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PS Gavali

MSc Agri Dairy Science,
Rajarshee Chhatrapati Shahu
Maharaj, College of Agriculture,
Kolhapur, Maharashtra, India

DK Kamble

Professor, Animal Husbandry
and Dairy Science, MPKV
Rahuri, Maharashtra, India

KB Kamble

Ph.D. Dairy Science, Mahatma
Phule Krishi Vidyapeeth,
Rahuri, Maharashtra, India

KB Kubade

MSc Agri Dairy Science,
Rajarshee Chhatrapati Shahu
Maharaj, College of Agriculture,
Kolhapur, Maharashtra, India

VB Khomane

MSc Agri Dairy Science,
Rajarshee Chhatrapati Shahu
Maharaj, College of Agriculture,
Kolhapur, Maharashtra, India

Corresponding Author:

PS Gavali

MSc Agri Dairy Science,
Rajarshee Chhatrapati Shahu
Maharaj, College of Agriculture,
Kolhapur, Maharashtra, India

Process standardization for preparation of basundi added jaggery

PS Gavali, DK Kamble, KB Kamble, KB Kubade and VB Khomane

Abstract

Among traditional dairy indigenous products *Basundi* is one of the heat desiccated indigenous dairy product, attempts were made for replacement of sugar with jaggery in preparation of *basundi*. The product was prepared from buffalo milk containing 6 per cent fat and to know the effect of stage of addition of jaggery on the quality of *basundi*, jaggery was added in original volume of milk (S_1), at concentration became $\frac{3}{4}$ of original volume of milk (S_2) and at concentration became $\frac{1}{2}$ of original volume of milk (S_3) stages. From that treatments at $\frac{3}{4}$ volume of original volume of milk attained during preparation of *basundi* (S_2) was selected on sensory quality of product and the jaggery was added at 6 (L_1), 7 (L_2) and 8 (L_3) per cent of original volume of milk and the result showed that out of three treatments combination, good quality *basundi* could be prepared by addition of 7 per cent jaggery and the optimized product had 7.82, 7.12, 7.50, 7.65, and 7.52 score for flavour, colour and appearance, body and texture, consistency and overall acceptability, respectively.

Keywords: Buffalo milk, *Basundi*, jaggery, sensory evaluation

Introduction

Among traditional dairy indigenous products *Basundi* is one of the heat desiccated indigenous dairy product, The market value of product depends upon a relative creamy consistency, white to light brown colour, sweetish caramel aroma and soft textured flakes uniformly distributed throughout the product mass (Patange *et al.* 2006) ^[15]. Traditionally *basundi* is prepared from buffalo milk which is concentrated, along with the scrapping and agitating, to about two fold by slow boiling in open kettle. Sugar at the rate of 6 to 7 per cent of milk added at the last stage of concentration followed by optional addition of flavours and nuts. The product is cooled and served chilled (Pal and Raju 2007) ^[16].

Basundi can be classified in the condensed milk group along with rabri, khoa, mithai and kheer and the dehydration of milk is done in iron karahi directly on fire. The original volume of milk is reduced to 40 to 50 per cent. (Chougule *et al.* 2014) ^[3].

Now-a-days, the popularity and demand of *basundi* is increasing due to its delicacy. Several *basundi* pockets are established in the country. The known pockets are Ujani (Gaikwad and Hembade 2015) ^[7] Kunthalgiri Satara, Bholwadi etc. Hence its production and marketing is increasing in a few big cities of the country. The small-scale producers find it difficult to cope up with the increasing demand. Therefore, in recent times, attention is being focused either to scale up the operation or to modify the technology so as to make it amenable to mechanization and continuous operation (Bhutkar *et al.* 2015) ^[2].

The micronutrients present in the jaggery possess antitoxic and anti-carcinogenic properties. It has moderate amount of calcium, phosphorous and zinc. Gur is high calorie sweetener and as it contains minerals, protein, glucose and fructose, it is known to be healthier in comparison to white sugar (Shrivastav *et al.* 2016) ^[18].

In India, sugarcane is being processed for making jaggery (gur), rab (concentrated sugarcane juice), sugar and khandsari. These jaggery is considered as a food material and is consumed directly as sweetener and also in different preparations including animal feed mixtures (Singh *et al.* 2011) ^[19]. It is used in Ayurvedic medicines and is considered to be the best of all sugarcane preparations.

Considering demand of *basundi* and important nutritional properties of jaggery along with available in local area, attempts were made for replacement of sugar with jaggery in preparation of *basundi*.

Materials and Method

Fresh buffalo milk was procured from Dairy farm, RSCM College of Agriculture, Kolhapur and it was standardized to 6.0 per cent fat and 9% SNF. Good quality jaggery was procured from local market of Kolhapur city. Sugar Clean crystalline cane sugar was procured from local market of Kolhapur city.

An iron karahi was used for preparation of basundi. Long handled stirrer with flattened end made up of mild steel was used for stirring-cum scrapping the milk during preparation of basundi. L.P.G. gas was used as heating media. madhur khoa Pvt. Ltd., Kolhapur make cream separator was used for separation of cream and skim milk for standardization. All glasswares used were of Borosil make for analytical work. Anamed Electronic balance model M-3000, capacity 3000g was used for weighing during the course of investigation. All the chemicals required for analytical work was used of Analytical Reagent (AR) and Guaranteed Reagent (GR) grade manufactured by Merk, India Ltd/Glaxo India Ltd.

Preparation of Jaggery Basundi

Basundi was prepared as per the procedure, given by Patel and Upadhyay (2003b) [13]. Initially buffalo milk was standardized to 6 per cent fat by Pearson's square method (De,1980) [4]. The standardized milk was then allowed to boil in karahi. During boiling, milk was continuously stirred and scrapped to avoid burning till the concentration reaches to 2:1. Followed by addition of sugar, which was 6 per cent of milk taken. The heating was continued for few minutes. Prepared basundi was allowed to cool down at room temperature.

Selection of Stage of Addition of Jaggery in Basundi

To know the effect of stage of addition of jaggery in *basundi*, the product was prepared from buffalo milk containing 6 per cent fat. The jaggery was added at following stages.

S₁: Addition of jaggery in milk at boiling stage

S₂: Addition of jaggery when concentration of milk became $\frac{3}{4}$ of original volume

S₃: Addition of jaggery when concentration of milk became $\frac{1}{2}$ of original volume

From above treatments one best stage of addition of jaggery was selected on sensory quality of product and allowed for further study.

Optimization of Level of Jaggery

The jaggery was added at following level at optimized stage in milk.

L₁. 6 per cent of original volume of milk.

L₂. 7 per cent of original volume of milk.

L₃. 8 per cent of original volume of milk.

The above treatment combinations were evaluated for sensory attributes and one best level optimized on the basis of sensory evaluation.

Optimized Flow Diagram of Jaggery Basundi

Jaggery basundi was prepared as per optimized stage and level of jaggery addition. The new optimized procedure of

preparation of jaggery *basundi* was given below,

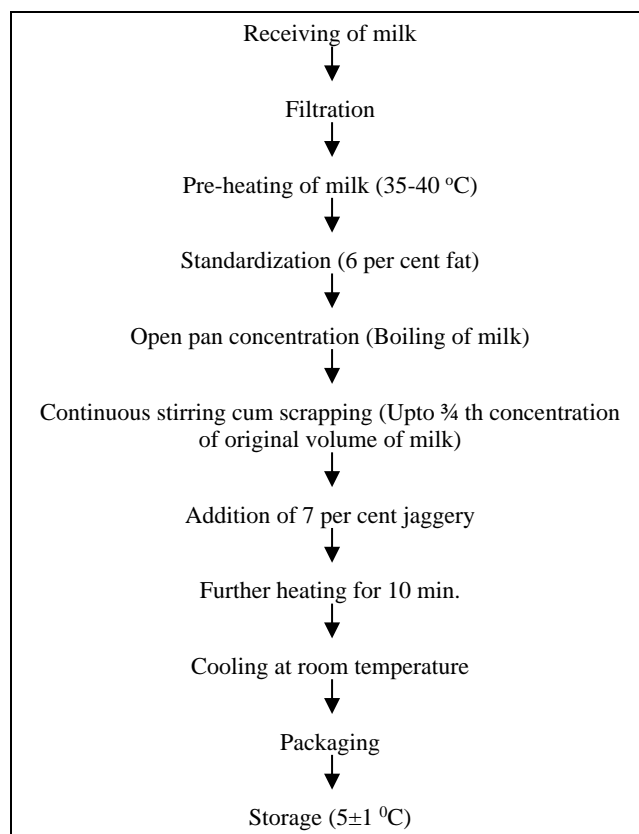


Fig 1: Preparation of optimized jaggery *basundi*

Sensory Evaluation

The product was evaluated for sensory quality using 9 points Hedonic scale as per Amerine *et al.*, (1965) [1]. For colour, flavour, body and texture and consistency etc. Sensory attributes was evaluated by semi trained panel of judges from staff of Division of Animal Husbandary and Dairy Science, College of Agriculture, Kolhapur.

Statistical Analysis

Data generated during the course of investigation were analyzed by employing CRD technique as per Snedecor and Cochran (1994) [20].

Result and Discussion

Selection of Stage of Addition Jaggery

To know the effect of stage of addition of jaggery on the quality of *basundi*, jaggery was added in original volume of milk (S₁), at concentration became $\frac{3}{4}$ of original volume of milk (S₂) and at concentration became $\frac{1}{2}$ of original volume of milk (S₃) stages. The effect of stage of addition of jaggery on sensory quality of basundi is presented in Table 1.0 It is revealed from the data that all the sensory parameters were significantly ($P<0.05$) affected by the stage of addition of jaggery.

Table 1: Effect of stage of addition of jaggery on sensory attributes of *basundi*

Treatment	Flavour	Color and Appearance	Body and Texture	Consistency	Overall Acceptability
S ₁	7.53 ^b ±0.15	7.55 ^b ±0.03	7.03 ^a ±0.02	7.70 ^b ±0.10	7.45 ^b ±0.04
S ₂	7.73 ^c ±0.09	7.75 ^c ±0.04	7.52 ^c ±0.04	8.0 ^c ±0.30	7.75 ^c ±0.04
S ₃	7.00 ^a ±0.10	7.30 ^a ±0.04	7.12 ^b ±0.04	7.31 ^a ±0.15	7.24 ^a ±0.02
CD(P<0.05)	0.12	0.01	0.01	0.10	0.01

Flavour

The maximum score (7.73 ± 0.09) for flavour was observed for *jaggery basundi* prepared by addition of jaggery when concentration became $\frac{3}{4}$ of original volume of milk followed by addition of jaggery at original volume of milk (7.53 ± 0.15). The flavour score for *jaggery basundi* prepared by adding the jaggery in S_3 stage was lower (7.00 ± 0.10) might be due to development of caramelized flavour due to prolong heating. The flavour score significantly ($P < 0.05$) increased. Similar finding was reported by Gaikwad and Hembade (2010) [8] in Ujani basundi where they reported that rise in the concentration of milk due to heating resulted in development of caramelized flavour and thereby increase in overall flavour score of basundi.

The milk was concentrated to 2.5, 3.0, 3.5X (original milk solids including sugar) with 8 per cent sugar level and the product made with 3.0X concentration got highest score for flavour i.e. 40.66 and product made with 3.5X concentration had lowest score i.e. 28.66 respectively.

The flavour score of S_1 basundi was lacking in jaggery flavour whereas in S_3 stage pronounced flavour of jaggery was recorded and which did not liked by the judges. Patel and Upadhyay (2004) [14] reported, the flavour score increases significantly on increase in intensity of heat treatment and it might be due to the development of pleasant, cooked, nutty flavour in high heat treated milk.

However in the present finding it was true upto S_2 stage. Addition of jaggery in $\frac{1}{4}$ concentrated milk for preparation of kulfi was reported by Ubale *et al.* (2014) [21]. Patel and Upadhyay (2004) [14] reported, the flavour score was the highest in case of basundi prepared by open pan method.

Colour and appearance

The maximum score (7.75 ± 0.04) for colour and appearance was obtained to the *basundi* prepared by addition of jaggery when volume became $\frac{3}{4}$ of original volume of milk followed by addition of jaggery at initial stage of heating of milk (7.55 ± 0.04). Judges expressed their views that the appearance of product was coagulated and thick, when the product was prepared by addition of jaggery at $\frac{1}{2}$ of original volume of milk followed by heating to reach the TSS 35° brix and then sample rated the score up to 7.30 ± 0.04 .

It is observed that the effect of colour and appearance score was significantly ($P < 0.05$) influenced by the stage of addition of jaggery further it was noticed that in S_1 stage there was marginally very faint colour of basundi whereas in S_3 stage the intensity of brown colour was slightly darker with appearance of product was slightly coagulated with occurrence of separation of moisture. Relatively slightly thick creamy appearance with sweetish caramel aroma was observed in S_2 stage basundi and the fact was closely associated with the finding of Chougule *et al.* (2014) [3].

Body and Texture

The score of body and texture for *jaggery basundi*, also significantly ($P < 0.05$) affected by stage of addition of jaggery. It is cleared that as the concentration became $\frac{3}{4}$ of original volume of milk, the body and texture score was recorded maximum (7.52 ± 0.04). The product at this stage was minimum firm body. The score recorded for body and texture for S_1 and S_3 treatments

were 7.03 ± 0.02 and 7.12 ± 0.04 , respectively. Similar finding was reported by Patel and Upadhyay (2003) [12] body and texture score was increased significantly ($P < 0.05$) on increase

in severity of preheat treatment which might be the result of significantly higher viscositor superior consistency of the product as it evident from Table 1.0 as well as comments of the judges who adjudged the fore-wormed milk product as superior owing to optimum viscosity and smooth consistency which also reported by Gaikwad and Hembade (2010) [8] they prepared Ujani *basundi* at 2.5, 3, 3.5 X concentration including 8 per cent sugar level, they observed highest score for body and texture at 3X concentration beyond which it was declined.

Consistency

The stage of addition of jaggery was also affected on the consistency score of *jaggery basundi*. It is observed from Table 1.0, the maximum score (8.0 ± 0.30) for consistency was observed for S_2 stage, followed by *basundi* was prepared at S_1 stage (7.70 ± 0.10) and S_3 stage (7.31 ± 0.15), respectively. Similar finding was observed by Gaikwad and Hembade (2010) [8] the product was concentrated to 3.5X had more viscous, which is not matched with traditional product hence scored low. The product made with 3.5X was more viscous and did not have optimum consistency.

Overall Acceptability

The overall acceptability score presented in Table 1.0 revealed that the most acceptable stage for addition of jaggery was that when concentration of milk became $\frac{3}{4}$ of original volume of milk and recorded maximum score (7.75 ± 0.04) for *jaggery basundi* followed by addition of jaggery at $\frac{1}{2}$ volume of original volume of milk (7.45 ± 0.04), respectively. Chougule *et al.* (2014) [3] reported that relative thick creamy consistency, white to light brown colour, sweetish caramel aroma and soft textured flakes distributed throughout the product mass contribute to market value of prepared product. From Table 1.0 it is clearly observed that the *basundi* prepared with addition of jaggery at S_3 stage scored significantly lower for all sensory attributes. The sample with S_2 scored maximum and significantly higher than other two samples at 5 per cent level of significance for most of the sensory attributes.

From the above sensory observation of colour and appearance, body and texture, flavour, consistency and overall acceptability it was concluded that the best quality *jaggery basundi* could be prepared by addition of jaggery in milk when the concentration of milk became $\frac{3}{4}$ of original volume of milk followed by 10 to 15 min. heating to reach the TSS upto 35° brix.

Patel and Upadhyay (2003) [12] have reported that the increasing the total solid content of milk significantly affected on the sensory parameters like flavour and total score of *basundi*, but colour and appearance as well as body and texture were non-significantly affected.

Optimization of Level of Jaggery Addition

Jaggery was procured in single lot from local market of Kolhapur city. The jaggery added at 6 (L_1), 7 (L_2), 8 (L_3) per cent of original volume of milk. The result were presented as follows,

Flavour

Flavour being a combination of taste, smell and mouth feel, has large number of factors it. Sample L_3 obtained highest score for flavour i.e. (8.04 ± 0.04) while sample L_1 had lower score for flavour i.e. (7.36 ± 0.05) Statistically, it has significant

($P < 0.05$) effect on flavour of *basundi*.

When *basundi* added with more than 8 per cent jaggery flavour score of *basundi* decreases. Flavour score of jaggery *basundi* increased with increasing jaggery level at certain point and beyond that flavour score declined slowly. Similar effect of sugar level on flavour score of *basundi* was reported by Patel and Upadhyay (2003) [12] and Gaikwad and Hembade (2011) [6]. Both reported that as increased sugar level, the flavor score was also increased but at highest point, the flavour score of *basundi* was significantly declined due to excess of sweetness.

The improvement in flavour score *basundi* with increase in level of jaggery may be because of rather than sucrose jaggery contains reducing sugar upto 10-15 per cent, protein, fat, minerals and some of phenolic components, reported by Rao *et al.* (2007) [17] and Nayaka (2009) [10]. Rao *et al.* (2007) [17] reported that jaggery contains sucrose 65-85 per cent, reducing sugar 10-15 per cent, protein 0.4g per 100g of jaggery, fat 0.1g per 100g of jaggery, minerals 0.6-10 per cent.

Colour and appearance

The sample L_3 had the highest score for colour *i.e.* (7.13±0.03). The colour and appearance score for L_1 and L_2 were 7.11±0.04 and 7.12±0.02. The appearance of colour may be because of colour of jaggery ranged from golden yellow to golden brown, dark brown, like dark chocolate, which reported by Nath *et al.* (2015) [11]. The gradual increase in level of addition of jaggery colour and appearance found to non-significantly increased. The addition of jaggery has non-significant effect on colour and appearance of *basundi*. Such trend was reported by Patel and Upadhyay (2003b) [13] they concluded that the sugar level had non-significant effect on colour and appearance of *basundi*.

The change in colour score with increase in jaggery level was also reported by Mahalaxmi and Hemalatha (2018) [9] of millet cookies. The increase in the colour score may be because of having some of phenolic colouring substances in jaggery as compared to sugar. At highest level of jaggery addition in *basundi* reflected dark brown colour of *basundi* was observed and comments of panel judges was, this might be due to caramelization due to heating. Similar finding observed by Gaikwad and Hembade (2011) [6] they reported that, levels of sugar addition did not affect the colour and appearance therefore panelists have given nearly equal score to all Ujani *basundi* samples.

Body and Texture

Body and texture also an parameter for acceptability of product by consumer. Sample L_1 obtained highest score for body and texture *i.e.* (7.94±0.04) while L_2 and L_3 showed lowest score for body and texture *i.e.* (7.50±0.04) and (7.41±0.02), respectively. As the level of addition of jaggery increases there was decrease in the body and texture of jaggery *basundi*, it was might be due to addition of jaggery. Addition of jaggery has significant ($P < 0.05$) effect on body and texture of *basundi*. The observed behavior of treatment could be explained in terms that jaggery *basundi* more viscous than sugar *basundi* due to viscous body, attractive

colour and appearance of jaggery *basundi* appreciated by judges. Nath *et al.* (2015) [11] reported that, compare to sugar jaggery is softer and amorphous because of presence of vitamins, proteins and ingredients of cane are not removed and this may resulted in improvement of body and texture score of *basundi*. The same result was observed by Gaikwad and Hembade (2015) [7] in Ujani *basundi* has more thick body than *basundi*, which is main characteristic of this product. Gaikwad and Hembade (2010) [8] also reported that, the body and texture score decreased with increase in sugar level and it might be due to increased sugar level which affect the original body and texture hence the panelists gave low score as the sugar level increased above 8 per cent.

Consistency

The sample L_3 founded good score for consistency *i.e.* (8.02±0.05), while sample L_1 had score 7.82±0.05 and sample L_2 had 7.97±0.04, respectively. Statistically, Effect of jaggery addition was significant ($P < 0.05$). The product made with addition of 8 per cent jaggery (L_3) was more viscous. As the level of addition of jaggery increases, the product was became more viscous which was not liked by judges. As the level of addition of jaggery increases consistency of *basundi* also increases. Similar findings were reported by Patel and Upadhyay (2003) [12] stated that consistency of *basundi* increased as the sugar level in *basundi* increased. Dhumal (2016) [5] also showed that as the sugar percentage increased in *basundi*, the consistency score of fig *basundi* was also increased. The rise in consistency due to increase in jaggery may be because of various nutritional constituents of jaggery and several soluble and insoluble impurities as reported by Rao *et al.* (2007) [17].

Overall acceptability

Overall acceptability of jaggery added *basundi* sample ranged between 7.55 and 7.69. The L_3 level shows highest score *i.e.* (7.69±0.05). The significant differences were observed in between the level L_1 , L_2 , and L_3 . It was predicted from the sensory score *basundi* with that addition of jaggery L_1 , L_2 , and L_3 differ significantly ($P < 0.05$) for these sensory parameters. Contraversly report was published by Mahalaxmi and Hemalatha (2018) [9] for the functional organic jaggery millet cookies, where they found that as the jaggery ratio increased, the appearance and colour did not vary significantly, while texture, taste, aroma, and overall acceptability reduced significantly ($P < 0.05$). Gaikwad *et al.* (2015) [7] reported the sensory scores for flavour, body and texture and colour and appearance and characterization of Ujani *basundi* and *basundi* are 8.29±0.86, 8.32±0.86, 8.64±0.93 and 8±1.43, 7.9±1.43 respectively for Ujani *basundi* and *basundi*. For overall acceptability, average score obtained for colour and appearance, flavour, body and texture and consistency were considered Dhumal (2016) [5] reported, the overall acceptability score of fig *basundi* was significantly affected as the sugar level increased, the overall acceptability score was also increased.

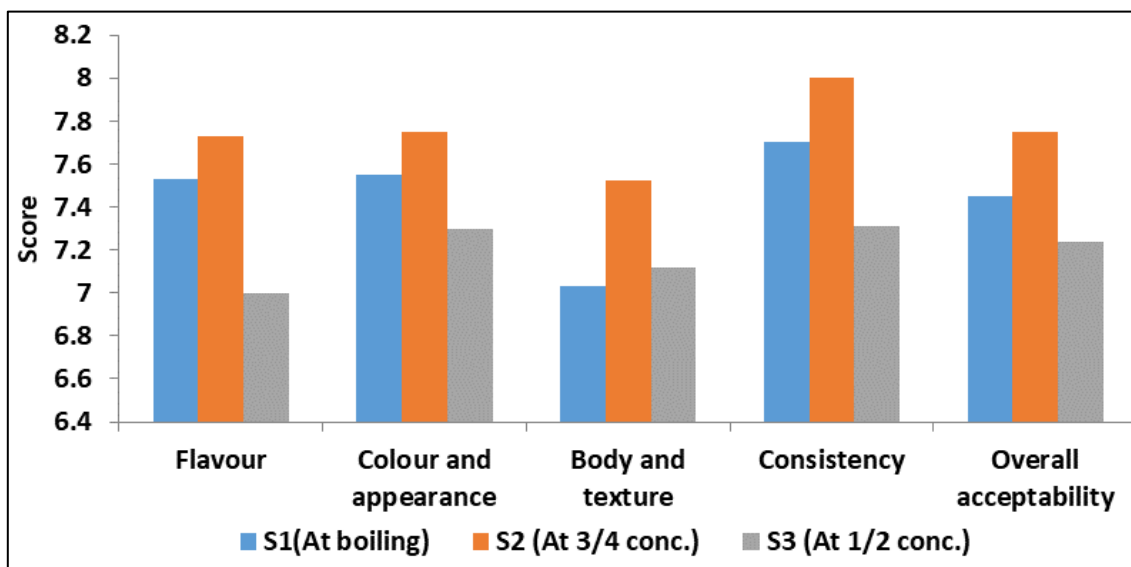


Fig 2: Effect of stage of addition of jaggery on sensory qualities of *basundi*

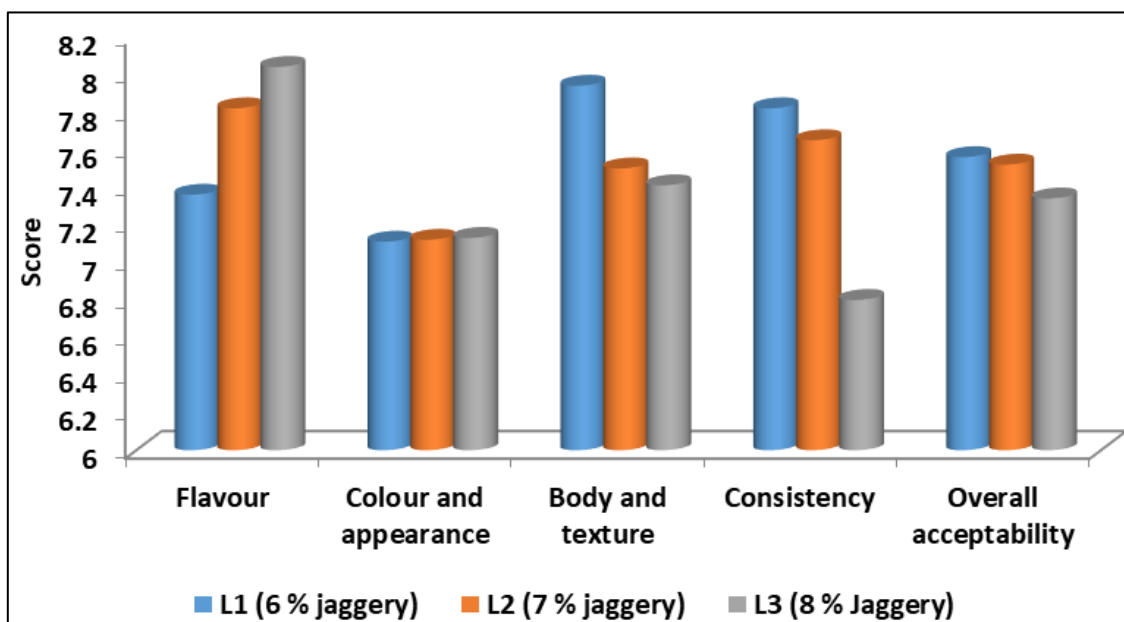


Fig 3: Effect of level of addition of jaggery on sensory qualities of *basundi*

Conclusion

From the present study it was concluded that the sensorial acceptable quality of jaggery added good quality of *basundi* could be prepared by addition of 7 per cent jaggery at $\frac{3}{4}$ volume of original volume of milk attained during preparation of *basundi*. The optimized product had 7.82, 7.12, 7.50, 7.65, and 7.52 score for flavour, colour and appearance, body and texture, consistency and overall acceptability, respectively.

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