioid peptide that is released during the digestion of A1 beta-casein (Jois, 2018).

The milk containing only the A2 -casein type contained (per 100 ml) 271 kJ energy, 3.1 g protein, 3.6 g fat, 5.0 g carbohydrate, 48 mg sodium, 150 mg potassium, and 117 mg calcium (Jianqin *et al.*, 2016).

Turmeric (*Curcuma longa*) is a tropical South Asian rhizomatous herbaceous perennial plant in the Zingiberaceae ginger family. Turmeric grows from a tuberous rhizome with a thick, segmented covering.

Rhizomes have a yellowish-brown exterior and a dull orange interior (Ravindran, 2007).

Turmeric is widely utilized as a medicine for the treatment of numerous disorders due to the presence of curcumin as an active ingredient and volatile oils. It's widely used as an anti-inflammatory. As a result, it has antioxidant properties that are superior to vitamin E. The antitumor activity of the rhizome extract has been examined. Other activities demonstrated include antibacterial activity. Turmeric decreases cholesterol levels and inhibits platelet aggregation, resulting in cardiovascular benefits (Pawar *et al.*, 2014).

Curcumin is a bioactive compound derived from turmeric. Turmeric aids in the treatment of exercise-induced inflammation and muscle soreness, resulting in improved recovery and performance in active people. Curcumin is a phytochemical derived from the *Curcuma longa* rhizome. Curcumin (curcumin I, diferuloylmethane) is a dimeric ferulic acid derivative consisting of two *o*-methoxyphenol rings linked by a heptadienedione chain (Chetan *et al.*, 2022).

Curcumin possesses anti-inflammatory, antioxidant, antiviral, and antifungal properties. Curcumin is not hazardous to humans, according to research. Curcumin has anti-inflammatory properties through inhibiting a variety of compounds that are involved in inflammation. Turmeric can help reduce post-surgical inflammation. Turmeric reduces the creation of blood clots, which helps to avoid atherosclerosis (Akram *et al.*, 2010).

Soybean is a high-nutritional-value food that contains 35-50% protein and essential amino acid composition. Soymilk is a type of soybean product that is high in protein and fatty acids. It is widely accepted that Asians' healthy living is attributed to a diet rich in soybean and its active components. Soymilk may have numerous health benefits, including lowering the risk of heart disease, cancer, aging, and osteoporosis. The beany flavor in soybean is due to lipoxygenases which catalyse the enzymatic oxidation of linoleic acid and linolenic acid (Yu *et al.*, 2017).

Soya milk is the most popular traditional drink made from soya, particularly in Southeast Asia. Grinding, heating, and filtration are done to prepare it from soaked soybeans. Probiotics, on the other hand, are live bacteria that are added to it which provide health advantages (FAO, 2001). The demand for soymilk and soy food is expanding. Many organizations are conducting intense plant breeding programs to create new and enhanced soybean varieties with desirable features for soymilk and soybean-based food manufacturing (Achouri *et al.*, 2008).

Soymilk is cholesterol-free and low in calories; it may provide health advantages by lowering body weight and blood lipids. Soymilk, with its distinct nutty flavor and high nutritional value, can be used as a substitute for dairy milk (Kohli *et al.*, 2017).

Jaggery, an indigenous sweetener, is being manufactured in India since time immemorial. Last century witnessed the growth of white sugar manufacturing at the expense of jaggery and khandasari industry. White sugar contains only sucrose which leads to varieties of health problems. Its excessive consumption causes coronary thrombosis, dental carries and other heart related problems. On the other hand, jaggery contains 51% sucrose, 0.25% protein, 21.2% glucose and 3.4% minerals in addition to trace amounts of fats, iron, calcium and phosphates, which are absent in white sugar. In addition, it also possesses medicinal properties. In rural India jaggery enjoys wide acceptability. Scientific production and storage of jaggery will encourage this cottage industry and provide a healthy alternative to white sugar (Gupta *et al.*, 2006).

Jaggery is popularly known as 'medicinal sugar' it is being used in pharmaceutical formulations and daily consumption jaggery may associated with elevation in human life span. Jaggery is rich in minerals and contains high amount of phenol (Verma *et al.*, 2019).

Jaggery is far complex than sugar, as it is made up of longer chains of sucrose. Hence, it is digested slower than sugar and releases energy slowly and not spontaneously. This provides energy for a longer time and is not harmful for the body (Nath *et al.*, 2015).

The current investigation was carried out to assess organoleptic qualities and proximate composition of prepared golden A2 milk.

MATERIALS AND METHODS

Materials. A2 milk was procured from dairy farm, VNMKV Parbhani. Turmeric rhizomes and soybean were obtained from local market Parbhani. The proposed findings were carried out in Department of Food Engineering, College of Food Technology, Parbhani.

Methods

Extraction of turmeric juice from freshly harvested rhizomes. Fresh turmeric rhizomes were washed and cleaned to remove all impurities. Peeling was done to produce clear turmeric juice then the rhizomes were sliced into small pieces in order to extract juice using a juice extractor. The resulting juice was filtered using muslin cloth to get clear juice.

Preparation of soymilk. Soybean was sorted to remove stones, broken and deformed seeds. Then beans were cleaned and steeped in water with 0.5% NaHCO₃ overnight. After that, it was rinsed and blanched for 10-15 minutes. The rehydrated soybean was cleaned, dehulled manually by hand rubbing, and rinsed and remove the okra. The soybean seeds were mashed in grinder and expressed in a 6:1 (water to beans on a weight basis) ratio. The extracted milk was then heated and homogenized to enhance flavour and destroy trypsin inhibitor (Kohli *et al.*, 2017).

Table 1: Formulation for preparation of golden A2 milk with different level of turmeric rhizome juice.

Sample	Cow milk(ml)	Soymilk(ml)	Turmeric rhizome juice(ml)	Jaggery(g)
T ₀	100	-	-	8
T ₁	80	15	5	8
T ₂	70	20	10	8
T ₃	60	25	15	8

The golden A2 milk was prepared by blending cow milk (A2) milk with soymilk and turmeric rhizome juice in varying proportion. Jaggery powder is used as a sweetener; 8gm for 100 ml golden milk. Samples were prepared as T₁, T₂ and T₃ with turmeric rhizome juice as 5%, 10% and 15% respectively. Prepared samples were evaluated by organoleptic properties and proximate composition.

Sensory evaluation of golden A2 milk

Sensory evaluation of golden A2 milk was carried out for different properties such as colour, sweetness, flavour, mouthfeel and overall acceptability using standard method of (Amerine *et al.*, 1965). Trained and semi-trained panelists used 1 to 9-point hedonic scale for rating the quality of golden A2 milk.

Preparation of golden A2 milk. According to different recipe formulations golden A2 milk with turmeric rhizome juice and soymilk was prepared. Jaggery powder used as sweetener (8g /100ml) of golden milk. The prepared blended milk heated at 80°C for 10 minutes and cooled at room temperature and then filled in sterilized glass bottles of capacity 200 ml. Filled bottles were stored at refrigeration temperature (4±1°C).

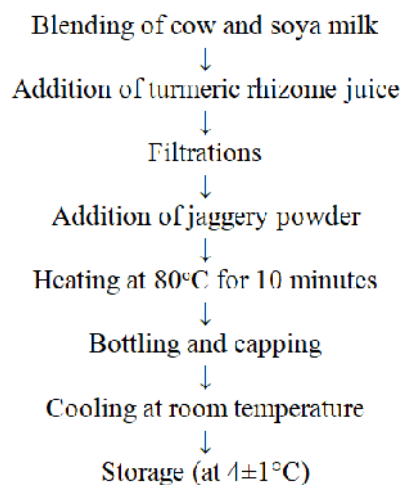


Fig. 1. Process flow chart for preparation of golden A2 milk.

RESULT AND DISCUSSION

Sensory evaluation of golden A2 milk. The sensory evaluation of golden A2 milk was carried out by members of trained and semi trained panel using 9-point hedonic scale and the scores were given by evaluating colour, sweetness, flavour, mouthfeel and overall acceptability which was compared with control sample and presented in Fig. 2.

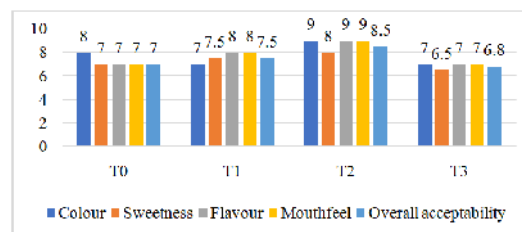


Fig. 2. Organoleptic evaluation of golden A2 milk.

The result of Fig. 2 revealed that there was slight change in colour of samples due to varying level of turmeric rhizome juice. T₂ obtained highest score followed by T₁ and T₃. T₃ scores lower than all the samples due to highly darkened colour and appearance of golden A2 milk. By comparing scores given by panel members it was clear that colour and appearance of beverage depends on amount of turmeric juice added to the prepared drink.

Sample (T₂) scored higher for flavour followed by T₁ and T₃. Sample T₃ obtained over all low score, because addition of higher proportion of turmeric juice affects the flavour of the sample. Thus, increase in proportion of turmeric juice was not acceptable by the panel members due to its intense flavour.

All the sample obtained good score for sweetness as the quantity of sweetener was same for all samples. Mouthfeel of the samples slightly changed with addition of turmeric juice. Selected sample T₂ ranked highest due to significant addition of turmeric juice followed by sample T₁ and T₃. The maximum overall acceptability score was recorded for selected sample T₂ (8.5) followed by sample T₁ (7.5) for colour and mouth feel which was higher than samples T₀ and T₃.

The sensory analysis revealed that among the samples of golden A2 milk prepared with turmeric rhizome juice T₂ containing 10% turmeric rhizome juice obtained the highest score in all the sensory quality attributes and found to be overall acceptable whereas significant difference in sensory score was observed in sample T₃ and T₀.

Physical properties of golden A2 milk. Data pertaining to various physicochemical parameters of golden A2 milk *viz.*, pH, acidity, specific gravity, TSS, density and viscosity were evaluated and results obtained are given in Table 2.

Table 2: Physical properties of golden A2 milk (T₂).

Parameter	Value*
pH	5.8
Acidity (%)	0.65
Specific gravity	1.060
TSS (°Bx)	15
Density(kg/m ³)	1.054
Viscosity (CP)	7.64

*Each value represents the average of three determinations

Data from Table 2 reveal that the pH of golden A2 milk (T₂) was 5.8, acidity 0.65%, specific gravity 1.060, TSS 15 °Bx, density 1.054kg/m³ and viscosity 7.64. Present findings are in close conformity with the findings of (Rehman *et al.*, 2007).

Proximate chemical composition of golden A2 milk

The data from Table 3 represents that moisture content found to be 80.6 ± 0.3 per cent while protein, fat, carbohydrate, ash, crude fiber, curcumin was 1.28 ± 0.1, 4.96 ± 0.2, 9.58 ± 0.3, 0.93 ± 0.04, 0.65 ± 0.14 and 1.85 ± 0.1 per cent respectively. Similar findings were evaluated for turmeric-fortified cow and soya milk by Idowu *et al.* (2022).

Table 3: Chemical composition of golden A2 milk.

Parameter (%)	Value*
Moisture	80.6±0.3
Protein	1.28±0.1
Fat	4.96±0.1
Carbohydrate	9.58±0.3
Ash	0.93±0.04
Crude fiber	0.65±0.03
Curcumin	1.85±0.1

*Each value represents the average of three determinations

Mineral composition of golden A2 milk. Minerals are inorganic elements that the body requires as structural components and as regulators of body functions. Data from Table 4 revealed that the prepared golden milk is good source of calcium and other minerals. The concentration of these minerals was recorded to be Ca 138, Zn 0.54, Fe 1.24, Na 31.4 and negligible amount of Cu *i.e.* 0.13 mg/100g. It is found that addition of jaggery as a sweetener significantly enhance iron content.

Table 4: Mineral composition of golden A2 milk(T₂).

Mineral	Value (mg/100g)
Ca	138
Zn	0.54
Fe	1.24
Na	31.4
Cu	0.13

*Each value represents the average of three determinations

CONCLUSION

A2 milk represents good digestibility qualities, it is a source of energy, protein, and fat, and a high milk intake contributes to increased height, stronger bones, and better dental health. Soymilk have high quality protein with a low amount of saturated and trans fatty acids and all are familiar with goodness of turmeric. Turmeric is rich source of antioxidant as it is filled with curcumin. Curcumin in turmeric have some promising effect observed in patient with pro-inflammatory diseases including cancer, cardiovascular disease, uveitis, gastric ulcer. Considering nutritional profile of ingredients, the golden A2 milk with freshly harvested turmeric rhizome juice and soymilk was prepared. It is observed that the prepared drink is good source of protein and crude fiber. The study revealed that the organoleptic characteristic of turmeric based A2 milk *viz.*, colour, sweetness, flavour, mouthfeel and overall acceptability were significantly influenced by addition

of turmeric rhizome juice. It can be concluded that golden A2 milk can be prepared using cow milk, soymilk and turmeric rhizome juice in proportion 70:20:10 (T₂) received highest sensory score *i.e.*, 8.5 in case of all sensory attributes.

FUTURE SCOPE

Due to changing life style and busy life schedule the beverage food will play an important role in human diet to provide nutritional quality. With the various aspects of health and nutrition, turmeric value-added products will play important role to achieve the medicinal importance. In light of the above nutritional profile of turmeric, soybean and cow milk present investigation was planned to develop an innovative product which can also impart health benefits by addition of fresh turmeric rhizome juice and soymilk.

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