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Effect of different levels of apple (*Malus pumila*) powder on proximate composition of *lassi*

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Abstract
The *lassi* was prepared by blending 2, 4 and 6 per cent of apple powder. The proximate composition of finished product with 0, 2, 4 and 6% apple powder (T1, T2, T3 and T4) showed significant increase in per cent protein from 2.25 to 2.30, 2.42 and 2.56), total solids (25.42 to 25.77, 26.06 and 26.70), ash from 1.17, 1.27, 1.36 and 1.47) and SNF (18.16, 18.55, 18.86 and 19.60). The per cent fat and moisture content of lassi, decreased significantly from 7.26 to 7.23, 7.20 and 7.11 per cent and 74.58 to 74.23, 73.95 and 73.30 per cent, respectively. The per cent acidity was increased significantly from 0.57 to 0.62, 0.66 and 0.72) and pH was decreased significantly (5.77 to 4.68, 4.32 and 4.20) due to higher level of addition of apple powder in *lassi*.

Keywords: Proximate composition, apple powder, *lassi*

Introduction
India is the world's largest milk producer, with record milk production of 221.06 million tonnes in 2021-2022 and annual growth of 5.29 per cent. The per capita availability of milk is 444 gram/day in 2021-22 (Anonymous, 2022-2023) [1]. Out of total milk produced in India, 55% of milk was used for product manufacture and 45% was consumed as liquid milk. There is a huge scope for preparation of traditional milk products, including fermented milk products such as *dahi, lassi shrikhand, yoghurt* etc. (Rao, 2020) [14].
Lassi is a major source of calcium. We need sufficient calcium to keep our bones healthy and thus drinking *lassi* can help bones being strong and healthy. *Lassi* contains lactobacillus species which helps in digestion and lubricates the digestive tracts and smoothens the entire cycle of processing and it is additionally a superb source of Probiotics which guarantees appropriate prosperity of health (Saha *et al*., 2021) [15].
Apple (*Malus pumila*) fruit is one of the most popular and favourite fruits among the health conscious and fitness lover peoples. This fruit is rich in phytonutrients like flavonoids, includes quercetin, catechin, phloridzin and chlorogenic acid which are essential for optimum health and wellbeing. Apples contain antioxidant like vitamin C which has health promoting and disease prevention properties (Bharti *et al.*, 2018) [2].
Apples is rich source of protein, fat, dietary fibre, carbohydrates, sugar, water and energy (0.26 gm, 0.17 gm, 2.4 gm, 13.81 gm, 10.39 gm, 85.56 gm, 52 kcal, respectively per 100 gm). Vitamin C, potassium, magnesium, calcium, iron content per 100 gm of apple is 4.6 mg, 107 mg, 5 mg, 6 mg, 0.12 mg, respectively. (Chaudhary *et al.*, 2014) [4].

Materials and Methods
The research was conducted during 2023-2024 in the Department of Animal Husbandry and Dairy Science, College of Agriculture, Latur, Vasantrao Naik Marathwada Krishi Vidyapeeth, Parbhani.

Materials
Collection of Materials
Buffalo milk (6% fat and 9% SNF) was procured from local market of Latur city (Natural Milk Pvt. Ltd., Latur). Apple powder was purchased from Annapurna Agro Export plot number 17-bharadpur manawar dhar, 454446 (M.P.) India. The standard culture (NCDC-

167) procured from National Dairy Research Institute, Karnal (Haryana). Commercial grade clean, white sugar was purchased from local market of Latur city.

Starter culture, its maintenance and propagation

Sterilized skim milk was used to maintain the standard freeze-dried dahi culture, which comprises *Lactococcus lactis and Streptococcus thermophilus*. 100 ml of fresh skim milk was transferred into 250 ml conical flasks and covered with non absorbent cotton plugs. The flasks were sterilized for 15 minutes at 15 psi pressure in autoclave. Sterilized skim milk was inoculated with active starter NCDC-167 @ 1.5 percent under laminar air flow chamber to propagate the culture. After 12 hours of incubation at 37 °C, the flasks were kept at refrigerated temperature at 5 to 7 °C. At weekly intervals culture propagation was repeated in order to use active culture.

Sugar

Good quality, clean, crystalline, cane sugar was purchased from local market of Latur city.

Methods

Preparation of *lassi* blended with apple (*Malus pumila*) powder

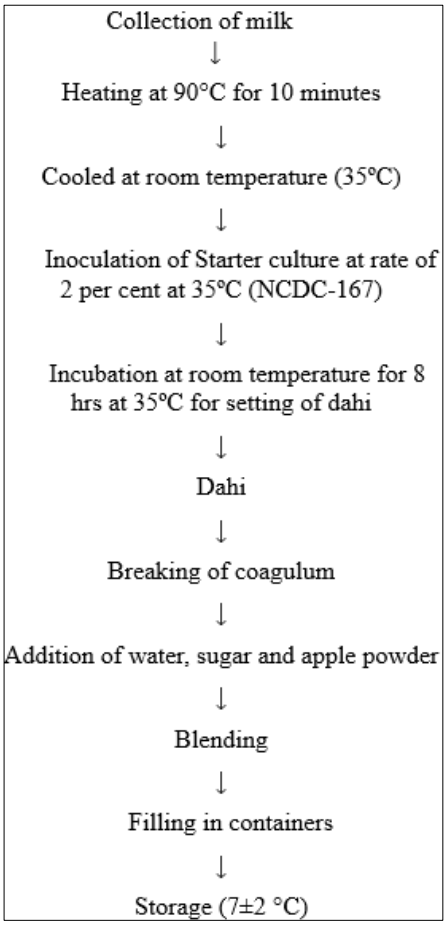
Treatment combination

Lassi blended with apple powder was prepared using 15 per cent sugar by weight of dahi and apple powder as per the treatment combination as follows.

T_1 - 100 parts of dahi (Control)
T_2 - 98 parts of dahi and 2 parts of apple powder
T_3 - 96 parts of dahi and 4 parts of apple powder
T_4 - 94 parts of dahi and 6 parts of apple powder

Procedure for preparation of *lassi* blended with apple (*Malus pumila*) powder

The *lassi* was prepared as per the procedure given by De (2018) [5]. Buffalo milk (3% Fat and 6% Solid Not Fat) was heated at 90 ºC for 10 min. then cooled at 37 ºC and inoculated with starter culture @ 2 per cent and incubated at 35 ºC in incubator for 8 hours. Dahi prepared was broken and added with 15 per cent sugar plus 20 per cent water on weight basis and apple powder as per treatment combination and blended well with hand blender and stored at refrigerated temperature 7±2 ºC.



Flow chart for preparation of *lassi* blended with apple (*Malus pumila*)

Physico-chemical analysis

Titrable acidity, pH, fat, protein, moisture, total solids, ash and SNF. Titrable acidity of sample was determined as per method outlined in IS 1479 (Part-I) (1960)[7], The fat content was determined by using Gerber's method described in in IS: 1224 (Part II) (1977)[8]. The per cent protein content of *lassi* was determined by using Lowry method (1951) [12]. Moisture, total solids and ash per cent was determined by methods described in IS: SP (Part XI) 1981 [9]. SNF content of *lassi* was calculated by subtraction method (Solid Not Fat (%) = Total Solids - Fat).

Results and Discussion

Acidity of *lassi* blended with apple powder

The mean value of per cent acidity for control (T_1) and *lassi* blended with apple powder T_2, T_3 and T_4 are 0.57, 0.62, 0.66 and 0.72 per cent respectively. The per cent acidity of control without apple powder was significantly lower than

lassi blended with different levels of apple powder. Among the treatment per cent acidity of T_2 and T_3 does not differ significantly from each other, However per cent acidity value of T_4 was higher than all treatments and differ significantly. The significantly increased in per cent acidity of *lassi* with apple powder, was due to higher vitamin C (27 per cent) content in apple powder.

The results of present study are in agreement with Kedaree *et al.* (2021 b) [11] where *lassi* was prepared by addition of apple powder in *kulfi* at 2.5, 5 and 7 per cent and observe increase in acidity from 0.10 to 0.13.

Table 1: Acidity of *lassi* blended with apple powder (Per cent)

Replication treatment	R_1	R_2	R_3	R_4	Mean
T_1	0.60	0.54	0.55	0.57	0.57^c
T_2	0.62	0.62	0.62	0.63	0.62^b
T_3	0.66	0.66	0.65	0.66	0.66^b
T_4	0.82	0.69	0.68	0.69	0.72^a
S.E.± 0.0180 C.D. at 5% 0.055					

The values with different superscripts differ significantly (p<0.05)

pH of *lassi* blended with apple powder

The pH value of T_1, T_2, T_3 and T_4 are 5.77, 4.68, 4.32 and 4.20 respectively. The pH of control (T_1) sample was significantly higher than all treatments. Among the treatments pH value decreased towards increase in per cent addition of apple powder. However, pH of T_2 was higher among all treatments and differ significantly from T_3 and T_4. The significantly decrease in pH of *lassi* with apple powder was due to increase in acidity. The finding of present study are in agreement with Chaitali *et al.* (2019) [3] who reported that addition of apple pulp in *yoghurt* at 10, 20, 30 per cent decreased pH from 4.54 to 4.01.

Table 2: pH of *lassi* blended with apple powder

Replication treatment	R_1	R_2	R_3	R_4	Mean
T_1	5.50	5.86	5.84	5.89	5.77^a
T_2	4.90	4.70	4.60	4.50	4.68^b
T_3	4.20	4.30	4.50	4.28	4.32^c
T_4	4.10	4.28	4.30	4.10	4.20^c
S.E.± 0.075 C.D. at 5% 0.232					

The values with different superscripts differ significantly (p<0.05)

Fat content of *lassi* blended with apple powder

The per cent fat content of control (T_1) and *lassi* blended with apple powder T_2, T_3 and T_4 was 7.26, 7.23, 7.20 and 7.11 respectively. The fat content of control sample was significantly higher than all treatments. Among the treatment fat content decreased significantly toward higher level of addition of apple powder. The significantly decreased in fat content of *lassi* with apple powder was due to lower fat (2 per cent) content in apple powder.

Table 3: Fat content of *lassi* blended with apple powder (Per cent)

Replication treatment	R_1	R_2	R_3	R_4	Mean
T_1	7.26	7.23	7.28	7.27	7.26^a
T_2	7.23	7.22	7.24	7.22	7.23^b
T_3	7.20	7.21	7.20	7.19	7.20^c
T_4	7.12	7.09	7.10	7.11	7.11^d
S.E.± 0.0070 C.D. at 5% 0.0217					

The values with different superscripts differ significantly (p<0.05)

The results of present study are similar with Kedaree *et al.* (2021 a) [10] and Chaitali *et al.* (2019) [3] reported that addition of apple powder in *lassi* and apple pulp in *yoghurt* at 2, 4, 6, 8 and 10, 20, 30 per cent decreased fat content significantly from 7.49 to 7.02 and 2.92 to 2.55 in treated product.

Protein content of *lassi* blended with apple powder

The values for protein content for control (T_1) and lassi blended with apple powder T_2, T_3, T_4 are 2.25, 2.30, 2.42 and 2.56 respectively. The protein content of control was lowest and differ significantly from T3 and T4. Among the treatment protein content increased significantly toward higher level of addition of apple powder. The significantly increased in protein content of *lassi* blended with apple powder was due to protein content (4 per cent) in apple powder.

The results are similar with Chaitali *et al*. (2019) [3] who reported that addition of apple pulp in *yoghurt* at 10, 20 and 30 per cent increased protein content from 3.44 to 4.48.

Table 4: Protein content of *lassi* blended with apple powder (Per cent)

Replication treatment	R_1	R_2	R_3	R_4	Mean
T_1	2.22	2.28	2.27	2.23	2.25^c
T_2	2.25	2.29	2.31	2.35	2.30^c
T_3	2.37	2.40	2.47	2.44	2.42^b
T_4	2.54	2.54	2.54	2.60	2.56^a
S.E.± 0.0184 C.D. at 5% 0.0568					

The values with different superscripts differ significantly (p<0.05)

Moisture content of *lassi* blended with apple powder

The mean moisture content for control (T_1) and *lassi* blended with apple powder T_2, T_3 and T_4 was 74.58, 74.23, 73.95 and 73.30 per cent, respectively. The moisture content of control sample was significantly higher than all treatments. Among treatment moisture content of T_2, T_3 and T_4 differ significantly from each other. The significant decrease in moisture content of *lassi* towards higher level of apple powder could be due to hygroscopic nature of apple powder.

The results of present study are in agreement with the findings of Kedaree *et al.* (2021 a) [11] who reported that addition of apple powder in *lassi* at 2, 4,6 and 8 per cent decreased moisture from 62.40 to 57.12.

Table 5: Moisture content of *lassi* blended with apple powder

Replication treatment	R_1	R_2	R_3	R_4	Mean
T_1	74.58	74.60	74.57	74.56	74.58^a
T_2	74.53	74.20	74.20	74.00	74.23^b
T_3	73.98	74.00	74.00	73.80	73.95^c
T_4	73.43	73.08	73.40	73.29	73.30^d
S.E.± 0.0721 C.D. at 5% 0.222					

The values with different superscripts differ significantly (p<0.05)

Total solids content of *lassi* blended with apple powder

The mean total solid content in control (T_1) and *lassi* blended with apple powder T_2, T_3 and T_4 was 25.42, 25.77, 26.06 and 26.70 per cent, respectively. The total solid content of control sample was significantly lower than all treatments. Among treatment total solid content increased significant toward higher level of addition of apple powder. The significantly increase in total solid content of *lassi* with apple powder was due to higher total solid (96.32) content in apple powder.

Table 6: Total solids content of *lassi* blended with apple powder (Per cent)

Replication treatment	R_1	R_2	R_3	R_4	Mean
T_1	25.42	25.40	25.43	25.44	25.42^d
T_2	25.47	25.80	25.80	26.00	25.77^c
T_3	26.02	26.00	26.00	26.20	26.06^b
T_4	26.57	26.92	26.60	26.71	26.70^a
S.E.± 0.0721 C.D. at 5% 0.222					

The values with different superscripts differ significantly (p<0.05)

The results of present study are in agreement with the findings of Kedaree *et al*. (2021 b) [11] and Chaitali *et al.* (2019) [3] reported that addition of apple powder in *kulfi* and apple pulp in *yoghurt* at 2.5, 5, 7.5 per cent and 10, 20, 30 per cent increased total solid content significantly from 31.34 to 36.75 and 17.48 to 27.31 in treated product, respectively.

Ash content of *lassi* blended with apple powder

The mean ash content control (T_1) and *lassi* blended with apple powder T_2, T_3 and T_4 was 1.17, 1.27, 1.36 and 1.47 per cent, respectively. The ash content of control sample was significantly lower than all treatments. Among treatment ash content increased significantly toward higher level of addition of apple powder. The significant increased in ash content of *lassi* with apple powder was due to higher ash (3.26 per cent) content in apple powder.

Table 7: Ash content of *lassi* blended with apple powder (Per cent)

Replication treatment	R_1	R_2	R_3	R_4	Mean
T_1	1.20	1.15	1.19	1.14	1.17^d
T_2	1.30	1.25	1.30	1.24	1.27^c
T_3	1.39	1.34	1.38	1.33	1.36^b
T_4	1.50	1.45	1.49	1.45	1.47^a
S.E.± 0.0147 C.D. at 5% 0.0453					

The values with different superscripts differ significantly (p<0.05)

The results are in agreement with Kedaree *et al.* (2021 a) [10] and Sahu *et al.* (2021) [16] reported that addition of apple powder in *lassi* and apple pulp in *shrikhand* at 2, 4, 6, 8 and 15, 20, 25 per cent, respectively increased ash content significantly from 1.14 to 1.33 and 0.64 to 0.83 in treated product.

SNF content of *lassi* blended with apple powder

The mean per cent SNF content for control (T_1) and *lassi* blended with apple powder T_2, T_3 and T_4 was 18.16, 18.55, 18.86 and 19.60 per cent, respectively. The SNF content of control sample was significantly lower than all treatments.

Among treatment SNF content increased significantly toward higher level of addition of apple powder. The significant increase in SNF content of *lassi* blended with apple powder was due to increase in total solids and decrease in fat content of *lassi* blended with apple powder.

Results are in agreement with the results obtained by Yadhav (2017) [17] who reported that addition of mango pulp in *lassi* at 12, 15, 18 and 21 per cent increased SNF from 16.50 to 20.33.

Table 8: SNF content of lassi blended with apple powder (Per cent)

Replication treatment	R_1	R_2	R_3	R_4	Mean
T_1	18.16	18.17	18.15	18.17	18.16^d
T_2	18.24	18.58	18.58	18.78	18.55^c
T_3	18.82	18.79	18.80	19.01	18.86^b
T_4	19.45	19.83	19.50	19.60	19.60^a
S.E.± 0.0147 C.D. at 5% 0.0453					

The values with different superscripts differ significantly (p<0.05)

Conclusion

The value added, nutritional and palatable *lassi* could be prepared by blending of buffalo milk *lassi* with apple powder. From the results of proximate chemical composition, it could be concluded that 4 per cent apple powder could be added in *lassi* without affecting taste and overall acceptability of finished product.

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