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Lassi evolution: A comprehensive study on the integration of pear pulp for enhanced physicochemical proficiency

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Abstract
The study was conducted in the Department of Animal Husbandry and Dairy Science, College of Agriculture, Latur. Vasantrao Naik Marathwada Krishi Vidyapeeth, Parbhani, under the title "Studies on preparation of *lassi* blended with pear (*Pyrus communis*) pulp" In the present investigation the attempt was made to study the physico-chemical properties of lassi prepared by using pear pulp. The lassi was prepared by considering treatment combination of buffalo milk as 90% 80% 70% and 60% and 10%, 20% 30% and 40% of pear pulp in treatments T_2, T_3, T_4 and T_5 treatment T_1 taken as a control prepared from buffalo milk only. The physico-chemical properties (pH, acidity, fat, protein, ash, moisture, total sugar, total solid, viscosity, antioxidant and color index) for the lassi prepared from buffalo milk blended with pear pulp. The treatment T_1, T_2, T_3, T_4 and T_5 contained score for pH 3.89, 4.14, 4.35, 4.39 and 4.47, acidity 0.63, 0.67, 0.67, 0.66 and 0.70 percent, fat 1.36, 1.37, 1.37 1.26 and 1.43 percent, protein 0.35, 0.45, 0.53, 0.77 and 0.93 percent, moisture 87.29, 86.55, 85.49, 83.95 and 83.42. percent, ash 0.41, 0.41, 0.44, 0.47 and 0.48. percent, total solid 22.94, 24.03, 22.61, 23.37 and 23.75 percent, total sugar 12.29, 13.16, 13.26, 14.19 and 14.31 percent viscosity 21.29, 21.68, 22.35, 22.81 and 23.29 percent antioxidant 0.33, 0.75, 1.36, 1.60 and 2.00 TEAC (µmol)/mg, Average colour intensity of pear lassi measured by L* a* and b* readings ranged from 86.51 to 95.52, 2.2 to 9.4 and 1.5 to 8.9, respectively in control and develop treatments On the basis of result it was revealed that as the concentration of pear in lassi increased change in physico-chemical properties of *lassi* was observed.

Keywords: Buffalo milk, physico-chemical properties, pear fruit, Lassi

Introduction
Milk is essential component of diet of 6 billion people. The milk production of India reaches 221.1 million tons/yr. (NDDB 2021-22) [15]. In addition to milk several dairy products such as cream, butter, yogurt, kefir and cheese have been produced and consumed worldwide for millennia. (Francesco, V., Strata, A. 2016) [6]. Fermented milks are popular in view of their organoleptic and other properties such as the characteristic flavour, refreshing taste and improved digestibility. Fermentation is probably the ideal technology to preserve milk – a highly perishable commodity without any adverse effect on nutritive value. The demand for fermented milk products is increasing and it has been estimated that about 10.0 percent of total milk produced in India is used for preparation of traditional fermented milk products (Khurana and Kanawjia, 2007) [12]. Lassi is one of popular, ready to serve indigenous fermented milk beverages. It is served on very large scale in cold drinks shops & restaurants during summer in almost every state in India. Lassi has the same health benefits as yogurt or curd in that it reduces acidity in stomach, colonizes the gut with healthy bacteria, improves immunity, helps digestion & serves to keep internal organs cool during hot summers. It is prepared by stirring whole curd into a delicious drink with addition of sugar or salt a small amount of cold water or ice to make the product flowable. (Kedaree *et al*. 2021) [9-10]. Pear fruit are excellent source of vitamin C, less allergic than many other fruits &its juice is sometimes used as the first juice introduced to infants. Pear is gently sweet juicy fruit with glitter & buttery texture. It holds 2nd rank after apple in nutrition amongst cultivated fruits. Ancient Greek poet Homer narrated pear as one of the gift from God. Pear belongs to dicotyledonous plant species of genus pyrus (Family-Rosaceae). (Parle, M. & Arzoo 2016) [19].

Material and Methods

The current study was conducted in the Department of Animal Husbandry and Dairy Science, College of Agriculture, Latur. Vasantrao Naik Marathwada Krishi Vidyapeeth, Parbhani, under the title "Studies on preparation of *lassi* blended with pear pulp *(pyrus communis)* " The following materials and procedures were utilized in this investigation.

Preparation of pear pulp

Collection of fresh pear fruit
↓
Cleaning
↓
Washing
↓
Peeling
↓
Removal of yellow mucus before slices of Pear
↓
Cutting into pieces
↓
Blending
↓
Store pear pulp (at 5 °C)

Preparation of *lassi* blended with Pear *(pyrus communis)* pulp

Receive buffalo milk (fat 6 percent & SNF 9 percent)
↓
Filtration/clarification
↓
Heating (90 °C)
↓
Cooling (37 °C)
↓
Inoculation of 2 percent standard *dahi* culture NCDC-167
↓
Incubation (37 °C, 10-12 hours)
↓
Dahi
↓
Breaking of coagulum
↓
Addition of chilled water (20 percent by weight of *dahi*)
↓
Addition of sugar (15 percent by weight of *lassi*) and Pear Pulp (as per treatments)
↓
Uniform mixing
↓
Packaging
↓
Cooling and Storage (5 °C)

Treatment combinations

Lassi prepared with pear (*pyrus communis*) pulp was finalized on a weight basis by adding sugar 15 percent by weight of *lassi* and pear pulp as per the treatment combinations as follows:

T_1 - 100 Parts of curd
T_2 - 90 Parts of curd + 10 Parts of pear pulp
T_3 - 80 Parts of curd + 20 Parts of pear pulp
T_4 - 70 Parts of curd + 30 Parts of pear pulp
T_5 - 60 Parts of curd + 40 Parts of pear pulp

Evaluation of physico-chemical properties of Lassi

Lassi samples from various treatments were analyzed for titratable acidity, pH, fat, protein, moisture, total solids, total sugar, antioxidant, colour index, ash, viscosity.

The data were analyzed statistically by using Completely Randomized Design (CRD) as per Panse and Sukhatme (1985) [17].

Result and Discussion

Physico-chemical analysis of *lassi*

The *pear pulp* added *lassi* was subjected to analysis for physico-chemical properties *i.e.*, acidity, fat, pH, protein, ash, moisture, total solids, viscosity, total sugar, antioxidant, colour index along with its control treatment. The data obtained through research work was given in tabulated formats.

Titratable acidity percentage of *pear pulp* blended *lassi*

Titratable acidity is one of most important parameter from physico-chemical properties. Titratable acidity is the indication of total acid concentration of final food product. The acidity of *pear pulp* added *lassi* was changed with different levels of *pear* given in Table 1.

Table 1: Titratable acidity percentage of *pear pulp* blended *lassi*

Replication/Treatments	R_1	R_2	R_3	R_4	Mean
T_1	0.64	0.62	0.65	0.61	0.63^{c}
T_2	0.66	0.67	0.71	0.66	0.67^{ab}
T_3	0.67	0.65	0.69	0.68	0.67^{b}
T_4	0.65	0.64	0.68	0.69	0.66^{b}
T_5	0.69	0.70	0.71	0.71	0.70^{a}
S.E.±0.009618 C.D. at 5% 0.028991					

The values with different small letters superscripts row wise differ significant at 5 percent level of significance.

In above observation the acidity content of pear fruit added *lassi* increased significantly from treatment T_0 to T_5. The acidity of finished product was increased as increased in concentration of pear fruit pulp. It may be due to higher acidity content of pear fruit pulp. The treatment T_3, T_4 and T_5 significantly differ from each other and treatment T_1 and T_2 was at par each other.

The mean acidity content recorded for treatment T_1, T_2, T_3, T_4 and T_5 were 0.63, 0.67, 0.67, 0.66 0.70, respectively. The highest acidity content was found in treatment T_5 (0.70) and lowest for treatment T_1 (0.63).

The results obtained for the acidity of the prepared *lassi* were comparable with the following research.

Patil *et al*. (2015) [20] assessed that acidity of their products also increased as custard apple powder increased, acidity of the *dahi* ranges from 0.65 to 0.83. Acidity content of *dahi* increased with increased in custard powder from T_1 (0.65), T_2 (0.72), T_3 (0.75) and T_4 (0.83).

Bagal *et al*. (2016) [1] evaluated *lassi* by using papaya and recorded that average acidity of the product increased with increase in the level of papaya pulp

pH of *pear pulp* blended *lassi*

The pH of *pear pulp* added *lassi* was determined by pH meter. The pH is the negative logarithm of the hydrogen ions. It represents the acidic or basic nature of the product. The pH of the *lassi* changed by the addition of different levels of *pear pulp* was shown in Table 2.

Table 2: pH of *pear pulp* blended *lassi*

Replication/Treatment	R_1	R_2	R_3	R_4	Mean
T_1	3.96	3.80	3.86	3.95	3.89^{c}
T_2	4.10	4.00	4.20	4.29	4.14^{b}
T_3	4.28	4.31	4.36	4.48	4.35^{a}
T_4	4.30	4.47	4.32	4.48	4.39^{a}
T_5	4.40	4.49	4.50	4.52	4.47^{a}
S.E.±0.04541 C.D. at 5% 0.1369					

The values with different small letters superscripts row wise differ significant at 5 percent level of significance.

From the table 2. it was revealed that mean pH content in the developed product as found to be 3.89, 4.14, 4.35, 4.39 and 4.47 percent for treatments T_1, T_2, T_3, T_4 and T_5 respectively. The highest value of pH was shown by the control treatment T_5 i.e., 4.47 and the lowest had shown by treatment T_1 i.e., 3.89 The pH of developed *lassi* goes on increasing with increases in pear fruit pulp level. All the treatments T_1, T_2, T_3, T_4 and T_5 were significantly different from each other.

The result for pH of pear pulp *lassi* were comparable with the research work given below.

Kakade (2018) [8] who performed research on *lassi* with addition of wheat grass extract, He showed that increase in the pH of *lassi* with increase in wheat grass extract. The Ph of *lassi* of treatments T_1, T_2, T_3, T_4 was 4.29, 4.32, 4.34 and 4.36. They indicated that Ph increased with increased level of extract added in the *lassi*.

Monika *et al*. (2018) [13] demonstrated that pH of whey germinated pearl millet *lassi*. It is indicated that whey germinated pearl millet lassi shown lower pH value and whey-soaked pearl millet *lassi* shown higher Ph value.

Fat percentage of *pear pulp* blended *lassi*

Gerber's fat determination instrument was used to measure developed fat of product. The overall quality of the product was determined by the percentage present in final product. The average fat percentage developed in *lassi* is shown in Table 3

Table 3: Fat percentage of *pear pulp* added *lassi*

Replication/Treatment	R_1	R_2	R_3	R_4	Mean
T_1	1.32	1.34	1.39	1.42	1.36^{b}
T_2	1.39	1.32	1.36	1.42	1.37^{b}
T_3	1.36	1.35	1.37	1.41	1.37^{b}
T_4	1.26	1.25	1.27	1.29	1.26^{c}
T_5	1.40	1.42	1.44	1.46	1.43^{a}
S.E.±0.01668 C.D. at 5% 0.05028					

The values with different small letters superscripts row wise differ significant at 5 percent level of significance.

The fat content for the *pear lassi* was tabulated in Table 3. They were recorded for different levels of *pear pulp lassi* (10 percent, 20 percent, 30 percent and 40 percent). The average fat content for *pear* added *lassi* for treatment T_1, T_2, T_3 T_4 and T_5 were 1.36, 1.37, 1.37, 1.26, and 1.43 respectively. The highest value of fat found in treatment T_5 (1.43) and lowest for treatment T_4 (1.26). From the above it was come out that as the level of *pear pulp* in *lassi* increased the percentage of fat in *lassi* increased simultaneously. The fat percentage in all the treatments T_1, T_2, T_3, T_4 and T_5 were different. The treatments T_1 and T_2 were at par with each other and significantly (p<0.05) differed from treatments T_3 and T_4. Treatments T_3 and T_4 were also at par with each other.

The result obtained from the prepared *pear lassi* were comparable with works done.

Kumar and Das (2015) [12] researched on sorghum flour *lassi*. He observed that there was increase in fat content with increase in sorghum flour concentration. The fat content of sorghum based fermented beverage under treatment T_0 T_1, T_2 and T_3 was 2.32, 2.40, 2.46 and 2.55 respectively.

David *et al*. (2013) [3] evaluated skimmed milk *lassi* blended with coconut milk at a ratio T_1 (70:30), T_2 (60:40) and T_3 (50:50). He evaluated higher average fat content as 0.34, 0.44, 0.59 and 0.70.

Protein content of *pear pulp* blended *lassi*

Protein is one of the important constituents of any milk product which helps in body building. The protein percentage of *lassi* changed by different levels of *pear pulp* which given in Table 4.

Table 4: Protein percentage of *pear pulp* blended *lassi*

Replication/Treatment	R_1	R_2	R_3	R_4	Mean
T_1	0.38	0.37	0.34	0.31	0.35^{e}
T_2	0.42	0.44	0.47	0.49	0.45^{d}
T_3	0.51	0.53	0.52	0.56	0.53^{c}
T_4	0.78	0.76	0.77	0.79	0.77^{b}
T_5	0.92	0.91	0.93	0.96	0.93^{a}
S.E.±0.01238 C.D. at 5% 0.03732					

Proteins are one of the essential content of the product in terms of its health benefits to the body. The values recorded in respect of protein content of developed product are shown in table no 4. From the table no.4, it is noticed that, protein content of the *lassi* was non significantly increased within the successive treatments with addition of pear pulp at 5 percent level of significant. Highest protein content was found in T_5 (0.93) which was prepared with addition of 40 percent pear pulp. Lowest protein content was recorded in treatment T_1 (0.35) which was prepared by 0 percent pear pulp. Average mean values recorded was ranging from 0.35, 0.45, 0.53, 0.77 and 0.93 for treatment T_1 T_2, T_3 T_4 and T_5 respectively.

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

From the above data, we can clearly concluded that. (The treatments T_2 with T_3 were at par each other and significantly (p<0.05) differed from treatments T_1 with T_4. The treatment T_4 was significantly (p<0.05) differed from treatments T_1, T_2 with T_3 and T_5. All the treatments T_1, T_2, T_3 and T_4 were significantly different from each other. The values recorded in protein content in the present investigation were comparable with below research workers.

Kedaree *et al.* (2021) [9-10] validated that preparation of buffalo milk *lassi* with apple powder. The highest level of protein content was noticed at treatment T_4 i.e. (4.3975) with 8% apple powder whereas, lowest (4.37 percent) at T_0 without apple powder. It was observed that the protein content showed gradual increase in *lassi* with the increase in level of apple powder. The simultaneous increase from T_0 to T_4 may be due to high amount of protein content of apple powder (4.39percent). Non-significant differences were observed in between the treatments T_4, T_3, T_2, T_1 and T_0. Whereas treatment T_4 found superior over the treatment T_0

Prabhakar (2018) [21] performed research on mango fortified bajra *lassi*. The average chemical composition mango fortified bajra *lassi* of treatments T_0, T_1, T_2, T_3 and T_4 was 3.33, 3.85, 3.89, 4.07, 4.13 percent respectively.

Moisture percentage of *pear pulp* blended *lassi*

The moisture present in the product it means it is percentage of water in any product. The moisture content in *lassi* with addition of *pear pulp* is tabulated in the below Table 5.

Table 5: Moisture percentage of *pear pulp* blended *lassi*

Replication / Treatment	R_1	R_2	R_3	R_4	Mean
T_1	87.17	87.22	87.34	87.46	87.29^a
T_2	86.24	86.56	86.63	86.78	86.55^b
T_3	85.35	85.41	85.55	85.68	85.49^c
T_4	84.56	83.61	83.76	83.88	83.95^d
T_5	83.30	83.35	83.49	83.56	83.42^e
S.E.±0.1185 C.D. at 5% 0.3574					

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

The average moisture percentage for *lassi* with addition *pear pulp* ranged from 83.42 to 87.29. It was recorded that highest percentage for treatment T_1 (87.29)) and lowest for treatment T_5 (83.42). The treatments T_1 with control and T_2, T_3, and T_4 contain *pear pulp* with 10 percent, 20 percent 30 percent and 40 percent, respectively. The moisture percentage for treatments T_1, T_2, T_3 and T_4 were 87.29, 86.55, 85.49, 83.95 and 83.42, respectively. From the above information it was observed that moisture percentage decreased with increase in *pear pulp* percentage. The treatment T_1 with T_2 were at par with each other and treatment T_3 and T_4 were also at par with each other.

The consequence for *pear pulp* added *lassi* were comparable with the following discussed research works.

Prabhakar (2018) [21] undertook the moisture percentage for various sample of mango fortified *lassi* which are ranges from 79.87 to 76.05 for treatments T_1 to T_4 and it was observed that moisture percentage decreased from T_1 to T_4.

Gaikwad *et al.* (2018) [7] worked on physico-chemical properties of *lassi* blended with menthol *lassi*. Average moisture content in the *lassi* shows declined by addition of menthol juice. Moisture content of product ranges from 82.51 to 78.56 which was decreasing from T_1 to T_4. This might be due to increase in proportion of menthol blended with content of lower moisture in it.

Total solids percentage of *pear pulp* blended *lassi*

The total solids are content product which is remaining after the moisture of the food product has been removed. From the observation it is noticed that there was significantly increased in the total solid content of the developed *lassi* than control *lassi* except treatment T_1. The total solids of *lassi* fluctuated by addition of different levels of *lassi* which is mentioned below in Table 6.

Table 6: Total solids percentage of *pear pulp* blended *lassi*

Replication / Treatment	R_1	R_2	R_3	R_4	Mean
T_1	22.37	22.55	23.44	23.40	22.94^{bc}
T_2	23.30	23.40	24.55	24.87	24.03^a
T_3	22.43	22.57	22.64	22.81	22.61^c
T_4	23.21	23.30	23.44	23.56	23.37^{ab}
T_5	23.62	23.70	23.82	23.87	23.75^a
S.E.±0.2246 C.D. at 5% 0.6772					

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

In the Table 6. the total solids percentage for *pear* added *lassi* were shown. The average value recorded for *pear* added *lassi* were ranges from 22.94 to 23.75 From the above data, we know that for the treatments T_1, T_2, T_3 T_4 and T_5 total solids percentage were 22.94, 24.03 22.61, 23.37 and 23.75, respectively. The highest total solid content is in T_5 (23.75) and lowest in T_1 (22.94) was observed. The treatments T_1 with T_2 were significantly (p<0.05) differed from treatments T_3 with T_4. The treatments T_1 with T_2 non-significantly differed

from each other and treatments T_3 with T_4 were at par with each other.

The statistical data given in above table show that total solid percentage was with the addition of *pear pulp* in *lassi*.

Patil *et al.* (2015) [20] conducted experiment on probiotic custard apple *dahi* and stated that total solid content for treatment T_0, T_1, T_2 and T_3 were 12.00, 13.07, 14.07 and 15.03, respectively. It was observed that total solid content increased due to addition of custard apple powder.

Pandit *et al.* (2018) [16] found similar results in litchi fortified *dahi*. They reported that blending of litchi in *dahi* resulted in increased in total solid content from T_0 (21.10), T_1 (22.05) and T_3 (23.01).

Total sugar percentage of *pear pulp* blended *lassi*

Total sugar is one of the important parameter of liquid beverage that represents sugar present in the beverage. The average data recorded for total sugar content of developed *lassi* is shown in Table 7.

Table 7: Total sugar content of *pear pulp* blended *lassi*

Replication Treatment	R_1	R_2	R_3	R_4	Mean
T_1	12.21	12.30	12.28	12.37	12.29^c
T_2	13.02	13.14	13.23	13.26	13.16^b
T_3	13.15	13.20	13.32	13.38	13.26^b
T_4	14.08	14.22	14.18	14.30	14.19^a
T_5	14.13	14.32	14.39	14.42	14.31^a
S.E.±0.05124 C.D. at 5% 0.154					

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

This table represents the average mean values for total sugar content of *lassi* were 12.29, 13.16, 13.26, 14.19 and 14.31 for treatments T_1, T_2, T_3, T_4 and T_5 respectively. The highest total sugar content was recorded in treatment T_5 followed by treatment T_1, T_3, T_4 and T_2. It shows that as the *pear pulp* levels was increased the total sugar content of *lassi* increased. The treatments T_1 with T_2 and treatments T_3, T_4 and T_5 were at par each other and non-significantly differed from each other. The treatments T_1 with T_2 were significantly ($p<0.05$) differed from treatments T_3 and T_4. It was observed from the references of following research.

Pardhi *et al.* (2014) [18] performed research on *lassi* for the physico-chemical evaluation with addition of finger millet flour. He observed that the level of finger millet flour increased, the total sugar content in *lassi* also increased. The total sugar of developed *lassi* ranged from 14.43 to 16.26.

Kakade *et al.* (2018) [8] stated that the average total sugar content of wheat grass *lassi* were 5.78, 6.19, 6.27 and 6.28 percent for treatment T_1 T_2 T_3 and T_4 respectively. It indicates that as the wheat grass extract increased the total sugar content also increased due to higher sugar content in wheat grass.

Ash percentage of *pear pulp* blended *lassi*

The ash percentage of prepared *lassi* was estimated by muffle furnace. The ash content of *lassi* changed by addition of *pear pulp* shown in Table 8.

Table 8: Ash percentage of *pear pulp* blended *lassi*

Replication/Treatment	R_1	R_2	R_3	R_4	Mean
T_1	0.42	0.41	0.41	0.40	0.41^c
T_2	0.43	0.42	0.41	0.41	0.41^c
T_3	0.45	0.44	0.43	0.46	0.44^b
T_4	0.48	0.46	0.47	0.48	0.47^a
T_5	0.49	0.48	0.48	0.47	0.48^a
S.E.±0.004916 C.D. at 5% 0.0148					

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

It was observed from the Table 8. that ash percentage for *pear pulp* added *lassi* were ranges from 0.41 to 0.48. The data was recorded for treatments T_1, T_2, T_3 and T_4 were 0.41, 0.44, 0.47, 0.48, respectively. It was highest for T_5 (0.48) and lowest for T_1 (0.41). It was revealed that ash percentage of *lassi* increases as the *pear pulp* levels increases from T_1 to T_5 All treatments T_1, T_2, T_3, T_4 and T_5 were significantly ($p<0.05$) differed from each other. Obtained data compared with the further findings,

Dixit *et al.* (2018) [5] discovered fresh *lassi* using whey and moringa powder. The average ash content for this *lassi* increased with the addition of *moringa powder*. Mean value for treatments T_0, T_1, T_2 and T_3 were 0.70, 0.73, 0.76 and 0.82, respectively.

Highest ash content found in treatment T_3 (0.82). It may be due to higher content of minerals in moringa powder.

Kedaree *et al.* (2021) [9-10] showed similar result of *lassi* blended with kiwi pulp for sensory evaluation. The average value for kiwi *lassi* ranged from 0.64, 0.66, 0.68 and 0.70 for treatments T_0, T_1, T_2 and T_3, respectively. It was stated that the values for kiwi *lassi* declines as the *kiwi pulp* added in *lassi*.

Viscosity of *pear pulp* blended *lassi*

Viscosity is major parameter of liquid beverage which helps to determines the flow characteristics of the beverage. The average viscosity of prepared *lassi* is shown in Table 9.

Table 9: Viscosity content of *pear pulp* blended *lassi*

Replications Treatments	R_1	R_2	R_3	R_4	Mean
T_1	21.17	21.22	21.36	21.44	21.29^e
T_2	21.78	21.82	22.12	22.00	21.68^d
T_3	22.32	22.43	22.37	22.28	22.35^c
T_4	22.78	22.84	22.69	22.95	22.81^b
T_5	23.15	23.26	23.32	23.44	23.29^a
S.E.±0.1231 C.D. at 5% 0.3710					

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

From the table no. 9, it is clearly demonstrated that viscosity of the *lassi* increased as pear percent increased in *lassi*. Mean values recorded for viscosity of the sample were 21.29, 21.93, 22.35, 22.81 and 23.29 for treatments T_1, T_2, T_3, T_4 and T_5 respectively. Highest viscosity value recorded in T_5 (23.29) and lowest viscosity value recorded in T_1 (21.29). This data shows that *lassi* prepared by addition of pear pulp become more viscous with the increased in level of pear pulp. It may be due to the viscus and gelation properties of pear pulp when react with other solids.

The above analysis shows that *lassi* made by addition of *pear pulp* become more viscous with the increased in the percentage of *pear pulp*. All treatments T_1, T_2 and T_3, T_4 and T_5 were at par each other. The treatments T_1 and T_2 were significantly (p<0.05) differed from treatments T_3, T_4 and T_5 respectively.

Obtained data were compared with the following research works, Chawla *et al*. (2018) [2] carried research on *lassi* with vitamin A by using natural vegetable powder. The viscosity recorded for *lassi* were 17.2, 18.6, 20.3, 21.23 for treatments T_0, T_1, T_2 and T_3, respectively. It was concluded that as the level vegetable powder increases, viscosity of *lassi* were increases.

Dixit *et al.* (2018) [5] created moringa powder *lassi* and average values recorded for viscosity was 243.23, 247.00, 252.12 and 258.18 for treatments T_0, T_1, T_2 and T_3. He observed that viscosity of *lassi* increases with increase in moringa powder.

Antioxidant activity of *pear pulp* blended *lassi*

The prepared *pear pulp* was mixed in *lassi* were subjected for antioxidant activity by ABTS method, before evaluating, the raw materials used to prepare *lassi* was subjected for its evaluation of antioxidant activity. After that, the antioxidant activity in the *pear lassi* was determined. The result obtained are mentioned in Table 10. It was observed that antioxidant activity of *pear pulp* added *lassi* increased with increased in *pear pulp* level. The addition of plant-based antioxidants in dairy foods has met acceptance for the accelerate the antioxidant activity in dairy products.

Table 10: Antioxidant activity of *pear pulp* blended *lassi*

Replication / Treatments	R_1	R_2	R_3	R_4	Mean TEAC (µmol) / mg protein
T_1	0.35	0.32	0.31	0.37	0.33^e
T_2	0.74	0.73	0.76	0.79	0.75^d
T_3	1.14	1.23	1.47	1.62	1.36^c
T_4	1.53	1.61	1.52	1.75	1.60^b
T_5	1.93	1.91	2.04	2.14	2.00^a
S.E.±0.06017 C.D.at 5% 0.1813					

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

The antioxidant activity of *pear pulp* added *lassi* were 0.33, 0.75, 1.36, 1.60 and 2.00 TEAC (µmol)/mg protein for treatments T_1, T_2, T_3, T_4 and T_5 respectively. The above all treatments were significantly (p<0.05) differed from each other. The treatment T_1 has obtained the lowest value for antioxidant activity i.e, 0.35 ±0.005TEAC ((µmol)/mg protein which is control i.e. it was made by without addition of *pear pulp*. The highest antioxidant activity recorded for treatment T_5 i.e. 2.00 ±0.005 TEAC ((µmol)/mg protein. From the above data, it was concluded that as the level of *pear pulp* in *lassi* increased the antioxidant activity of *lassi* increased. The treatments T_1 and T_2 were significantly different from each other and treatments T_3, T_4 and T_5 were at par each other.

The *pear* contains more amounts of antioxidants, so that in above treatments antioxidant activity of *lassi* increased as the *pear pulp* in *lassi* increased, the herb piper betel contains bioactive compounds such as Chavicol, Chavibetol, Chavibetol acetate and Eugenol and many other useful polyphenols which could be responsible for the higher radical scavenging activity of PBLE added sample as compared to their controls.

Rohn *et al*. (2004) [22] reported that because of the lack of high molecular weight complexation compounds, the antioxidant activity of control was lower than sample.

Khan *et al*. (2019) [11] evaluated that antioxidant activity of milk and dairy products can be enhanced by phytochemicals supplementation.

Colour Index of pear pulp blended *lassi*

In the table L*, a* and b* values of developed pear *lassi* were determined. The colour intensity of all *lassi* samples measured by reflectance spectroscopy technique (Hunter Lab, Reston, Virginia, USA). As per result L* values denoted lightness ranges from 0 (black) to 100 (white), a* value denoted redness of the product ranged from (+60) Red to (-60) Green and b* shows yellowness ranged from (+60) yellowness to (-60) blue

The table indicate that, average colour intensity of pear *lassi* measured by L* a* and b* readings ranged from 86.51 to 95.52, 2.2 to 9.4 and 1.5 to 8.9, respectively in control and develop treatments. It is noticed from above observations that, blending of pear pulp in *lassi* brought variation in the original colour of *lassi*.

Dhumal *et al*. (2018) [4] evaluated that addition of pudina in buffalo milk results into increasing the colour intensity of the finished product. Average values of L*, a* and b* ranged from 58.30-65.53, 1.52- 1.65 and 2.15-2.23, respectively for treatment T_1, T_2, T_3 and T_4 was observed.

Table 11: Colour Index values of *lassi* blended with pear pulp

Replication	R-I			R-II			R-III			R-IV			Mean		
Treatment	L*	a*	b*	L*	a*	b*	L*	a*	b*	L*	a*	b*	L*	a*	b*
T_1	86.38	2.05	1.43	86.47	2.15	1.52	86.58	2.25	1.66	86.63	2.35	1.71	86.51^e	2.2^e	1.5^e
T_2	87.28	3.03	2.59	87.48	3.19	2.63	87.57	3.29	2.79	87.68	3.38	2.73	87.50^d	3.2^d	2.6^d
T_3	88.45	6.18	5.64	88.54	6.28	5.78	88.65	6.38	5.87	88.79	6.49	5.92	88.60^c	6.3^c	6.1^c
T_4	92.41	8.23	7.76	92.39	8.47	7.81	92.16	8.35	7.95	92.77	8.27	7.92	92.43^b	8.3^b	7.8^b
T_5	95.34	9.34	8.99	95.43	9.55	8.97	95.59	9.45	8.98	95.73	9.51	8.98	95.52^a	9.4^a	8.9^a
L*				SE ± 0.08833						CD at 5% = 0.2662					
a*				SE ± 0.06181						CD at 5% = 0.1863					
b*				SE ± 0.04902						CD at 5% = 0.1477					

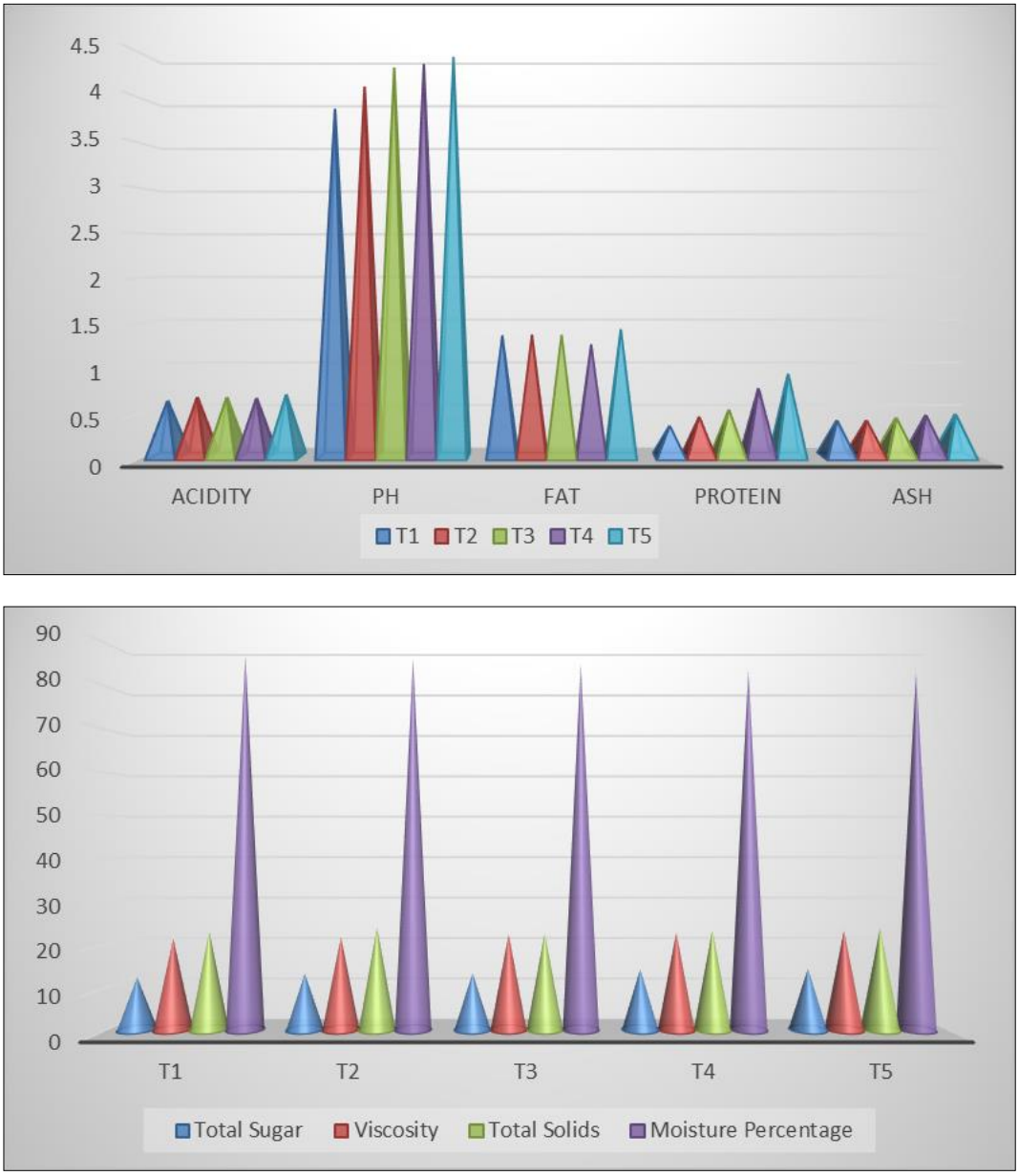

Fig 1: Graphical representation of Physico-chemical analysis of pear pulp blended *lassi*

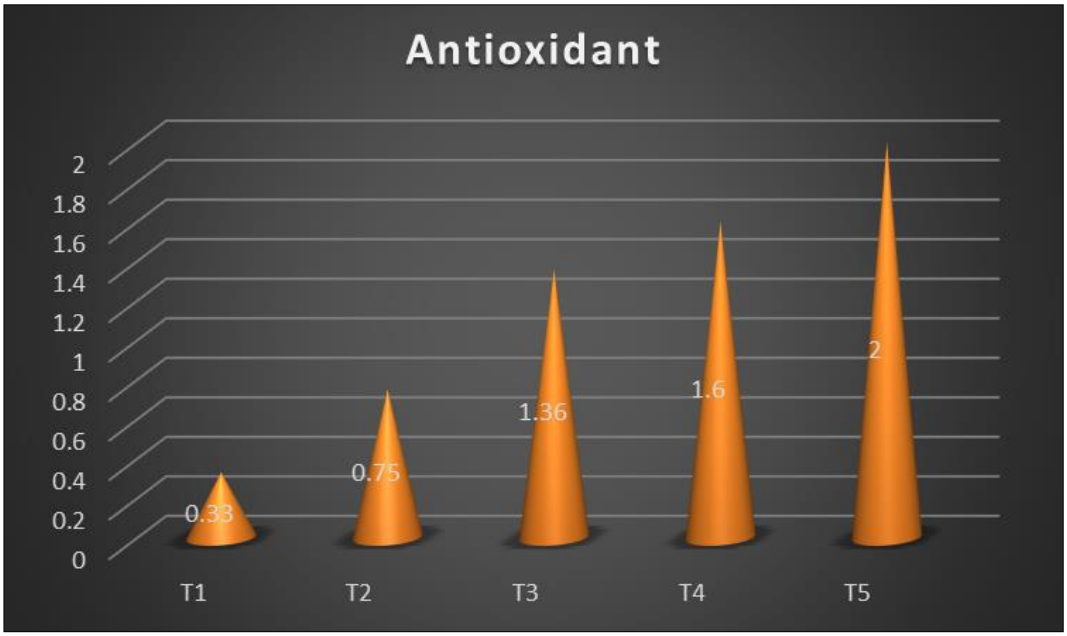

Fig 2: Graphical representation of antioxidant activity of pear pulp blended *lassi*

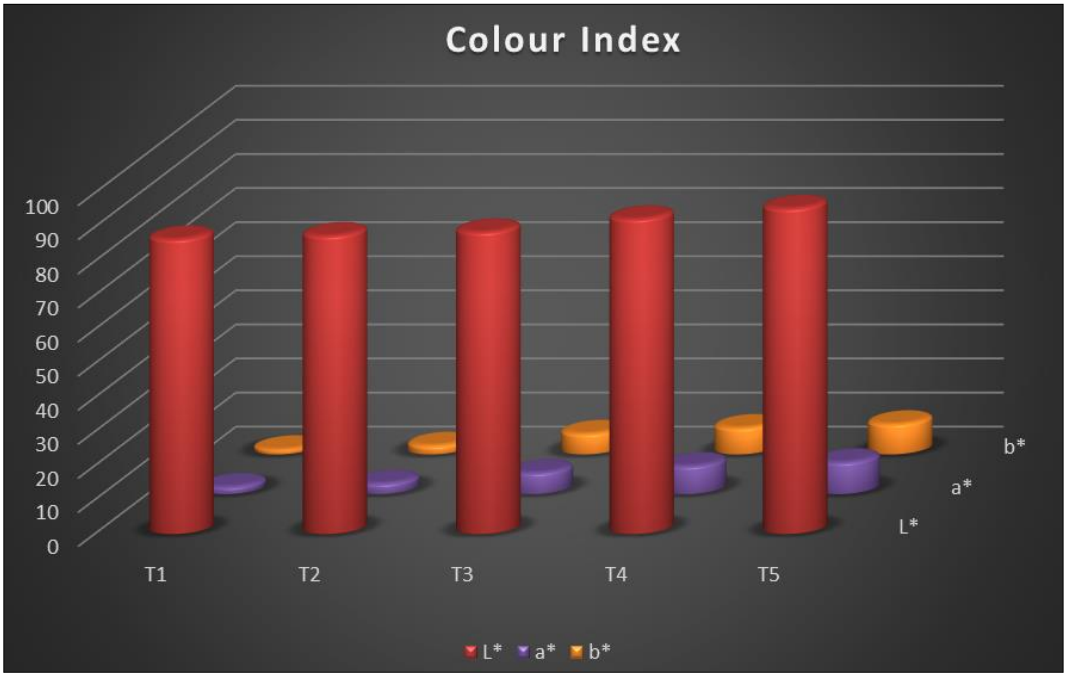

Fig 3: Graphical representation for colour index of pear pulp blended *lassi*

Conclusion

From present investigation it was observed that the Pear fruit pulp can be used for acceptable *lassi* on the reason of physico-chemical properties of *lassi*. The nutritional and long shelf life *lassi* can be made by using *pear* pulp for completing consumer's demand. The sensory parameters related with dairy product was recorded and which scored more than 8 ranged in between like very much to like extremely on 9-point hedonic scale. *Lassi* developed by using 70 percent of curd and 30 percent of *pear* pulp was most acceptable on all sensory and physico-chemical parameters. In the present research, as the level of *pear* pulp in *lassi* increases change in physico-chemical properties of *lassi* was observed.

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