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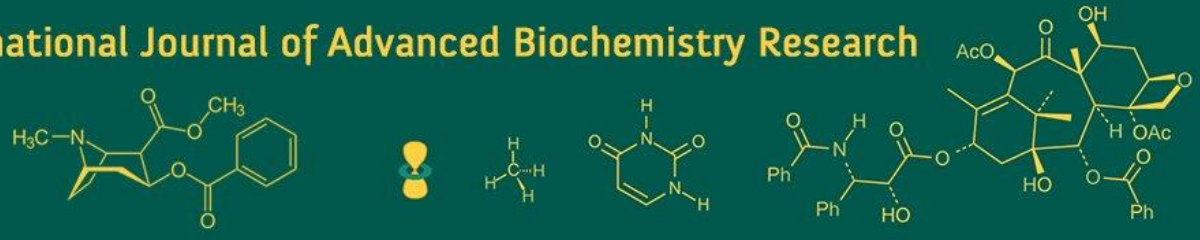

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Effect of addition of kidney bean (*Phaseolus vulgaris*) paste on chemical composition and production cost of *peda*

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Abstract
The *peda* was prepared by blending 2.5, 5 and 7.5 per cent of kidney bean paste. The prepared *peda* analyzed for its proximate composition. The proximate composition of *peda* blended with kidney bean paste T_2, T_3 and T_4 showed significant increase in total solids (85.02, 85.31, 85.64 per cent), protein (15.55, 16.13, 17.17 per cent), ash (2.47, 2.69, 2.97 per cent) as compared to control T_1 (84.67; 15.02; 2.23 per cent, respectively). However, significant decrease was observed in moisture (14.98, 14.69 and 14.36 per cent), total sugar (44.78, 44.56, 44.25 per cent) and fat (22.22, 21.93, 21.25 per cent) as compared to control T_1 (15.33; 44.96; 22.46 per cent, respectively). The production cost of *peda* blended with kidney bean paste T_2, T_3 and T_4 was decreased (Rs. 393.6, 389.6 and 385.6 per 1 kg) as compared to control T_1 (Rs. 397.6 per 1 kg), respectively.

Keywords: Kidney bean, *peda*, *khoa*, protein, chemical composition

Introduction
India ranks 1st in the world in terms of total milk production. Total milk production in the country is 239.30 million tonnes. The per capita availability of milk is 471 grams per day in India during the year 2023-24 which is 43% more than the world average of around 329 grams per day in 2023 (Anonymous, 2024-25) [2]. Around 50% of total milk produced in India is converted to traditional Indian dairy products such as khoa, paneer, shrikhand, etc. (Rasane *et al*., 2015) [17]. About 7% of milk produced in India is converted to *khoa* (Ali *et al*., 2021) [3]. *Khoa* based sweets differs from other sweets due to its rich aroma, pleasant taste, and more shelf life. (Viji *et al*., 2022) [21].
Peda is indigenous milk sweet prepared by heating a mixture of *khoa* and sugar until the desired granular texture and flavour develops (Gavhane *et al*., 2014) [6].
Legumes are one of the most nutritious foods in the world and combined with other products are the basis of diet for a large part of the world's population (Martin-Cabrejas, 2019) [13]. Kidney bean a grain legume is a rich source of vitamin B (B_1, B_2, B_3, B_6 and B_9), vitamin C and vitamin K. As beans are rich source of good protein, they became popular in many cultures throughout the world (Singh and Chandra, 2020) [20].
Kidney beans became famous all over the world due to its health benefits as well as their rich texture. Kidney beans are termed as "King of Nutrition". Nutritional values of kidney bean per 100g are Carbohydrates 60.01 g, Sugars 2.23 g, Energy 1,393 kJ (333 kcal), Fat 0.83 g, Dietary fibre 24.9 g, Protein 23.58 g. (Parmar *et al*., 2016) [16].
Previous research workers prepared value added *peda* using cereals, medicinal plants, fruits & vegetables such as wheat bran *peda* (Lingayat, 2014) [11], rice bran brown *peda* (Dixit, 2017) [5], turmeric & black pepper powder herbal *peda* (Panday *et al*., 2018) [14], ginger powder *peda* (Gavhane *et al*., 2014) [6], beetroot powder *peda* (Shevale, 2022) [19] and red pumpkin pulp *peda* (Bhutkar *et al*., 2015) [4] etc. Keeping this in view, an attempt has been made in this study to prepare the *peda* blended with kidney bean paste

Materials and Methods
The research was conducted during 2024-2025 in the 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 & good quality red kidney bean seeds and clean, crystalline cane sugar was purchased from local market.

Methodology

Good quality kidney bean seeds were soaked in water for 12-14 hours at room temperature and then kidney bean paste was prepared by peeling and grinding kidney bean seeds in mixer until fine paste 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. Kidney bean paste was added as per treatment combinations. 30 per cent sugar was added in control by weight of *khoa* and 30 per cent by weight of *khoa* plus kidney bean paste in treatment groups. *Khoa* was heated and blended till it get properly mixed. Round balls of *peda* with each weighing 25 gm were made and stored at room temperature.

Treatment combination

Peda blended with kidney bean paste was prepared using 30 per cent sugar by weight of *khoa* for control and 30 per cent by weight of *khoa* and kidney bean paste in treatment groups as follows.

- T_1 - 100 parts of *khoa* (Control)
- T_2 - 97.5 parts of *khoa* and 2.5 parts of kidney bean paste
- T_3 - 95 parts of *khoa* and 5 parts of kidney bean paste
- T_4 - 92.5 parts of *khoa* and 7.5 parts of kidney bean paste

Peda blended with kidney bean paste and control *peda* 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).

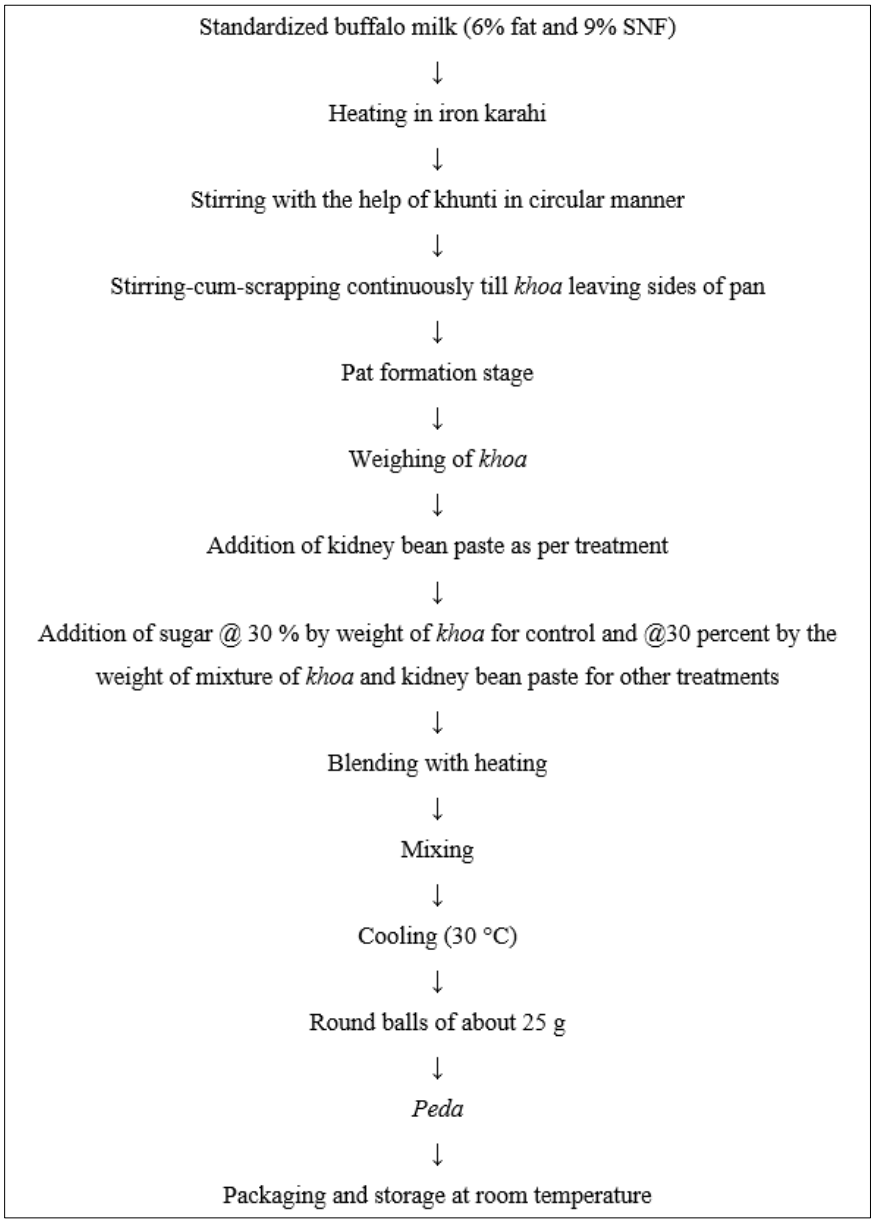

Fig 1: Flow chart for preparation of *peda* blended with kidney bean (*Phaseolus vulgaris*) paste (Ghule *et al.* 2013)

Results and Discussion

Moisture content of *peda* blended with kidney bean paste

The mean value of per cent moisture content for control (T_1) and *peda* blended with kidney bean paste T_2, T_3 and T_4 was 15.33, 14.98, 14.69 and 14.36 per cent, respectively and presented in Tabel 1. The per cent moisture content of control T_1 and treatments T_2, T_3, T_4 decreased significantly towards higher level of addition of kidney bean paste. The per cent moisture content of control T_1 (15.33) was highest. Whereas, addition of kidney bean paste 2.5, 5, 7.5 per cent decreased per cent moisture content significantly. Moisture content of control and treatments differs significantly from each other.

The significant decrease in moisture content of *peda* blended with kidney bean paste was due to low moisture content (12.13 per cent) in boiled kidney bean as reported by the Roy *et al.* (2021) [18].

Table 1: Moisture content of *peda* blended with kidney bean paste (per cent)

Replication / Treatment	R1	R2	R3	R4	Mean
T1	15.51	15.26	15.17	15.39	15.33[a]
T2	15.17	14.91	14.84	15.01	14.98[b]
T3	14.83	14.65	14.54	14.74	14.69[c]
T4	14.53	14.32	14.19	14.41	14.36[d]
S.E. ± 0.0701 C.D. at 5% 0.2160					

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

Fat content of *peda* blended with kidney bean paste

The mean value of per cent fat content of control (T_1) and *peda* blended with kidney bean paste T_2, T_3 and T_4 was 22.46, 22.22, 21.93 and 21.25 per cent, respectively and presented in Tabel 2. The per cent fat content of control sample T_1 (22.46) was highest and differs significantly from all other treatments. Among the treated samples per cent fat content of T_2 (22.22) was highest. However, per cent fat content decreased significantly towards higher level of addition of kidney bean paste.

The significant decrease in fat content of *peda* blended with kidney bean paste was due to lower fat (2.66 per cent) content in kidney bean as compared to *khoa* (24.20 per cent).

The results obtained in present study are similar with Vyawahare *et al.* (2022) [22] who reported that the per cent fat content in *burfi* sample blended with 10, 20, 30, 40 per cent date paste, decreased from 20.60 to 19.19 per cent.

Table 2: Fat content of *peda* blended with kidney bean paste (per cent)

Replication / Treatment	R1	R2	R3	R4	Mean
T1	22.46	22.25	22.63	22.50	22.46[a]
T2	22.07	22.17	22.49	22.13	22.22[b]
T3	21.88	21.75	22.25	21.85	21.93[c]
T4	21.32	21.00	21.56	21.12	21.25[d]
S.E. ± 0.1025 C.D. at 5% 0.3159					

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

Protein content of *peda* blended with kidney bean paste

The mean value of per cent protein content for control (T_1) and *peda* blended with kidney bean paste T_2, T_3 and T_4 was 15.02, 15.55, 16.13 and 17.17 per cent, respectively and presented in Tabel 3. The protein content of control sample T_1 (15.02) was lowest whereas addition of kidney bean paste 2.5, 5, 7.5 per cent increased per cent protein content significantly. Among the treated samples per cent protein content of T_4 (17.17) was higher than all other treatments. The addition of kidney bean paste increased protein content in all treatment as compared to control and value differs significantly from each other. The significant increase in protein content of *peda* blended with kidney bean paste was due to high protein content (24.30 per cent) in kidney bean as compared to *khoa* (18.30 per cent).

The results obtained in present study are similar with Pariskar *et al.* (2015) who reported that the *kheer* prepared by blending 90, 80, 70 parts of buffalo milk and 10, 20, 30 parts of soy milk, respectively increased protein content from 7.28 to 8.26 per cent.

Table 3: Protein content of *peda* blended with kidney bean paste (per cent)

Replication / Treatment	R1	R2	R3	R4	Mean
T1	14.92	15.2	15.12	14.83	15.02[d]
T2	15.61	15.69	15.41	15.47	15.55[c]
T3	16.20	16.38	15.99	15.94	16.13[b]
T4	17.02	17.55	17.20	16.92	17.17[a]
S.E. ± 0.1011 C.D. at 5% 0.3116					

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

Ash content of *peda* blended with kidney bean paste

The mean value of per cent ash content for control and *peda* blended with kidney bean paste T_1, T_2, T_3 and T_4 was 2.23, 2.47, 2.69 and 2.97 per cent, respectively and presented in Tabel 4.

The per cent ash content of treatments T_2, T_3, T_4 increased significantly towards higher level of addition of kidney bean paste. The per cent ash content of control sample T_1 (2.23) was lowest. Whereas, addition of kidney bean paste 2.5, 5, 7.5 per cent increased per cent ash content significantly. Ash content of control and treatments differs significantly from each other. Increase in ash content in all treatment was due to addition of kidney bean paste with less moisture content than *khoa*.

The results of present study are contradictory with Vyawahare *et al.* (2022) [22] who reported that the per cent ash in burfi sample blended with 10, 20, 30, 40 per cent date paste, decreased significantly from 2.75 to 2.43 which could be due to higher moisture content in date paste. The significant increase in ash content of *peda* blended with kidney bean paste was due to low moisture content (12.13 per cent) in boiled kidney bean as reported by the Roy *et al.* (2021) [18].

Table 4: Ash content of *peda* blended with kidney bean paste (per cent)

Replication / Treatment	R1	R2	R3	R4	Mean
T1	2.22	2.25	2.16	2.30	2.23[d]
T2	2.45	2.48	2.43	2.53	2.47[c]
T3	2.59	2.64	2.71	2.82	2.69[b]
T4	2.87	3.01	2.92	3.07	2.97[a]
S.E. ± 0.0381 C.D. at 5% 0.1175					

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

Total solids content of *peda* blended with kidney bean paste

The mean value of per cent total solid content for control (T_1) and *peda* blended with kidney bean paste T_2, T_3 and T_4 was 84.67, 85.02, 85.31 and 85.64 per cent, respectively and presented in Tabel 5. The per cent total solid content of control sample T_1 (84.67) was lowest. Whereas, addition of kidney bean paste 2.5, 5, 7.5 per cent increased per cent total solid content significantly. Total solid content of control and treatments differs significantly from each other. The significant increase in per cent total solid content of *peda* with kidney bean paste was due to lower moisture content in kidney bean paste than *khoa*.

The results obtained in present study are contradictory with Vyawahare *et al.* (2022) [22] who reported that the per cent total solid in burfi sample blended with 10, 20, 30, 40 per cent date paste, decreased from 85.76 to 84.33 which could be due to higher moisture content in date paste. The significant increase in total solid content of *peda* blended with kidney bean paste was due to low moisture content (12.13 per cent) in boiled kidney bean as reported by the Roy *et al.* (2021) [18].

Table 5: Total solids content of *peda* blended with kidney bean paste (per cent)

Replication / Treatment	R_1	R_2	R_3	R_4	Mean
T_1	84.49	84.74	84.83	84.61	84.67^{d}
T_2	84.83	85.09	85.16	84.99	85.02^{c}
T_3	85.17	85.35	85.46	85.26	85.31^{b}
T_4	85.47	85.68	85.81	85.59	85.64^{a}
S.E. ± 0.0701 C.D. at 5% 0.2160					

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

Total sugar content of *peda* blended with kidney bean paste

The mean value of per cent total sugar content of control (T_1) and *peda* blended with kidney bean paste T_2, T_3 and T_4 was 44.96, 44.78, 44.56 and 44.25 per cent, respectively and presented in Tabel 6. The total sugar content of control sample T_1 (44.96) was highest. Whereas, addition of kidney bean paste 2.5, 5, 7.5 per cent decreased total sugar content significantly. Total sugar content of control and treatments differs significantly from each other. Among the treatments per cent total sugar content of T_2 (44.78) was highest and decreased significantly toward higher level of addition of kidney bean paste.

The significant decrease in per cent total sugar content of *peda* blended with kidney bean paste was due to low sugar (2.23 gm/100 gm) content in kidney bean as reported by the Parmar *et al.* (2016) [16].

Table 6: Total sugar content of *peda* blended with kidney bean paste (per cent)

Replication / Treatment	R_1	R_2	R_3	R_4	Mean
T_1	44.89	45.04	44.92	44.98	44.96^{a}
T_2	44.70	44.74	44.83	44.86	44.78^{b}
T_3	44.50	44.58	44.51	44.65	44.56^{c}
T_4	44.26	44.12	44.13	44.48	44.25^{d}
S.E. ± 0.0518 C.D. at 5% 0.1597					

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

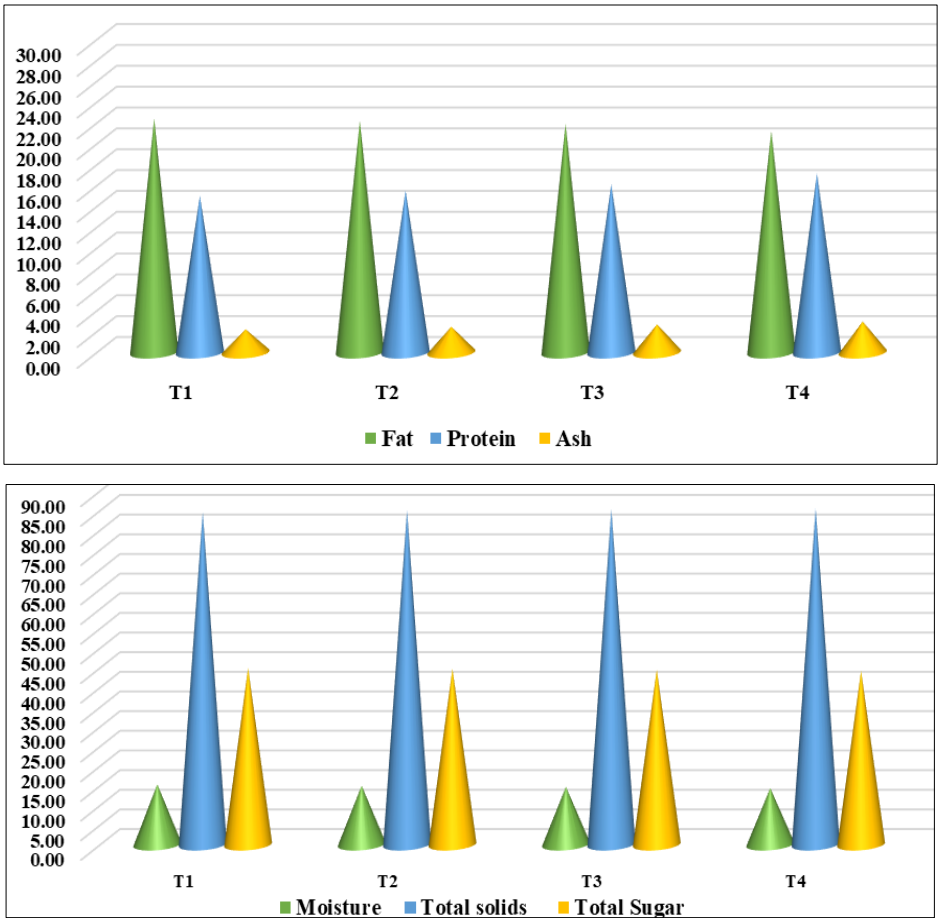

Fig 2: proximate composition of *peda* blended with kidney bean paste

Production cost of *peda* blended with kidney bean paste

The production cost of control *peda* and *peda* with kidney bean paste was calculated on the basis of cost of ingredients used including labour and fuel charges. The production cost of *peda* blended with kidney bean paste is presented in table 7.

Table 7: Production cost of *peda* blended with kidney bean paste

Sr. No	Particulars	Cost (Rs/kg)	Treatment combinations							
			T1		T2		T_3		T4	
			Qty (Per gm)	Amt (Rs)	Qty (Per gm)	Amt (Rs)	Qty (Per gm)	Amt (Rs)	Qty (Per gm)	Amt (Rs)
1.	Khoa (Kg)	340	1000	340	975	331.5	950	323	925	314.5
2.	Kidney bean paste (Kg)	180	-	-	25	4.5	50	9.0	75	13.5
3.	Sugar @ 30 % (Kg)	42	300	12.6	300	12.6	300	12.6	300	12.6
4.	Labour charges	120/8hr	-	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	-	393.6	-	389.6	-	385.6

The production cost of control (T_1) and *peda* blended with kidney bean paste T_2, T_3 and T_4 was Rs. 397.6, 393.6, 389.6 and 385.6 per 1 kg, respectively.

The cost of *peda* blended with kidney bean paste was decreased as compared to control, towards the higher level of addition of kidney bean paste, due to lower price of added kidney bean as compared to *khoa*.

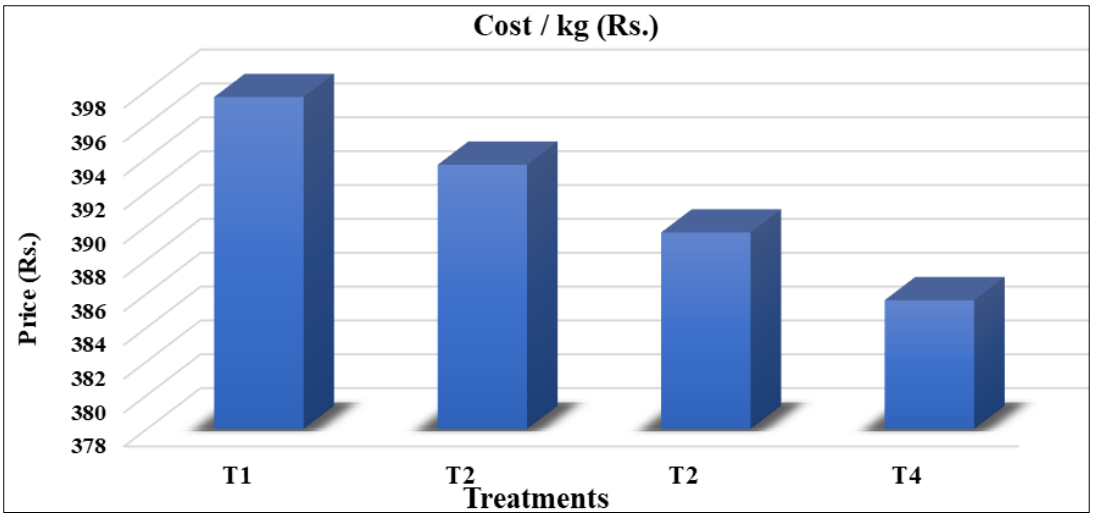

Fig 3: Production cost of *peda* blended with kidney bean paste

Conclusions

The value added and nutritious *peda* could be prepared by blending of buffalo milk *khoa* with kidney bean paste. From the results of chemical composition it was concluded that *peda* blended with kidney bean paste could be prepared successfully with increase in protein and decrease in fat content of finished product. The production cost of *peda* could be decreased due to addition of kidney bean paste as compared to control.

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