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Physico-chemical quality of kefir prepared by addition of Mango, Jamun and Strawberry pulp

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Abstract
Kefir is a fermented dairy product which has been originated from the Caucasus Mountains. Initially, preliminary trials were conducted to finalize the incubation temperature and the level of fruit pulp. Mango, Jamun and Strawberry pulp were added for the preparation of fruit kefir. Kefir was prepared by incubating milk at 37 °C for 9 hrs + 24 °C for 15hrs and addition of Mango, Jamun and Strawberry pulp at 16%, 18% and 20% respectively. The average chemical score was 2.87% to 3.67% for fat, 3.36% to 2.79% for protein, 4.26% to 3.31% for reducing sugar, 13.10% to 11.10% for total solids, 0.62% to 0.72% for titrable acidity, 5.07 to 4.83 for pH, 0.62% to 0.68% for ash and viscosity range from 250.78 to 360.81mPas.

Keywords: kefir, physico-chemical, mango, Jamun, strawberry

Introduction
Kefir is a fermented dairy product which has been originated from the Caucasus Mountains (Gronnevik *et al.*, 2011). It is a traditional popular Middle Eastern beverage. The word kefir is said to have originated from the Turkish word 'Keyif' which means 'good feeling' (Leite *et al.*, 2013) [8]. The taste of kefir is slightly sour, acidic taste and it has a creamy consistency. In contrast to other fermented milk, kefir has been characterized by its specific flavor of yeasts and a mouthfeel originating from constituents like acetic acid, ethanol and CO_2. Kefir is a natural probiotic, which contains live active cultures of normal flora which is made of very strong strains of micro-organisms. It has various benefits to human health, such as improving lactose digestion and tolerance in adults as well as antimicrobial, antitumoral, antioxidant, antimutagenic, and antiapoptotic effects (Lopitz-Otsoa *et al.*, 2006) [9]. Recently there has been a trend to add fruit juices and pulp to cultured milk production. As the addition of natural flavor creates a wide variety of sensory choices in texture, color and flavor in fermented milk making it appealing to the consumer. Various fruits also provide nutritional benefits and enhance the product's nutritional value. Considering the above facts, the addition of Mango, Jamun and Strawberry fruit pulp is carried out in kefir. Moreover, mango fruits provide energy, dietary fiber, carbohydrates, proteins, fats, and phenolic compounds, which are vital to normal human growth, development, and health. The energy value per 100 g is 250 kJ. Jamun is a rich source of Vit A. and Vit C. The pulp of Jamun contains anthocyanin, delphinidin, petunidin, malvidindiglucisdes. Fruits are rich in raffinose, glucose, fructose, citric acid, malic acid, gallic acid, delphinidin-3-gentibioside, malvidin-3-laminaribioside, petunidin-3-gentiobioside and cyanidin glycoside. Pulp of Jamun has various nutrients like ascorbic acid, thiamine and niacin, free amino acids like alanine, asparagine, tyrosine, glutamine and cysteine (Ramya *et al.* 2012) [14]. The fruit of the strawberry plant is packed with beneficial nutrients, particularly Vitamin C and flavonoids. One cup of strawberries weighs approximately 144 grams and contains between 45 and 50 calories. Strawberries are over 90% water, 7% carbohydrates, about 2% fiber, and less than 1% each of protein, fat, and ash. Strawberries are also a dietary source of minerals and vitamins. The strawberries have various minerals *viz.* potassium, phosphorus, calcium, magnesium, sodium, iron, manganese, zinc, copper, and selenium. Strawberries are also a good source of the following vitamins: Vitamin C, thiamine, riboflavin, niacin, pantothenic acid, Vitamin B6, Folate, Vitamin B12, Vitamin A, and Vitamin E. Additionally, strawberries contain 18 different amino acids.

Materials and Methods

Kefir was prepared with slight modification to procedure given by the Guzel-Seydim *et al.*, 2010 [3]. Based on preliminary trials the following method was followed for preparation of fruit kefir.

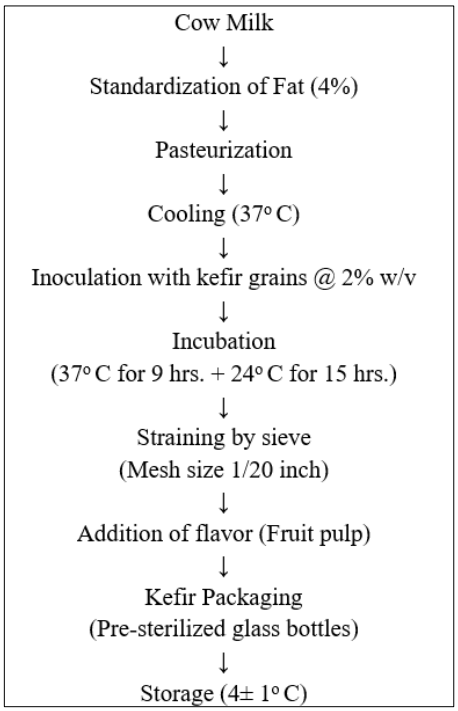

Fig 1: Flow diagram for preparation of fruit kefir

Preliminary trials were carried out for optimization of fruit pulp. Based on the sensory result addition of Mango, Jamun and Strawberry pulp at 16%, 18% and 20% respectively was carried out. The treatments taken for experiment were T_0 for control, T_1 for kefir added with Mango pulp at 16%, T_2 for kefir added with Jamun pulp at 18% and T_3 for kefir added with Strawberry pulp at 20%.

Statistical Analysis

The data generated during the course of this investigation was tabulated and analysed using Completely Randomized Design (CRD) for experimental trials and to compare control with other treatments.

Result and Discussion

Fat

The fat content of fruit *kefir was* significantly ($p<0.05$) influenced due to different fruit pulp treatments. The fat content under different treatments ranged from 2.87% to 3.67%. The fat content was 3.67, 3.20, 3.05 and 2.87 for treatment T_0 (Control), T_1 (Mango), T_2 (Jamun) and T_3 (Strawberry). The highest fat percent was observed in treatment T_0 (Control). The addition of fruit pulp resulted in a decrease in fat content in fruit kefir. This effect may be attributed low percent of fat content fruit pulp. Irigoyen *et al*. (2004) prepared kefir from cow milk by addition of kefir grains at 1% and 5%. They observed the fat per cent of kefir was 3.51 and 3.60 respectively. E. SARICA and H. COŞKUN (2020) [2] prepared kefir from Cow and Goat milk. The initial fat per cent at day 0 for both samples was 3.10±0.071 and 3.18±0.035 respectively. Patil (2018) [13] observed that addition of jamun pulp in yoghurt decreases the fat content. The fat content under different treatments ranged from 3.17 to 3.52%.

Protein

The mean value for protein content for treatments T_0 (Control), T_1 (Mango), T_2 (Jamun) and T_3 (Strawberry) were 3.36, 3.08, 2.91 and 2.79 per cent, respectively. The highest value of protein content was reported in treatment T_0 (Control) 3.36 per cent while lowest was for T_3 (Strawberry) 2.79 per cent. The level of fruit pulp showed a non-significant ($p>0.05$) effect on the protein content of fruit *kefir*. The protein per cent content in pulp is lower which has cause the reduction of protein content after addition of fruit pulp. Muir *et al*. (1999) [11] reported the protein content of traditional kefir samples between 3.22 and 4.54%. According to Codex Alimentarius standards the protein content of kefir should be minimum 2.7% per cent. The results are similar to result obtained by Rakhi *et al.* (2013) [17], Kabir *et al*. (2014) [6], Patil (2018) [13].

Reducing Sugars

The mean value for reducing sugar content for treatments T_0 (Control), T_1 (Mango), T_2 (Jamun) and T_3 (Strawberry) were 3.31, 3.55, 4.26 and 3.47 per cent, respectively. The highest value of reducing sugar content was reported in treatment T_2 (Jamun) 4.26 per cent while lowest was for T_0 (Control) 3.31 per cent. The level of fruit pulp showed significant effect ($p<0.05$) on the reducing sugar content of fruit *kefir*. The value of reducing sugar (fructose) present in Mango, Jamun and Strawberry pulp are 4.79, 8.60 and 4.10 per cent respectively. Fructose (Reducing sugar) present in pulp have cause increase in per cent reducing sugar in treatments than control. Patil (2018) [13] observed that addition of jamun pulp result in increasing of reducing sugar per cent of yoghurt. Similar result was also observed by Mbaeyi-Nwoha and Ekere (2014) [10] and Matter *et al.* (2016) [1].

Total Solids

Total solid content in Mango, Jamun and Strawberry pulp were 16.22%, 12.38% and 5.40% respectively. Rakhi *et al.* (2013) [17] observed increase in total solids due to addition of mango pulp in Dahi. Patil (2018) [13] observed decrease in total solid content after addition of jamun pulp in yoghurt. Osudhahunsi *et al.* (2007) observed decrease in total solid content of soy yoghurt after addition of strawberry pulp. The results obtained in this research follows the trend observed by Rakhi *et al.* (2013) [17], Patil (2018) [13] and Osudhahunsi *et al.* (2007).

Titrable Acidity (% lactic acid)

The mean value for Titrable acidity for treatments T_0 (Control), T_1 (Mango), T_2 (Jamun) and T_3 (Strawberry) were 0.66, 0.62, 0.72 and 0.69, respectively. The highest value of Titrable acidity was reported in treatment T_2 (Jamun) 0.72 while lowest was for T_1 (Mango) 0.62. The level of fruit pulp showed non-significant effect ($p>0.05$) on the titrable acidity of fruit *kefir*. The results obtained in this research follows the trend observed by Patil (2018) [13], HARMANKAYA *et al.* (2018) [15], Sung-Ho Yoo *et al.* (2013) [16] and E. SARICA* and H. COŞKUN (2020) [2].

pH

The mean value for pH for treatments T_0 (Control), T_1

(Mango), T_2 (Jamun) and T_3 (Strawberry) were 5.01, 5.17, 4.83 and 4.90, respectively. The highest value of pH was reported in treatment T_1 (Mango) 5.17 per cent while lowest was for T_2 (Jamun) 4.83. The level of fruit pulp showed significant effect ($p<0.05$) on the pH of fruit *kefir*. Sung-Ho *et al.* (2013) [16] observed the pH values were between 3.99 and 4.52 of kefir. Irigoyen *et al*. (2005) [4] stated that significant difference in pH can be observed depending on the percentage of kefir grain added inoculate. The results obtained in this research follows the trend observed by Patil (2018) [13] and Harmankaya *et al.* (2018) [15].

Ash

The mean value for ash content for treatments T_0 (Control), T_1 (Mango), T_2 (Jamun) and T_3 (Strawberry) were 0.68, 0.62, 0.62 and 0.63 per cent, respectively. The highest value of ash content was reported in treatment T_0 (Control) 0.68 per cent while lowest was for T_1 (Mango) and T_2 (Jamun) 0.62 per cent. The level of fruit pulp showed significant effect ($p<0.05$) on the ash content of fruit *kefir.* According to Santos *et al.* (2018) the addition of fruit pulp cause minerals in product to get diluted, thus cause ash values to drop. The results obtained in this research follows the trend observed by Patil (2018) [13] and Kabir *et al.* (2014) [6].

Viscosity

The mean value for viscosity for treatments T_0 (Control), T_1 (Mango), T_2 (Jamun) and T_3 (Strawberry) were 265.48, 360.81, 250.78 and 260.36 respectively. The highest value of viscosity was reported in treatment T_1 (Mango) 360.81 while lowest was for T_2 (Jamun) 250.78. The level of fruit pulp showed significant effect ($p<0.05$) on the viscosity of fruit *kefir*. A. Irigoyen *et al*. (2004) observed the viscosity of kefir ranged from 425 to 188 mPa*s. Koktas *et al*. (2013) prepared kefir by using grains at rate of 2% and 3%. They observed the viscosity of the kefir ranged between 225.0 to 315.2 mPas. The result obtained during research are in agreement to result obtained by Irigoyen *et al*. (2004) and Kok tas *et al*. (2013).

Table 1: Average Physico chemical composition of Fruit kefir

Treatment	Fat	Protein	Reducing Sugar	Total Solid	Titrable Acidity	pH	Ash	Viscosity (mPa*s)
T_0	$3.67^{a} \pm 0.05$	$3.36^{a} \pm 0.01$	$3.31^{d} \pm 0.02$	$12.49^{b} \pm 0.03$	$0.66^{b} \pm 0.02$	$5.01^{b} \pm 0.07$	$0.68^{a} \pm 0.01$	$265.48^{b} \pm 14.70$
T_1	$3.20^{b} \pm 0.04$	$3.08^{b} \pm 0.02$	$3.55^{b} \pm 0.02$	$13.10^{a} \pm 0.01$	$0.62^{a} \pm 0.01$	$5.17^{a} \pm 0.05$	$0.62^{c} \pm 0.01$	$360.81^{a} \pm 12.53$
T_2	$3.05^{c} \pm 0.06$	$2.91^{c} \pm 0.01$	$4.26^{a} \pm 0.01$	$12.48^{c} \pm 0.02$	$0.72^{d} \pm 0.01$	$4.83^{d} \pm 0.08$	$0.62^{c} \pm 0.01$	$250.78^{d} \pm 11.94$
T_3	$2.87^{d} \pm 0.11$	$2.79^{d} \pm 0.01$	$3.47^{c} \pm 0.01$	$11.10^{d} \pm 0.02$	$0.69^{c} \pm 0.01$	$4.90^{c} \pm 0.04$	$0.63^{b} \pm 0.01$	$260.36^{c} \pm 9.34$
SE±	0.07	0.02	0.02	0.08	0.02	0.06	0.01	12.28
CD at 5%	0.23	0.05	0.06	0.26	0.05	0.20	0.04	37.36

Conclusion

The average Physico-chemical composition of Kefir produced from addition of Mango, Jamun and Strawberry pulp were 2.87% to 3.67% for fat, 3.36% to 2.79% for protein, 4.26% to 3.31% for reducing sugar, 13.10% to 11.10% for total solids, 0.62% to 0.72% for titrable acidity, 5.07 to 4.83 for pH, 0.62% to 0.68% for ash and viscosity range from 250.78 to 360.81mPas.

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