J. Res. ANGRAU 49 (3) 64-71, 2021

UTILISATION OF PASSION FRUIT AND MANGO FOR THE DEVELOPMENT OF A PROBIOTIC DRINK

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Date of Receipt : 29.5.2021 Date of Acceptance : 02.8.2021

ABSTRACT

Probiotics are increasingly being added to food products in order to develop functional foods with health promoting effects. Hence, an attempt was made to develop a probiotic drink containing passion fruit and mango involving *L. acidophilus*.In the study, five treatments (along with one control) with three replications were standardized. The most acceptable combination (50% Passion fruit + 50 % Mango) of the drink was pasteurised at 80^0C for 20 minutes and allowed to cool. The pasteurised drink was then inoculated with 4il *L.acidophilus* and incubated for a period of one hour at 37^0C which had availability of 13. 35 log cfu g^{-1}.The probiotic passion fruit based drink along with its control(non-probiotic drink) had TSS content of 12.50 and 13.20 ^{0}Brix, titratable acidity of 1.98 % and 1.60 % , total sugar 16.66 and 17.10 g 100 g^{-1}, reducing sugar 4.08 and 4.40 g 100 g^{-1}, protein 0.70 and 0.36 g 100 g^{-1}, carbohydrate 13.32 and 14.72 100 g^{-1}, energy of 56.08 and 60.32 Kcal, ascorbic acid of 10 mg 100 g^{-1} and 13.7 mg 100 $g^{-1}$and total ash 1.60 % and 1.52 %, respectively.

Keywords: Passion fruit, *Lactobacillus acidophilus*, Mango, Viability, Sensory evaluation

INTRODUCTION

Probiotics are live microorganisms when administered in adequate amounts confer a health benefit on the host (WHO, 2001). Probiotic foods are those foods which contain a live microbiological culture either as a result of fermentation or as an intentional addition to benefit the host by improving the intestinal microbial balance. Addition of probiotics to food provides several health benefits such as decreasing the number of pathogenic gastrointestinal microorganisms, reducing the serum cholesterol level, improving the gastrointestinal function, strengthening immune system, protection of proteins and lipids from oxidative damage and has anticarcinogenic and antimutagenic effects.

The incorporation of probiotics to underutilised fruits can improve their acceptability and market potential. Such products may also have better profile of nutrients and therapeutic value. Yellow passion fruit (*Passiflora edulis*

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flavicarpa), which is native to the tropical Americas, is considered as an underutilized fruit crop but can be a good source of vitamins, like A and Cand minerals.

Passion fruit is not only nutritious but also has a variety of health care functions, such as refreshing, solve thirst, help digestion, improve renal function, eliminate fatigue and other effects (Liu *et al*., 2017). Passion fruit contains anti-inflammatory, anticonvulsant, antimicrobial, anticancer, antidiabetic, antihypertensive, antisedative, antioxidant properties and is used in treating conditions such as osteoarthritis, asthma and also act as colon cleanser. The different parts of the plants have also been used for treatment of ulcers, haemorrhoids, as sedatives, remedy for insomnia, digestive stimulant and remedy for gastric carcinoma (Thokchom and Mandal, 2017).The fiber and carbohydrate content of mango have been identified as beneficial to probiotic microorganisms during cold storage. A major challenge of adding probiotic microorganisms to fruit beverages is the impact on sensory attributes as a result of bacterial metabolism.The exotic components and sweetness of mango, and the acid balance help to lower the impact of bacterial metabolites and mask off flavors produced and attribute to the acceptance of mango based probiotic drinks (Acevedo-Martinez *et* al., 2018). Considering these factors, passion fruit and mango were selected for the incorporation of probiotics. If a probiotic product is developed from these fruit, it would definitely attract consumer attention and improve its economic value.

MATERIAL AND METHODS

The study was carried out from 2018 to 2020 at College of Agriculture, Kerala Agricultural University, Thrissur,Kerala. For the study, ripe passion fruit (yellow variety) and mango were collected from Cashew Research Station and Pineapple Research Stations of Kerala Agricultural University. Pure cultures of the probiotic strain *L. acidophilus* MTCC 10307 needed for the study was obtained from Institute of Microbial Technology (IMTECH), Chandigarh. All other ingredients needed for the study were purchased from the local market.

Standardisation of passion fruit drink

For the preparation of passion fruit based drink, the standard procedure of the FSSAI (2010) was followed.The quantity of ingredients used for preparation of drink was taken by calculating the acidity and TSS of the sample and then adding other ingredients in accurate quantity to maintain the FSSAI limits. Juices were strained and measured. Sugar syrup was prepared by heating appropriate amount of sugar in required amount of water. After cooling, measured quantity of juice was mixed with sugar syrup. It was then pasteurized at 80^0C for 20 minutes.

Organoleptic evaluation

Organoleptic evaluation of the drinks were conducted using a score card (9 point hedonic scale) by a panel of 15 judges. A series of acceptability trials were carried out using simple triangle test at the laboratory level to select the panel of judges between the age group of 18-35 years as suggested by Jellinek(1985). Based on the organoleptic qualities the best combination of the drink was selected.

Development of passion fruit based probiotic drink

The selected fruit drink (25 ml) was pasteurised at 80^0C for 20 minutes and allowed to cool. The pasteurised drink was then inoculated with 4ìl *L. acidophilus* and incubated for a period of one hour at 37^0 C. The probiotic passion fruit based drinks along with their control (non-probiotic drink) were then packed in food grade plastic bottles and stored under refrigerated conditions (Fig.1.).

Viability of *L. acidophilus* in passion fruit based probiotic drink

The viable count of *L. acidophilus* present in the passion fruit based probiotic drink was enumerated by serial dilution and plate count method as detailed by Agarwal and Hasija (1986). The microbial enumeration was completed by pour plate method using MRS agar and the results are expressed as 10^9 $cfug^{-1}$.

Physicochemical qualities of the drinks

The developed probiotic drink along with its control (non-probiotic sample) was assessed for TSS, titratable acidity, reducing sugar and total sugar according to the method of Ranganna (1986). Protein, carbohydrate, energy and ascorbic acid of the drinks were determined according to the standard procedure of Sadasivan and Manickam (1992). Total ash was analysed by the procedure of AOAC (1994).

Statistical analysis

The observations were analysed statistically in completely randomised design (CRD). The scores of organoleptic evaluations were assessed by Kendall's coefficient of concordance and the differences among treatments in nutritional qualities were assessed using Duncan's multiple range test (DMRT).

RESULTS AND DISCUSSION

Standardisation of combination of ingredients in the drink

In passion fruit based drink, different combinations of passion fruit juice and mango juice were tried(Table 1), in which, the percentage of passion fruit juice varied from 50 to 90 and percentage of mango juice varied from 10 to 50. Blending of two or more juices enable to produce beverages of superior quality with sensory,nutritional and medicinal properties (Bhagwan and Awadhesh, 2014). The mean scores for the organoleptic evaluation of passion fruit based mango drinks(Table 2), revealed that the treatment which contained 50 percent passion fruit juice and 50 percent mango juice (T_5) scored maximum for the organoleptic attributes except for texture. This combination secured a mean score of 8.84, 8.71, 8.48, 8.02, 7.84 and 8.37 for appearance, colour, flavour, texture, taste and overall acceptability, respectively and thetotal score of this treatment was 50.26. The scores of organoleptic evaluations were assessed by Kendall's coefficient of concordance and it was found that there was agreement between the judges. A passion fruit nectar developed by Charan (2016) had total score of 52.1, 50.9 and 47.3, respectively for first, second and third months of storage under ambient conditions. Mango and passion fruit (80:20) smoothie beverage prepared by Gallina *et al.* (2019) revealed that the overall acceptability of the product was 7.40 with good aroma and flavour.

Viability of *L. acidophilus* in passion fruit based probiotic drink

L. acidophilus present in the drinks was enumerated (Table 3). The viable count of *L. acidophilus* was 13.35 log cfu g^{-1} as against the desired level of 8 log cfu g^{-1} in probiotic foods.

Recently, Monteiro *et al*. (2020)reported that passion fruit pulp act as a good medium for probiotic culture, when fermented at a temperature of 30^{0}C. The researchers also concluded that presence of phenolic compounds and other acidic molecules can be the reason for probiotic production. This can provide health benefits because of the combination of probiotic properties and also properties of bioactive compounds.Ranjitha *et al.* (2018) developed a probiotic mango RTS using *Lactobacillus rhamnosus* and reported that the cell count was 8.25± 0.21, 9.07± 0.5 and 9.1±0.32 log cfu ml^{-1} during second, fourth and sixth days of incubation period, respectively. Mango RTS beverage inoculated with *Lactobacillus helveticus* MTCC 5463 has the potential for development of probiotic mango beverage as they showed good sensory attributes and also higher concentration of phenolic compounds and flavonoids after fermentation.

Physico- chemical qualities of the drinks

The physico-chemical qualities such asTSS, titrable acidity, total sugar, reducing sugar, protein, carbohydrate, energy, ascorbic acid and total ash in the probiotic and non-probiotic drinks were analysed (Table 4).There was significant reduction in the TSS content of probiotic drink (12.50^o Brix) compared to non-probiotic drinks (13.20^o Brix). During fermentation, the probiotic organism produces lactic acid by hydrolysing starch. This metabolic activity convert starch to fermentable simple sugars which is used by probiotic organisms (Adams *et al*., 2008).

It was observed that there was significant increase in titratable acidity of probiotic drinks (1.98) compared to non-probiotic drink (1.60).Titratable acidity increased significantly (Pd”0.05) with increasing fermentation time irrespective of the medium. Similar findings were observed by Shukla (2013), in which, whey-pineapple juice blend gave higher titratable acidity for five and 10 hours of fermentation.

The probiotic drinks showed a significantly lower content of total sugar and reducing sugar compared to non-probiotic drink. Fernandes *et al*. (2011) also opined that there was a difference in total sugar and reducing sugar on pasteurising passion fruit juice. The pasteurized juice had 9.63 % total sugar and 8.33 % reducing sugar content.

A higher value of protein content was observed in the probiotic drink (0.70 g 100 g^{-1}) than non-probiotic control (0.36 g 100 g^{-1}). The carbohydrate content was higher in non-probioticjuice compared to probiotic samples. Total energy content was 60.32Kcal and 56.08 Kcal in non-probiotic and probiotic drinks, respectively. Stanton*et al*. (2005) reported that both genera *Lactobacillus* and *Bifidobacterium* were reported to have high requirements of free aminoacids, peptides, vitamins and fermentable carbohydrates for their growth and development. The reduction in energy content of probiotic drink compared to non-probiotic drink was due to higher carbohydrate and fat content in fresh juice than probiotic juice (Rafiq *et al*., 2016).

Table 1. Proportion of ingredients in the prepared passion fruit-mango drinks

Treatments	Combinations
T_0(Passion fruit) - Control	100%
T_1 (Passion fruit + Mango)	90% + 10 %
T_2 (Passion fruit + Mango)	80% + 20 %
T_3 (Passion fruit + Mango)	70% + 30 %
T_4 (Passion fruit + Mango)	60% + 40 %
T_5 (Passion fruit + Mango)	50% + 50 %

Table 2. Mean score and mean rank scores for the organoleptic qualities of prepared passion fruit-mango drinks

Treatments	Mean score						
	Appea -rance	Colour	Flavour	Texture	Taste	Overall Accep -tability	Total Score
T_{0-} Control (100% Passion fruit)	8.57 (3.93)	8.48 (4.30)	7.88 (3.07)	8.04 (4.47)	7.82 (4.47)	8.10 (4.13)	48.89
T_1 (90% Passion fruit +10% Mango)	8.35 (2.80)	8.00 (2.00)	7.82 (2.93)	7.26 (2.53)	6.77 (2.80)	7.64 (4.03)	45.84
T_2 (80% Passion fruit + 20% Mango)	8.33 (2.97)	8.02 (2.37)	7.88 (3.00)	7.64 (3.07)	7.17 (2.77)	7.80 (3.60)	46.84
T_3(70% Passion fruit + 30% Mango)	8.55 (3.47)	8.17 (3.07)	7.95 (3.27)	7.91 (3.70)	7.46 (3.40)	8.00 (3.00)	48.04
T_4 (60% Passion fruit + 40% Mango)	8.57 (3.53)	8.24 (3.47)	7.97 (3.23)	7.82 (3.73)	7.56 (3.77)	8.03 (2.93)	48.19
T_5(50% Passion fruit + 50% Mango)	8.84 (4.30)	8.71 (4.43)	8.48 (4.50)	8.02 (4.43)	7.84 (4.80)	8.37 (4.30)	50.26
Kendall's W value	0.12	0.37	0.31	0.38	0.37	0.23	

Values in parenthesis are mean rank score based on Kendall's W

Table 3. Viable cell count of *L. acidophilus* in the prepared drinks

Fruit juice drink	Viable count (log cfu g^{-1})
Non-probiotic drink	Nil
Probiotic drink	13.35

Table 4. Physico-chemical qualities of the prepared drinks

Treatments	TSS (°Brix)	Titrable acidity (%)	Total Sugars ($g100g^{-1}$)	Reducing sugars ($g\ 100g^{-1}$)	Protein ($g100g^{-1}$)	Carbohydrate ($g100g^{-1}$)	Energy (Kcal)	Ascorbic acid ($mg100g^{-1}$)	Total ash (%)
Non Probiotic (control)	13.20^{a}	1.60^{b}	17.10^{a}	4.40^{a}	0.36^{b}	14.72^{a}	60.32^{a}	13.70^{a}	1.52^{b}
Probiotic	12.50^{b}	1.98^{a}	16.66^{b}	4.08^{b}	0.70^{a}	13.32^{b}	56.08^{b}	10.00^{b}	1.60^{a}
CD Value@ 5 %	0.220	0.023	0.161	0.023	0.023	0.023	0.023	1.610	3.044
Significance	S	S	S	S	S	S	S	S	NS

S- Significant; NS- Non Significant; Values with different superscript differ significantly at 5% DMRT Column wise comparision

Fig.1. Passion fruit and mango based probiotic drink

Non-probiotic passion fruit and mango combination drink showed comparatively higher ascorbic content of 13.7 mg $100g^{-1}$ than the probiotic drink 10 mg $100g^{-1}$. Shukla *et al*. (2013) reported that reduction in ascorbic acid content of probiotic drinks may be due to pasteurisation of juice and exposure to light. The ascorbic acid content in RTS drink prepared by blending juices of passion fruit and cashew apple in different ratios such as 25:75, 50:50, 25:75 + ginger drops and 50:50 + ginger drops was 80.26 mg 100 g^{-1}, 79.73 mg 100 g^{-1}, 76.39 mg 100 g^{-1} and 79.29 mg 100 g^{-1}, respectively (Sobhana *et al*., 2011).The study reported non-significant changes in the total ash of probiotic and non-probioticdrinks. As stated by Jood and Khetarpaul (2005) bacterial culture might increase the bioavailability of various minerals but there need not be any change in the total mineral content in the probiotic foods.

CONCLUSION

The study revealed that good quality probiotic drink can be prepared by using 50 % passion fruit juice and 50 % mango juice with good acceptability, nutritional qualities and with a viable count of 13.35 log cfu/ ml. The probiotic passion fruit based drink had a TSS content of 12.50 ^{0}Brix, 1.98 percent titratable acidity, 16.66 g $100g^{-1}$ total sugar, 4.08 g 100 g^{-1} reducing sugar, 0.70 g $100g^{-1}$ protein,13.32 100 g^{-1} carbohydrate, 56.08 Kcal energy, 10 mg 100 g^{-1} ascorbic acid and a total ash 1.60 percent. It can be concluded that passion fruit can be a suitable substrate for the development of probiotic drinks.

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