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RESEARCH ARTICLE :

# Waste in to best: utilisation of paneer whey for herbal whey based beverage

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**SUMMARY :** The herbal whey based beverage obtained was subjected for organoleptic evaluation for its four different treatment combinations *viz.*, T-1(80% whey with 20% beetrootextract), T-2 (80% whey with 20% beetroot extract and 2% mentha extract), T-3 (80% whey with 20% beetroot extract and 4% mentha extract) T-4(80% whey with 20% beetroot extract and 6% mentha extract). In all treatments sugar was fixed at 7 per cent in 100 ml of beverage. The different organoleptic characteristics *viz.*, colour and appearance, flavour, taste, consistency and overall acceptability were recorded of fresh beverage. Among all treatments, it was observed that treatment T-4 was significantly superior over other treatments which had the highest overall mean score *viz.*, 8.51 and colour, flavor, taste and consistency were observed 8.00, 8.60, 8.45 and 8.60, respectively. The other three treatments were also acceptable secured more than 8 score in terms of sensory attributes such as, colour and appearance, flavour, consistency and taste/ mouth feel using 9 point hedonic scale by a panel of five semi-expert judges. The *paneer* whey can utilize to develop the acceptable and functional herbal whey beverage.

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KEY WORDS :
*Paneer* whey, Herbal whey beverage, *Mentha* extract, Beetroot extract, Organoleptic evaluation

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## BACKGROUND AND OBJECTIVES

Whey is a by-product of the manufacture of cheese, paneer and casein and has several commercial uses which was often disposed as waste in the past, causing high environmental contamination. Considerable efforts have been made over the past years to find new outlets for whey utilization and to reduce environmental pollution (Wasnik and Changade, 2015; Gonzalez-Martinez *et al.*, 2002; Douaud, 2007; Jelicic *et al.*, 2008). Whey and its protein concentrates are used as ingredients in the food industry mainly due to their foaming and emulsifying properties (Hall and Iglesias, 1997; Ji and Hauque, 2003; Jovanovic *et al.*, 2005) and nutritional and biological attributes (Akpinar-Bayizit *et al.*, 2009). It contains 45-50 per cent of total milk solids, 70 per cent of milk sugars, and 20 per cent of milk proteins, 70-90 per cent of milk minerals and almost all water soluble vitamins present in milk (Horten,1995). Whey protein concentrates, whey protein isolates and whey powder are prepared and widely marketed all over the world but all these process incurs sophisticated equipment and techniques like concentration, isolation and drying by using

vacuum freeze drying, high pressure techniques, filtration through different membrane, ultra centrifugation, ultra filtration, di-filtration, nano-filtration and reverse osmosis, etc. Hence, the conversion of whey into beverage is one of the most attractive avenues for utilizing whey for human consumption (Goyal and Gandhi, 2009). The development of health promoting food is one of the set targets in food process engineering. Yadav *et al.* (2010) worked on development and storage of whey based banana herbal (*Mentha arvensis*) beverage. The authors prepared this beverage, from *Mentha arvensis* extract (0 - 4%) and added fixed quantity of banana juice and sugar were fixed at 10 ml and 8 g, respectively per 100 ml of the beverage. Other food scientists were tried for the development of whey by using different additives, herbs and fruits such as whey based pineapple and bottle gourd mixed herbal beverage by Baljeet *et al.* (2013), whey based RTS beverage from ripe banana juice by Dhamsoniya and Varshney (2013) and whey based mango mint beverage by Chaudasama and John (2014). Research during the last two decades has shown that the combination of routine food with medicinal herbs having any special health beneficial effect can be an excellent source for development of functional food.

Menthol (*Mentha arvensis*) which belongs to the family Libeaceae is a common edible and aromatic perennial herb which is cultivated throughout the India commonly known by name *pudina*. It has an antioxidant, antimicrobial, cytotoxic and analgesic activities of *Mentha arvensis* extract (Nripendra *et al*., 2014). Herbal extract of *Mentha arvensis* has preventive and curative value. It is used to treat sour throat, gastric problems and other problems related to gastrointestinal tract (Campbell *et al.*, 1973; Jamal *et al.*,2006).The aromatic leaves widely used for flavouring foods and beverages. Whey based mango herbal beverage prepared with 2% *M*entha extract has been found to be highest overall acceptability on the day of preparation as well as after 30 days of storage (Sirohi *et al.*2005). In beverages menthol is used for the cooling effect and flavouring, (Yadav *et al.*, 2010).

Beetroot (*Beta vulgaris*) is botanically classified as an herbaceous biennial from Chenopodiaceous family and has several varieties with bulb colours ranging from yellow to red. Deep red-coloured beetroots are the most popular for human consumption, both cooked and raw as salad or juice. The roots and leaves of the beet have been used in folk medicine to treat a wide variety of ailments (Grubben and Denton,2004). Beetroot juice lower the blood pressure (BP) in men when consumed as a part of normal diet in free-living healthy adults. There is growing interest in the use of natural food colours, because synthetic dyes are becoming more and more hazardous (Manoharan *et al.*, 2012). But in food processing, as compared with anthocyanin and carotenoids, betalains are less commonly used, although these water-soluble pigments, they are stable between pH 3 and 7. To improve the red colour of tomato pastes, sauces, soups, desserts, jams, jellies, ice creams, sweets and breakfast cereals, fresh beet/beet powder or extracted pigments are used. It also contributes to consumer's health and wellbeing because it is known to have antioxidants because of the presence of nitrogen pigments called betalains, mainly comprise of red–violet-coloured betacyanins (betanin, isobetanin, probetanin and neobetanin) and yellow–orange-coloured betaxanthyns (Singh and Hathan 2014). By keeping the view in mind to convert whey in to beverage and nutritional and functional attributes of beet root and menthol. The attempt was made to preparation palatable, refreshing and functional beet root whey beverage.

## RESOURCES AND METHODS

The study was carried out in the Department of Animal Husbandry and Dairy science, College of Agriculture, Latur (M.S.) in the year 2016. All the raw materials required for research trial *i.e.* sugar, beetroot, milk, menthe arvensis etc were collected from the local market of Latur city of Maharashtra. The damaged and off type fruits and mentha leaves were discarded.

**Preparation of beet root extract :**

The beetroot extract was prepared as per the method developed by Kamte. 2015. For the preparation of beetroot extract, fresh and healthy beetroot was used. Beetroot were sorted without injury and washed thoroughly under the tap water, cleaned and dried using cloth. After cleaning beetroot were peeled manually and cut into small pieces. Further, pieces were ground in mixer grinder with *paneer* whey (1:1 proportion) in Mixer Jyoti at rpm 18000 for 2-3 min and extract were collected in 250 ml beaker.

**Preparation of *Paneer* whey and mentha Extract :**

The *paneer* whey was prepared as per the method described by Aneja *et al.*, 2002. The milk was heated in

a stainless steel vessel to 86°c and cooled to 76°c at room temperature. The hot milk was acidified by addition of citric acid 0.5 per cent with continuous stirring, resulted in complete coagulation of milk protein (casein). The liquid (*paneer* whey) was filtered through muslin cloth. And mentha extract was prepared from fresh leaves. The leaves were washed, ground in a mixer grinder with whey at proportion (1: 0.5) and filtered using muslin cloth.

**Preparation of herbal whey beverage :**

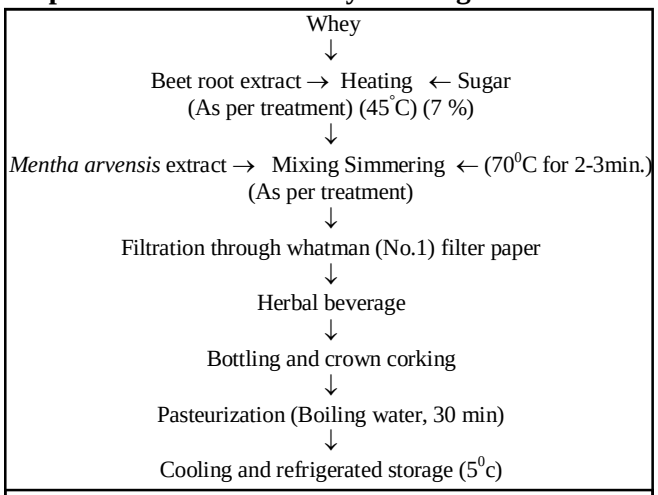


**Fig. A : Preparation of herbal whey beverage (Pandiyan *et al*., 2011).**

The beetroot whey beverage was prepared by using method of Pandiyan *et al.* (2011) with slight modification. For preparation of herbal whey beverage as per the treatment combination (Table 1). The *paneer* whey was heated at 45$^0$C temperature. Then added the cane sugar @ 7 per cent was maintained in all treatments. After that the beetroot and *mentha* extract was added as per the treatment combinations. Simmering was done at 70$^0$C for 2-3 min and filtered through (whatmanNo.1) filter paper and filled into pasteurized glass bottles (100 ml) and sealed. Pasteurization of filled bottles was done in boiling water for 30 min (Lal *et al*., 1998) and cooled to room temperature and stored at refrigerated condition (5$^0$C). The acceptability of the whey beverage was measured in terms of sensory attributes such as, colour and appearance, flavour, consistency and taste/ mouth feel using 9 point hedonic scale by a panel of five semi-expert judges developed by Quarter Master Food and Container Institute, U.S.A. (Gupta, 1976). The data obtained were analyzed statistically by using completely randomized block design (CRBD) as per Panse and Sukhatme (1985).

**Table A : Details of treatment combination**

| Sr. No. | Treatment combination symbols |
|---|---|
| 1. | Control (80 % *paneer* whey with 20 % beetroot extract ) = T- 1 |
| 2. | *Paneer* whey - beetroot extract – menthe arvensis extract (80:20:2 %) = - 2 |
| 3. | *Paneer* whey - beetroot extract – menthe arvensis extract (80:20:4 %) = T- 3 |
| 4 . | paneer whey - beetroot extract – menthe arvensis extract (80:20:6 %) = T- 4 |

**Organoleptic evaluation of the product :**

The herbal whey beverage was subjected to organoleptic evaluation by the semi expert panel of judges. It was evaluated for colour and appearance, flavour, test and mouth feel and overall acceptability. Score card was provided to all judges, comparing 9 point hedonic scale, developed by Quarter Master Food and Container Institute, U.S.A. (Gupta, 1976). The score of various treatments in respect of colour and appearance, flavour, taste and mouth feel and overall acceptability was worked out. The data were analyzed using Completely Randomized Block Design (CRBD).

## OBSERVATIONS AND ANALYSIS

The results obtained from the present study as well as discussions have been summarized under following heads :

**Colour and appearance :**

It was observed that from table number 2 that the mean score of beverage in treatments $T_1$, $T_2$, $T_3$ and $T_4$ were 8.10, 8.60, 8.30 and 8.00, respectively. The treatment $T_2$ was significantly superior over treatments $T_1$, and $T_4$ and at par with $T_3$. Beet root contribute to colour development, colloidal properties and dustiness in beverage prepared by using beetroot from whey (Kamte, 2015) which was observed in the next treatments *i.e.* in $T_3$ and $T_4$ as *mentha* extract increased progressively from 4 to 6 percent, respectively. It may be concluded that, 2 per cent *mentha* extract adding to the whey beverage was preferred by the judges, as far as colour and appearance character was concerned. Colour and appearance score were match with the score observed by Baljeet *et al*. (2013), the average sensory score of beverage for colour were 8.00, 8.00, 8.50, 8.00 and 8.00 for treatment $H_0$, $H_1$, $H_2$, $H_3$ and $H_4$, respectively in mixed

herbal beverage. Further, the results recorded in the present investigation for colour were comparable for trend/pattern observed in the studies of Dubey *et al.* (2007), Babar *et al.* (2008) and Moarefian *et al.* (2012) conducted to convert milk whey as beverages by using different fruits ingredients.

**Flavour :**

It was observed that the mean scores for flavour of beverage for treatments $T_1$, $T_2$, $T_3$ and $T_4$ were 8.10, 8.40, 8.50 and 8.60, respectively. The treatment $T_4$ was higher flavor score over all other treatments and significantly superior to $T_1$ and $T_2$. It would like to highlight here that the flavor scored observed by Kamte, 2015 was progressively reduced in successive treatments due to the effect benny/bitter flavor of beetroot contributed in her study was masked here owing to the menthol and judges scored and preferred higher treatment $T_4$ for flavor contain 6 % *menthe* extract. It clearly indicated that the adding of *mentha* extract more than 6 per cent for preparing herbal whey beverage might be milestone to development of functional beet root whey beverage and give hint to researcher to develop more functional herbal whey-beet root beverage after investigating the higher dose (> than 6 %) of menthol and beet root extract in future. The results recorded in the present investigation for flavour were comparable with the pattern observed in the studies of Bhavsagar *et al.* (2010), reported the average score of pineapple flavored beverage were 7.7, 7.6, 8.0 and 7.3 for treatment $T_0$, $T_1$, $T_3$ and $T_4$, respectively; Baljeet *et al.* (2013) developed the whey based pineapple (*Ananascomosus*) and bottle gourd (*Lagenariasiceraria*) mixed herbal beverage and reported that the average score of freshly prepared beverage for flavour 7.50($T_0$), 8.00($T_1$), 8.00 ($T_2$), 8.00($T_3$), 7.00($T_4$). It may be due to the effect of menthol used in present investigation.

**Taste/mouthfeel :**

Table 2 reflected the mean score of taste for the treatments $T_1$, $T_2$, $T_3$ and $T_4$ as, 7.90, 8.30, 8.55 and 8.45, respectively. From the above observations it was clearly indicated that the taste of beverage was improved over control (7.90) in all developed treatments due to the use of menthol extract and secured high score by $T_3$ (8.55). The treatment prepared by using four part of menthol extract was significantly superior than treatments $T_1$ and $T_2$ and at par with $T_4$, indicate that addition of menthol enhance the test and mouth feel particularly due to chilling effect attributed by menthol.The results recorded for taste were found more superior than the results recorded by Yadav *et al.* (2010) in whey based banana herbal beverage for taste scored 7.60, 8.10, 8.10, 7.20 and 6.90 in $P_0$, $P_1$, $P_2$, $P_3$ and $P_4$, respectively and Baljeet *et al.* (2013) in whey based pineapple (*Ananascomosus*) and bottle gourd (*Lagenariasiceraria*) mixed herbal beverage were 8.00($T_0$), 8.00($T_1$), 8.00 ($T_2$), 7.50($T_3$), 7.00($T_4$), might be credited to the use of menthol extract in preparation of whey based beverage in present investigation.

**Consistency :**

The average sensory score for consistency of herbal whey beverage in treatment $T_1$, $T_2$, $T_3$ and $T_4$ was 8.00, 8.35, 8.40 and 8.60, respectively. It was observed that, Treatment $T_4$ was significantly superior over $T_1$, $T_2$ and $T_3$. It is reveled from table that the *mentha* extract mixed treatment was shown good consistency than control, higher in $T_4$ (8.60) and lower in $T_1$ (8.00). As far as consistency is concerned, the treatment $T_4$ beverage blends with 6% per cent of the *mentha* extract was acceptable by panel of judges. Continuous increasing score was observed for consistency in present study, which was reduced in the studies of Babar *et al.* (2008) for *chakka* whey beverage (CWB) from pomegranate juice were 8.47, 8.65, 8.82 and 8.36 in treatment $T_1$, $T_2$, $T_3$ and $T_4$, respectively and Bhavsagar *et al.* (2010) in pineapple flavored beverage from *chhana* whey *i.e.* consistency score recorded was the highest for $T_2$ as 7.8 followed by 7.7 for $T_1$ and lowest for $T_3$ as 7.4. The

**Table 1 : Effect of recipe treatments on organoleptic characteristics of herbal whey based beverage**

| Treatments | Colour and appearance | Flavour | Taste | Consistency | Mean |
|---|---|---|---|---|---|
| $T_1$ | 8.10 | 8.10 | 7.90 | 8.00 | $8.03^a$ |
| $T_2$ | 8.60 | 8.40 | 8.30 | 8.35 | $8.41^b$ |
| $T_3$ | 8.30 | 8.50 | 8.50 | 8.40 | $8.43^b$ |
| $T_4$ | 8.00 | 8.60 | 8.45 | 8.60 | $8.51^b$ |
| S.E. ±0.0537 | | C.D. (P=0.05) = 0.1656 | | | |

The values with different small letters superscripts row wise differ significantly at 5 per cent level of significance.

results and trends recorded in the present investigation for consistency were more progressive than these mentioned research workers.

**Overall acceptability :**

Table 2 shows that the mean overall score of acceptability of herbal whey based beverage for treatments $T_1$, $T_2$, $T_3$ and $T_4$ were 8.03, 8.41, 8.43 and 8.51, respectively. It was observed that, treatments $T_4$ was significantly superior over others treatments which had the highest mean score of whey beverage prepared using 6 per cent *mentha* extract. Treatment $T_2$ was obtained high score for colour and appearance, $T_3$ was acceptable or high scored in the taste but overall acceptance was towards treatment $T_4$ due to the high score in consistency and taste. The treatment $T_1$ had least mean overall score *i.e.* 8.03. The organoleptic characteristics were studied by Rajesh *et al.*, 2015, in orange based blended ready-to-serve (RTS) beverages and Landge *et al.*2013, studied on preparation and sensory evaluation of whey beverage showed variation in sensory score of present study might be due to the different ingredient used by them. But in pineapple and bottle gourd juice prepared by using 1, 2, 3 and 4 per cent *Mentha* extract by Baljeet *et al.* 2013 and beetroot whey beverage studied by Kamte2015, recorded same trends in their study. The RTS beverage prepared from blend consisting 75 % bael pulp and 25 % aloe vera gel was found comparable to the present beverage in terms of taste, colour, flavour and medicinal properties (Dhiru and Bhagwan 2015). The results obtained in present investigation might be due to the masking effect of benny flavor of beet root and thrusting and chilling properties of menthol.

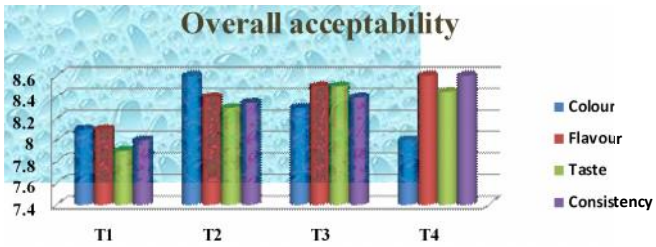


**Fig. 1 : Overall acceptability of herbalwhey beverage**

**Conclusion :**

From present investigation it can be concluded that the *menthe* extract can be very well utilized for development of organoleptic properties in beverage. On the basis of sensory scores the treatment T-4 *viz.*, 6 per cent *mentha* extract in 80 per cent *paneer* whey and 20 per cent beetroot extract on weight basis the development of health promoting beverage is possible, which might be countable for prevailing cold drinks present in market. Product developers seeking out functional and nutritional attributes of whey to tap the tremendous growth opportunities in the beverage industry can move forward for the development of such herbal whey beverages based upon whey, beetroot and menthol to exhaust nutritional, therapeutic as well as medicinal properties of beetroot and menthol.

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