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Effect of different levels of apple (*Malus pumila*) pulp on proximate composition and cost of production of *burfi*

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Abstract

The *burfi* was prepared by blending 15, 20, 25 per cent of apple pulp. The prepared *burfi* analyzed for its proximate composition. The proximate composition of *burfi* blended with apple pulp T₂, T₃ and T₄ showed significant increase in moisture (16.41, 17.49, 18.79 per cent), total sugar (47.12, 48.30, 49.30 per cent) as compared to control T₁ (15.63; 45.56 per cent, respectively). However, significant decrease was observed in fat (20.47, 19.39, 18.32), protein (13.39, 12.42, 11.38), ash (2.61, 2.43, 2.21) and total solids (83.59, 82.54, 81.21) as compared to control T₁ (21.53; 14.45; 2.83; 84.37 per cent, respectively). The cost of *burfi* blended with apple pulp with 15, 20 and 25 per cent apple pulp was (387.1, 383.6 and 380.1 Rs/lkg) which was lower than control (397.6 Rs/lkg) indicating that addition of apple pulp decrease cost of *burfi* in T₄ as compared to control.

Keywords: *Burfi*, apple pulp, proximate, protein

Introduction

India is the largest producer of milk and contributes 24% of the World's total milk production, achieving an annual production of 239.30 million tonnes during the year 2023-24 and annual growth 3.78 per cent. The average per capita availability of milk is 471 grams per day in 2023-24. The annual growth of other traditional dairy products like *khoa*, *paneer*, *ghee*, *ice-cream*, *curd*, etc. would be in the range of 11 % to 20% (Anonymous, 2024-2025) [2].

Burfi is one of the most popular *khoa* based sweet, prepared from cow or buffalo milk. *Burfi* is prepared by heating a mixture of concentration milk solids (*khoa*) and sugar to a near homogenous consistency followed by cooling and cutting into small cuboids (Chetana *et al.*, 2010) [5].

Apple (*Malus pumila*) fruit is one of the most popular and favourite fruits among the health conscious, fitness lover peoples (Bharti *et al.*, 2018) [4]. Apples contains vitamin C, magnesium, phosphorus, potassium, calcium, iron, zinc, polyphenols (4.6 mg, 5 mg, 11mg, 107mg, 6mg, 0.12mg, 0.04mg, 110.20 mg, respectively per 100 gm). Protein, fat, dietary fiber, carbohydrates, sugar, water, energy content per 100 gm of apple is 0.26 gm, 0.17 gm, 2.4 gm, 13.81 gm, 10.39 gm, 85.56 gm, 52 kcal, respectively (Bator *et al.*, 2024). As per the saying, "an apple a day, keeps the doctor away," apple helps to improve digestion, prevents stomach disorders, gallstones, constipation and liver disorders. Furthermore, apple helps to treat rheumatism, dysentery, eye disorders, a variety of cancer and gout (Kedaree *et al.*, 2021) [9].

Previous research workers prepared value added *burfi* using fruits such as sweet orange *burfi*, guava *burfi* (Rahate *et al.*, 2021) [14], pineapple *burfi*, mango *burfi* etc. Keeping this in view, an attempt has been made in this study to prepare the *burfi* blended with apple pulp.

Materials and Methods

The research was conducted during 2024-25 in Department of Animal Husbandry and Dairy Science, College of Agriculture, Latur, Vasantrao Naik Marathwada Krishi Vidyapeeth, Parbhani.

Materials

Fresh Standardized Buffalo milk (6% fat and 9% SNF), fresh & matured apple fruit and clean, crystalline cane sugar was purchased from local market.

Methodology

Fresh and matured apple fruit wash under clean water then peel off its skin, cut it into small slices and blend the slices until pulp form. Khoa was prepared by heating standardized buffalo milk (6 % Fat and 9% Solid Not Fat) in iron karahi with continuous stirring and scrapping until it reached pat formation stage. Apple pulp was added as per treatment combinations and sugar at 30 per cent by weight of *khoa* was added. The mixture was then further heated with continuous kneading at 50°C up to desirable solid mass stage attained. Then the mixture was spreading into greasy stainless-steel tray for cooling at 30°C. After cooling of mixture it was cutting into rectangular blocks. The final product packaging and storage at room temperature.

Treatment combination

Burfi blended with apple pulp was prepared using 30 per cent sugar by weight of *khoa* and apple pulp as per the treatment combination as follows.

T₁ -100 part of *khoa* by weight (Control)

T₂ - 85 part of *khoa* + 15 part of apple pulp by weight

T₃ - 80 part of *khoa* + 20 part of apple pulp by weight

T₄ - 75 part of *khoa* + 25 part of apple pulp by weight

Burfi blended with apple pulp and control *burfi* were analyzed for moisture, ash, fat, total solids, total sugar and protein by using standard methods. Moisture was determined as per standard procedure described by (Anonymous, 1959) ^[1]. Ash content was determined by methods described in IS: SP (Part XI) 1981. The fat content was determined by using Gerber's method described in IS: 1224 (Part II) (1977). Total solid content was determined as per the method described in IS 1479 (Part-II) 1961. Total sugar content was estimated by subtraction method i.e. Total sugar = 100 - (moisture + fat + protein + ash). The protein content was determined by using Lowry method (1951) ^[10]. The cost of the finished products was calculated on the basis of the prevailing prices of sugar, apple and milk. The cost of fuel and other item was considered under miscellaneous charges and final cost of production was worked out.

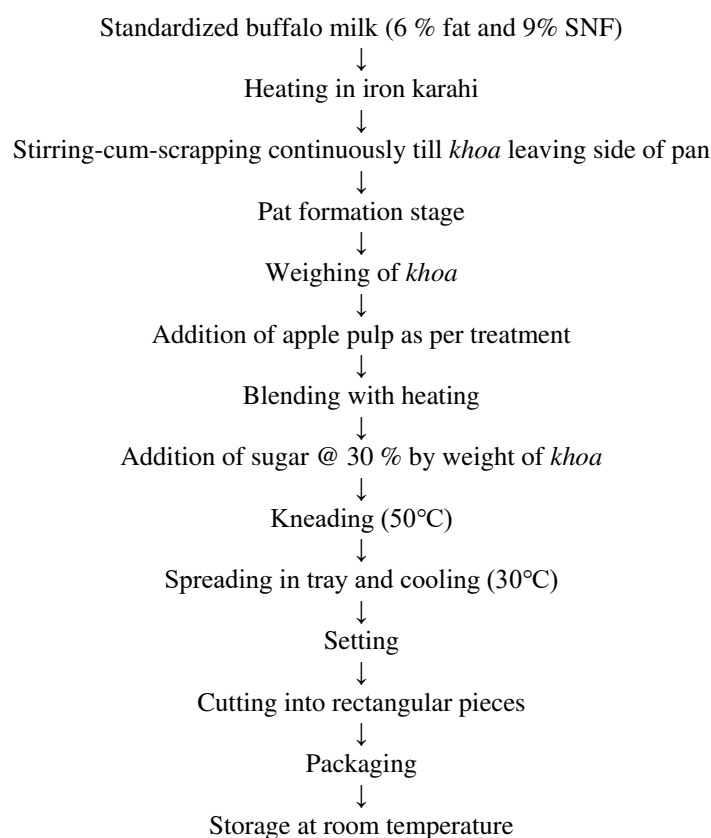


Fig 1: Flow diagram of preparation of *burfi* blended with apple pulp

Result and discussion

Moisture content of *burfi* blended with apple pulp

The mean value of moisture content for control (T₁) and *burfi* blended with apple pulp T₂, T₃ and T₄ was 15.63, 16.41, 17.49 and 18.79 per cent, respectively and presented in Table 1. The per cent moisture content of control (T₁) sample was (15.63) lower and differ significant from all treatments. Among the treatment per cent moisture content of T₄ was (18.79) higher than all other treatment and differ significant from each other. The per cent moisture content in all treatments increase significantly toward higher level of

addition of apple pulp.

The significant increase in moisture content of *burfi* blended with apple pulp was due to higher moisture (85.56 per cent) content in apple pulp.

The result of present study are in agreement with the findings of Sahu *et al.* (2021) ^[15] and Tanuja *et al.* (2016) ^[16] reported that addition of apple pulp in *shrikhand* and apple pomace in *burfi* at 15, 20, 25 and 5, 10 and 15 per cent respectively increased moisture content from 45.56 to 47.43 and 13.04 to 16.24 in treated product significantly.

Table 1: Moisture content of *burfi* blended with apple pulp (per cent)

Treatment	Replication				Mean
	R ₁	R ₂	R ₃	R ₄	
T ₁	15.25	15.68	15.86	15.73	15.63 ^d
T ₂	16.52	16.14	16.31	16.68	16.41 ^c
T ₃	17.09	17.59	17.34	17.82	17.49 ^b
T ₄	18.57	18.98	18.74	18.86	18.79 ^a

S.E. ± 0.1264 C.D. at 5% 0.3895

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

Fat content of *burfi* blended with apple pulp

The per cent fat content of control (T₁) and *burfi* blended with apple pulp T₂, T₃ and T₄ was 21.53, 20.47, 19.39 and 18.32 per cent respectively and presented in Table 2. The fat per cent content of control (T₁) sample was highest (21.53) and differ significant from all treatments T₂, T₃ and T₄. Among the treatment per cent fat content of T₂ was (20.47) higher than all other treatments and differ significantly from each other. The per cent fat content in all treatments decrease significantly toward higher level of addition of apple pulp.

The significant decrease in fat content of *burfi* with apple pulp was due to lower fat (0.17 per cent) content in apple pulp, than *khoa*.

The above results are in agreement with the findings of Pawar *et al.* (2024) [13] and Bage *et al.* (2019) [3] who reported that *lassi* blended with apple powder and apple pulp in *basundi* at 2, 4, 6 and 10, 20, 30, 40 per cent decreased fat content 7.26 to 7.11 and 10.80 to 7.16 in treated product significantly.

Table 2: Fat content of *burfi* blended with apple pulp (per cent)

Treatment	Replication				Mean
	R ₁	R ₂	R ₃	R ₄	
T ₁	21.68	21.56	21.25	21.63	21.53 ^a
T ₂	20.43	20.56	20.62	20.25	20.47 ^b
T ₃	19.18	19.56	19.43	19.37	19.39 ^c
T ₄	18.37	18.43	18.31	18.18	18.32 ^d

S.E. ± 0.1264 C.D. at 5% 0.3895

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

Protein content of *burfi* blended with apple pulp

The mean value of per cent protein for control (T₁) and *burfi* blended with apple pulp T₂, T₃ and T₄ was 14.45, 13.39, 12.42 and 11.38 per cent, respectively and presented in Table 3. The per cent protein content of control (T₁) sample was (14.45) highest and differ significantly from all treatments. Among the treatment per cent protein content of T₂ was (13.39) higher than all other treatment and differ significantly. The addition of apple pulp decreased per cent

protein content in all treatment as compared to control (14.45) and values differ significantly from each other.

The significant decrease in per cent protein content of *burfi* blended with apple pulp was due to lower protein content (0.26 per cent) in apple pulp, than *khoa*.

The results of present study are similar with Bage *et al.* (2019) [3] reported that addition of apple pulp in *basundi* at 10, 20, 30, 40 per cent decreased protein content from 8.20 to 6.51 per cent significantly in treated product.

Table 3: Protein content of *lassi* blended with apple pulp (per cent)

Treatment	Replication				Mean
	R ₁	R ₂	R ₃	R ₄	
T ₁	14.23	14.34	14.74	14.50	14.45 ^a
T ₂	13.09	13.57	13.68	13.21	13.39 ^b
T ₃	12.46	12.09	12.84	12.29	12.42 ^c
T ₄	11.12	11.32	11.62	11.45	11.38 ^d

S.E. ± 0.1309 C.D. at 5% 0.4035

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

Ash content of *burfi* blended with apple pulp

The mean value of per cent ash content for control (T₁) and *burfi* blended with apple pulp T₂, T₃ and T₄ was 2.83, 2.61, 2.43 and 2.21 per cent, respectively and presented in Table 4. The per cent ash content of control (T₁) sample was (2.83) highest and differ significantly from all treatments. Among the treatments per cent ash content of (T₂) was (2.61) higher than all other treatment and differ significantly. However addition of apple pulp in T₂, T₃ and T₄ decreased ash content significantly as compared to control.

The significant decrease in ash content of *burfi* blended with apple pulp was due to less ash content (0.11 per cent) and higher moisture content (85.56 per cent) in apple pulp, than *khoa*.

The results obtained in present study are contradictory with Bage *et al.* (2019) [3] who reported that the per cent ash in *basundi* sample blended with 10, 20, 30 and 40 per cent apple pulp, increased ash content from 1.08 to 1.20 which could be due to higher moisture content in *basundi*.

Table 4: Ash content of *burfi* blended with apple pulp (per cent)

Treatment	Replication				Mean
	R ₁	R ₂	R ₃	R ₄	
T ₁	2.93	2.73	2.81	2.84	2.83 ^a
T ₂	2.70	2.59	2.47	2.68	2.61 ^b
T ₃	2.50	2.49	2.32	2.42	2.43 ^c
T ₄	2.32	2.06	2.18	2.28	2.21 ^d

S.E. ± 0.0488 C.D. at 5% 0.1505

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

Total solids content of *burfi* blended with apple pulp

The mean value of total solids content for control (T₁) and *burfi* blended with apple pulp T₂, T₃ and T₄ was 84.37,

83.59, 82.54 and 81.21 per cent, respectively and presented in Table 5. The total solids content of control (T₁) sample was (84.37) higher and differ significantly from all

treatments. Among the treatments per cent total solids content of (T₂) was (83.59) higher than all other treatment and differ significantly.

The significant decrease in total solids content of *burfi* toward higher level of apple pulp was due to less total solids

(10 - 15 per cent) and higher moisture (85.56 per cent) content in apple pulp, than *khoa*.

The results of present study are similar with Navale *et al.* (2014) who reported that addition of wood apple pulp in *burfi* at 5, 10 and 15 per cent decreased total solids content from 83.04, 81.90, 80.83 and 79.70 per cent, significantly.

Table 5: Total solids content of *burfi* blended with apple pulp (per cent)

Treatment	Replication				Mean
	R ₁	R ₂	R ₃	R ₄	
T ₁	84.75	84.32	84.14	84.27	84.37 ^a
T ₂	83.48	83.86	83.69	83.32	83.59 ^b
T ₃	82.91	82.41	82.66	82.18	82.54 ^c
T ₄	81.43	81.02	81.26	81.14	81.21 ^d

S.E. $\pm$ 0.1264 C.D. at 5% 0.3895

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

Total sugar content of *burfi* blended with apple pulp

The mean value of total sugar content for control (T₁) and *burfi* blended with apple pulp T₂, T₃ and T₄ are 45.56, 47.12, 48.30 and 49.30 per cent, respectively and presented in Table 6. The per cent total sugar content of control (T₁) sample was (45.56) lower and differ significantly from all treatments.

The significant increase in total sugars content of *burfi* toward higher level of apple pulp was due to total sugar (10.39 per cent) and carbohydrates (13.81) content in apple pulp, than *khoa*.

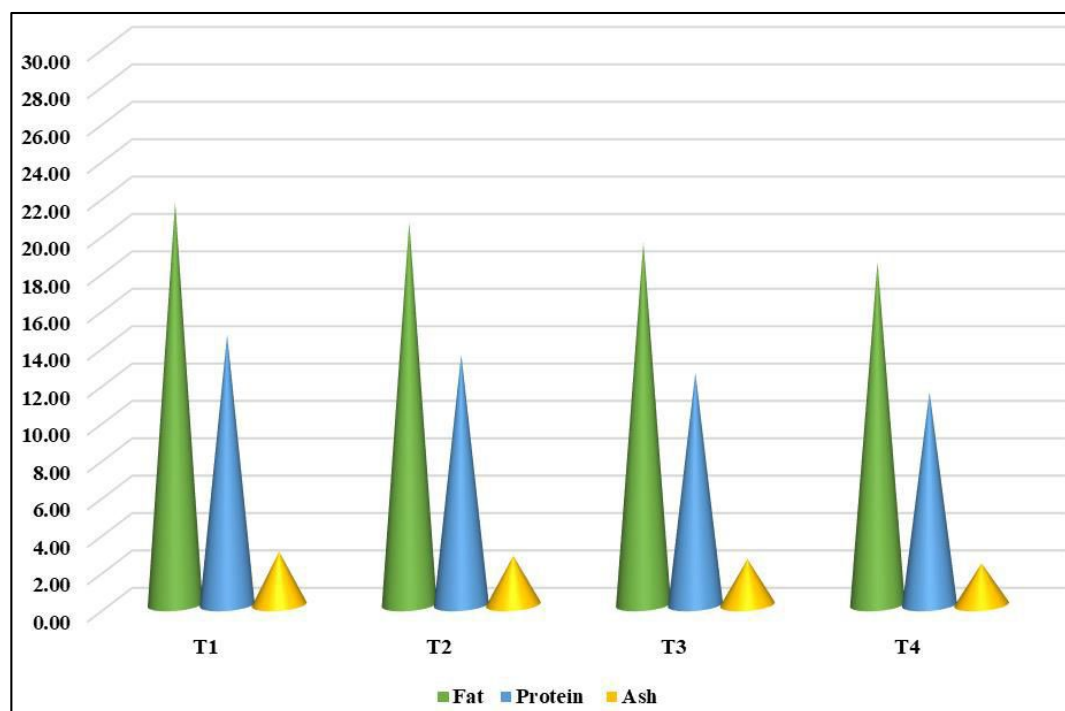
The results of present study are similar with Navale *et al.* (2014) who reported that addition of wood apple pulp in *burfi* at 5, 10 and 15 per cent increased total sugar content from 44.77, 45.37, 46.52 and 47.44 per cent, significantly.

Table 6: Total sugar content of *burfi* blended with apple pulp (per cent)

Treatment	Replication				Mean
	R ₁	R ₂	R ₃	R ₄	
T ₁	45.91	45.69	45.34	45.30	45.56 ^d
T ₂	47.26	47.14	46.91	47.18	47.12 ^c
T ₃	48.77	48.27	48.07	48.10	48.30 ^b
T ₄	49.62	49.21	49.15	49.23	49.30 ^a

S.E. $\pm$ 0.1271 C.D. at 5% 0.3916

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



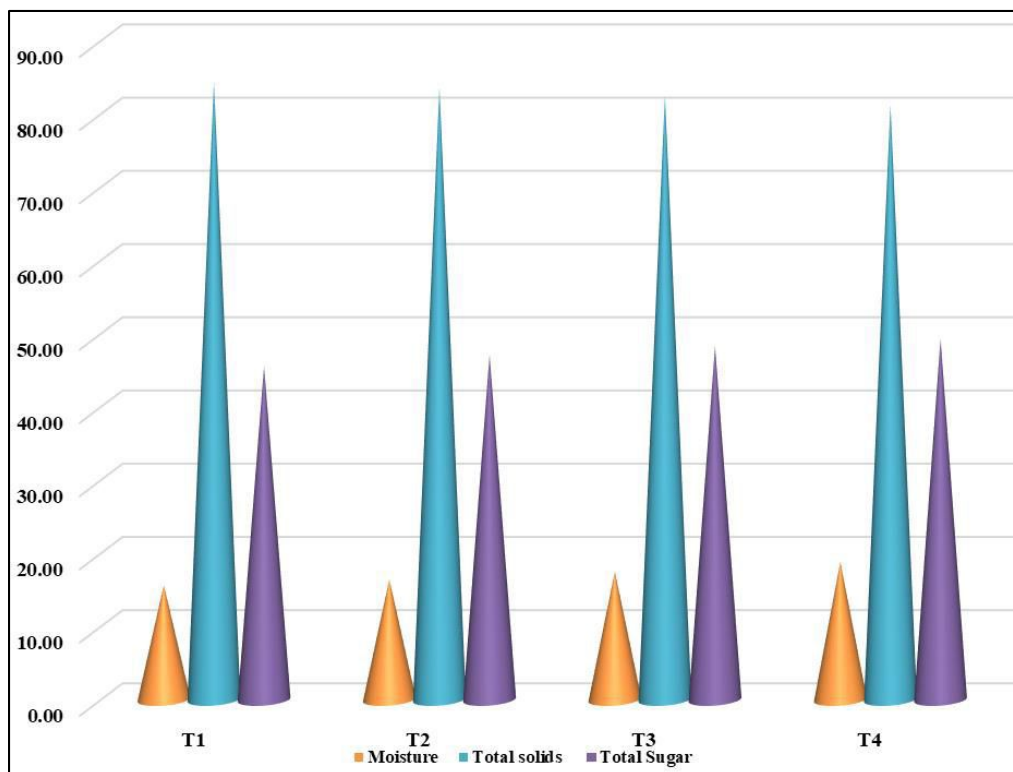


Fig 2: Proximate composition of *burfi* blended with apple pulp

The production cost of control *burfi* and *burfi* with apple pulp was calculated on the basis of cost of ingredients used including labour and fuel charges. The production cost of *burfi* blended with apple pulp is presented in table 7.

The cost of production of *burfi* blended with apple pulp was calculated and presented in table 4.29. The production cost of control (T₁) and *burfi* blended with apple pulp T₂, T₃ and

T₄ was 397.6, 387.1, 383.6 and 380.1 Rs per 1 kg, respectively.

The cost of *burfi* blended with apple pulp was observed to be decreased than control as well as toward the higher level of addition of apple pulp was due to lower price of apple fruit as compared to *khoa*.

Table 7: Cost of production of *burfi* blended with apple pulp

Sr. No	Particulars	Cost (Rs/kg)	Treatment combination							
			T1		T2		T3		T4	
			Qty (Per gm)	Amt (Rs)	Qty (Per gm)	Amt (Rs)	Qty (Per gm)	Amt (Rs)	Qty (Per gm)	Amt (Rs)
1.	Khoa (gram)	340	1000	340	850	289	800	272	750	255
2.	Apple (gram)	270	-	-	150	40.5	200	54	250	67.5
3.	Sugar @ 30 % (gm)	42	300	12.6	300	12.6	300	12.6	300	12.6
4.	Labour charges	120/ 8hrs	-	30	-	30	-	30	-	30
5.	Fuel charges	-	-	15	-	15	-	15	-	15
6.	Product obtained (kg)	-	1.00	-	1.00	-	1.00	-	1.00	-
7.	Cost per 1 kg	-	-	397.6	-	387.1	-	383.6	-	380.1

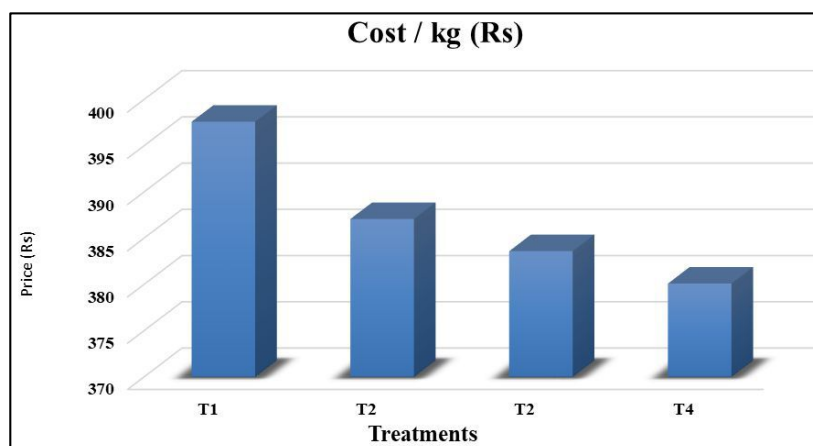


Fig 3: Cost of production of *burfi* blended with apple pulp

Conclusion

The value added and nutritious *burfi* could be prepared by blending of buffalo milk khoa with apple pulp. From the results of proximate composition of *burfi* i.e. fat, protein and total solids per cent was significantly decreased while moisture and total sugar per cent significantly increased with increased levels of apple pulp. The production cost of *burfi* could be decreased due to addition of apple pulp as compared to control.

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