ISSN Print: 2664-844X
ISSN Online: 2664-8458
NAAS Rating (2025): 4.97
IJAFS 2025; 7(10): 610-614
www.agriculturaljournals.com
Received: 05-09-2025
Accepted: 06-10-2025

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Studies on sensory and microbial quality of *peda* blended with kidney bean (*Phaseolus vulgaris*) paste

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DOI: https://www.doi.org/10.33545/2664844X.2025.v7.i10i.928

Abstract
The *peda* was prepared by blending 2.5, 5 and 7.5 per cent of kidney bean paste with buffalo milk *khoa* aimed to study sensory properties of *peda* blended with kidney bean (*Phaseolus vulgaris*) paste. The sensory scores of *peda* blended with kidney bean paste increased non-significantly in T_2 (8.75, 8.75, 8.75, 8.75) and then further decreased non-significantly in T_3 (8.25, 8.25, 8.25, 8.25) and T_4 (8.00, 7.75, 7.75, 8.00) as compared to control T_1 (8.50, 8.50, 8.50, 8.50) for colour and appearance, flavour, body and texture and overall acceptability, respectively. The standard plate count of fresh *peda* blended with kidney bean paste in T_2, T_3 and T_4 significantly decreased (9, 7, 5 $\times 10^3$ cfu/gm) as compared to control T_1 (10 $\times 10^3$ cfu/gm). The yeast and mould count was not observed as the product was fresh. The product was found to be free from coliform which indicates the hygienic quality of *peda*.

Keywords: Kidney bean, *peda*, *khoa*, microbial, sensory quality

Introduction
The milk production has increased by 3.78% in 2023-24 over the previous year. Milk production has increased by 51.05% over the past 10 years from 146.31 million tonnes (2014-15) to 239.30 million tonnes (2023-24) (Basic Animal Husbandry Statistics, 2024). Buffalo milk is preferred for preparation of *khoa* and *khoa* based sweets because it gives soft and uniform body with smooth, compact and homogenous texture to finished products (Dhage *et al.*, 2018) [3]. *Khoa*, a heat desiccated indigenous dairy product is the main base for the production of sweets in India (Rasane *et al*., 2015) [9]. *Peda* and *burfi* are two major *khoa* based milk- sweets are highly popular in India, because of their delicious taste and high nutritional value (Meshram, 2019) [8]. The base for *peda* is *khoa* and cane sugar in different proportions, other ingredients are also incorporated to cater the need of flavour or body and textural characteristics. (Gavhane *et al*., 2014) [5].
Kidney beans are rich source of good protein, they have become popular in many cultures throughout the world. The term 'kidney bean' refers to the shape of the bean. (Singh and Chandra, 2020) [10]. Addition of cereals and legumes in milk or milk products, directly or indirectly increases its nutritive value in human food.

Materials and Methods
The present study 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.

Microbiological Media
The *peda* samples were analyzed for standard plate count, coliform count, yeast and mould count by using Nutrient Agar (NA), Violet Red Bile Agar (VRBA) and Potato Dextrose Agar (PDA) media, respectively.

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

Sensory evaluation of control and *peda* blended with kidney bean paste was conducted by semi- trained panel of 5 judges using 9-point hedonic scale. The sensory attributes such as colour and appearance, body and texture, flavour and overall acceptability was studied and data obtained were analysed with Completely Randomized Block Design (CRD). The scores given by judges for different sensory parameters were recorded and subsequently discussed as follows. The microbiological analysis of *peda* samples for standard plate count, yeast and mould count, coliform count was performed according to A.O.A.C. method (1975).

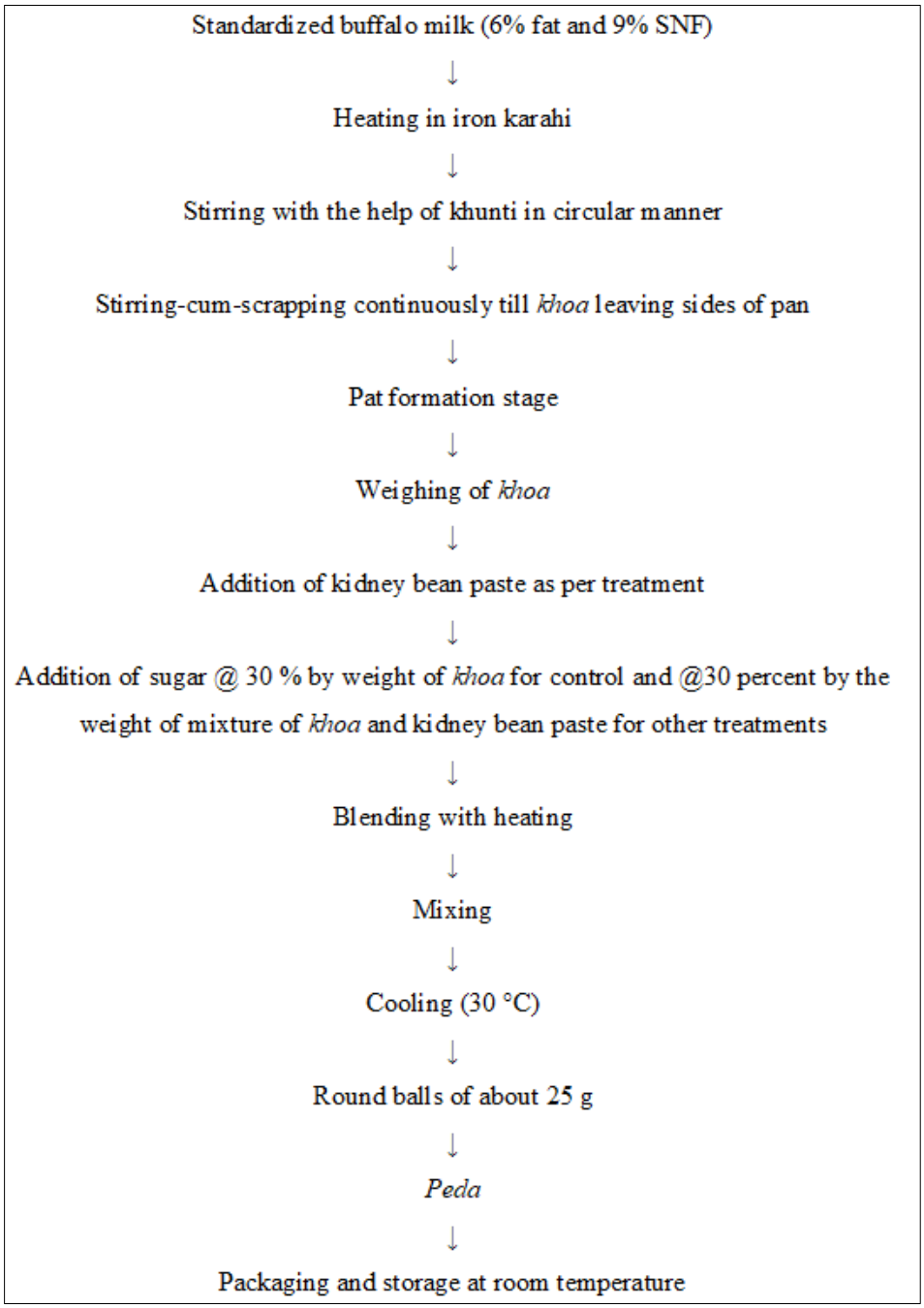

Fig 1: Flow chart for preparation of *peda* blended with kidney bean (*Phaseolus vulgaris*) paste (Ghule *et al.* 2013)

Results and discussion

Colour and appearance score of *peda* blended with kidney bean paste

The colour and appearance scores of *peda* blended with kidney bean paste are presented in Table 1.

Table 1: Colour and appearance score of *peda* blended with kidney bean paste

Replication / Treatment	R_1	R_2	R_3	R_4	Mean
T_1	8.00	8.00	9.00	9.00	8.50
T_2	8.00	9.00	9.00	9.00	8.75
T_3	8.00	9.00	8.00	8.00	8.25
T_4	8.00	8.00	8.00	8.00	8.00
S.E. ± 0.2282 C.D at 5% 0.7032					

The values differ non-significantly (P>0.05)

The colour and appearance score for control T_1 and *peda* blended with kidney bean paste T_2, T_3 and T_4 was 8.50, 8.75, 8.25 and 8.00, respectively. The results indicated that addition of kidney bean paste in *peda* decreased colour and appearance score non-significantly towards higher level of addition of kidney bean paste in *peda*. The colour and appearance score for T_2 (8.75) was highest and differ non significantly from T_1 (8.50), T_3 (8.25) and T_4 (8.00). The non-significant difference in colour and appearance score among the treatment and control was due to pale tan colour of kidney bean paste. However, at higher concentration T_3 and T_4 colour and appearance was less appealing due to dull colour of *peda*. The results obtained in present study are similar with Vyawahare *et al.* (2022) [11] who reported that the colour and appearance scores in *burfi* sample blended with 10, 20, 30, 40 per cent date paste, decreased from 6.77 to 6.16.

Flavour score of *peda* blended with kidney bean paste

The flavour scores of *peda* blended with kidney bean paste are presented in Table 2.

Table 2: Flavour score of *peda* blended with kidney bean paste

Replication / Treatment	R_1	R_2	R_3	R_4	Mean
T_1	8.00	9.00	8.00	9.00	8.50
T_2	9.00	9.00	9.00	8.00	8.75
T_3	8.00	9.00	8.00	8.00	8.25
T_4	7.00	8.00	8.00	8.00	7.75
S.E. ± 0.2602 C.D at 5% 0.8017					

The values differ non-significantly (P>0.05)

The flavour score for control (T_1) and *peda* blended with kidney bean paste T_2, T_3 and T_4 are 8.50, 8.75, 8.25 and 7.75, respectively. The results indicated that addition of kidney bean paste in *peda* increased flavour score non-significantly in treatment T_2 having mild pleasant flavour and decreased non-significantly towards higher level of addition of kidney bean paste in *peda*. The non-significant difference in flavour score among the treatment and control was due to beany flavour of kidney bean paste at higher level of addition of paste. The results of present study are similar with Febrianto *et al.* (2016) and Manonmani *et al.* (2014) [4, 7] who reported that addition of kidney bean powder in cinnamon herbal coffee and kidney bean flour in bread at 4, 8, 12, 16, 20 per cent and 5, 15, 25 per cent, respectively decreased flavour scores at higher level of addition of kidney bean powder and kidney bean flour than control.

Body and Texture score of *peda* blended with kidney bean paste

The body and texture scores of *peda* blended with kidney bean paste are presented in Table 3.

Table 3: Body and Texture score of *peda* blended with kidney bean paste

Replication / Treatment	R_1	R_2	R_3	R_4	Mean
T_1	8.00	9.00	9.00	8.00	8.50
T_2	8.00	9.00	9.00	9.00	8.75
T_3	9.00	8.00	8.00	8.00	8.25
T_4	8.00	7.00	8.00	8.00	7.75
S.E. ± 0.2602 C.D at 5% 0.8017					

The values differ non-significantly (P>0.05)

The body and texture score for control (T_1) and *peda* blended with kidney bean paste T_2, T_3 and T_4 are 8.50, 8.75, 8.25 and 7.75, respectively. The results indicated that addition of kidney bean paste in *peda* increased body and texture score non- significantly in T_2 then decreased with successive addition of kidney bean paste at higher percentage. The body and texture score for T_2 (8.75) was highest and differ non- significantly from T_1, T_3 as well as T_4. Decrease in body and texture score of *peda* at higher concentration of kidney bean paste was due to decrease in moisture. The results obtained in present study are similar with Vyawahare *et al.* (2022) [11] who reported that the body and texture scores in *burfi* sample blended with 10, 20, 30, 40 per cent date paste, decreased from 7.11 to 6.38.

Overall acceptability score of *peda* blended with kidney bean paste: The overall acceptability scores of *peda* blended with kidney bean paste are presented in Table 4.

Table 4: Overall acceptability score of *peda* blended with kidney bean paste

Replication / Treatment	R_1	R_2	R_3	R_4	Mean
T_1	8.00	9.00	9.00	8.00	8.50
T_2	9.00	9.00	9.00	8.00	8.75
T_3	8.00	8.00	8.00	9.00	8.25
T_4	8.00	8.00	8.00	8.00	8.00
S.E. ± 0.2282 C.D at 5% 0.7032					

The values differ non-significantly (P>0.05)

The overall acceptability score for control T_1 and *peda* blended with kidney bean paste T_2, T_3 and T_4 was 8.50, 8.75, 8.25 and 8.00 respectively. The results indicated that addition of kidney bean paste in *peda* increased overall acceptability score in treatment T_2 and further decreased non-significantly. The overall acceptability score was highest in treatment T_2 (8.75) and lowest in T_4 (8.00) as compared to control as well as other treatment. The results of present study are in accordance with Vyawahare *et al.* (2022) [11] who reported that the overall acceptability scores in *burfi* sample blended with 10, 20, 30, 40 per cent date paste, increased in treatment T_3 and decreased in treatment T_1, T_2 and T_4 as compared to control.

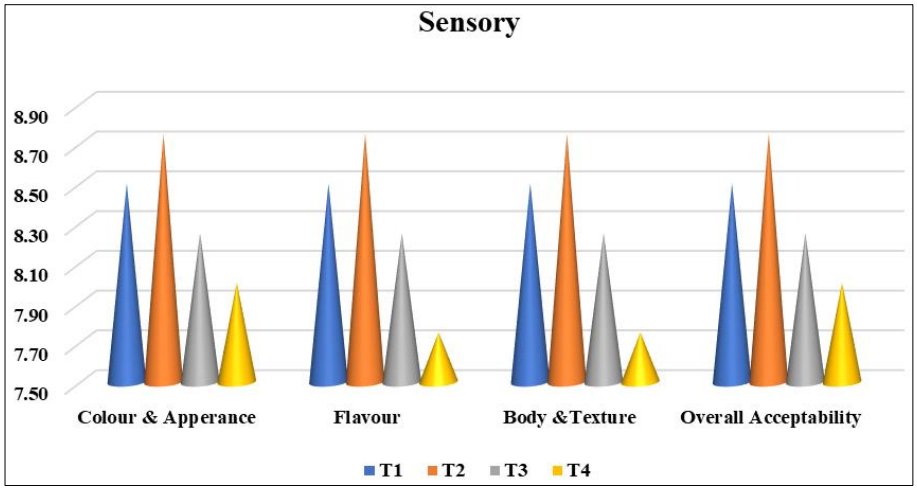

Fig 2: Sensory quality of *peda* blended with kidney bean paste

Microbial quality of fresh *peda* blended with kidney bean paste

The fresh product prepared was subjected to microbial analysis with respect to standard plate count, yeast and mould count and coliform count.

Standard Plate Count of fresh *peda* blended with kidney bean paste

The standard plate count of *peda* blended with kidney bean paste are presented in Table 5

Table 5: Standard plate count of fresh *peda* blended with kidney bean paste

Treatment	Replication				Mean
	Microbial count cfu×10^3/gm				
	R_1	R_2	R_3	R_4	
T1	11	9	10	11	10^a
T2	9	8	8	9	9^b
T3	7	8	6	6	7^c
T4	6	6	4	5	5^d
S.E. ± 0.4389 C.D. at 5% 1.3526					

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

The mean value of standard plate count of fresh sample for control T_1 and *peda* blended with kidney bean paste T_2, T_3 and T_4 was 10, 9, 7, 5 ×10^3 cfu/gm, respectively. The standard plate count of control sample (10 × 10^3 cfu/gm) was significantly higher than all other treatments. Among treatments standard plate count decreased significantly towards higher level of addition of kidney bean paste.

As the kidney bean paste increased in *peda* the count in *peda* was decreased. This might be due to decreased level of moisture in kidney bean paste.

Yeast and Mould Count of fresh *peda* blended with kidney bean paste

The yeast and mould count was not observed in control *peda* as well as *peda* with different level of kidney bean paste as the product was fresh.

Coliform Count of fresh *peda* blended with kidney bean paste: In the present study the product prepared by addition of different level of kidney bean paste with buffalo milk *khoa* was found to be free from coliform, indicates the hygienic quality of *peda*.

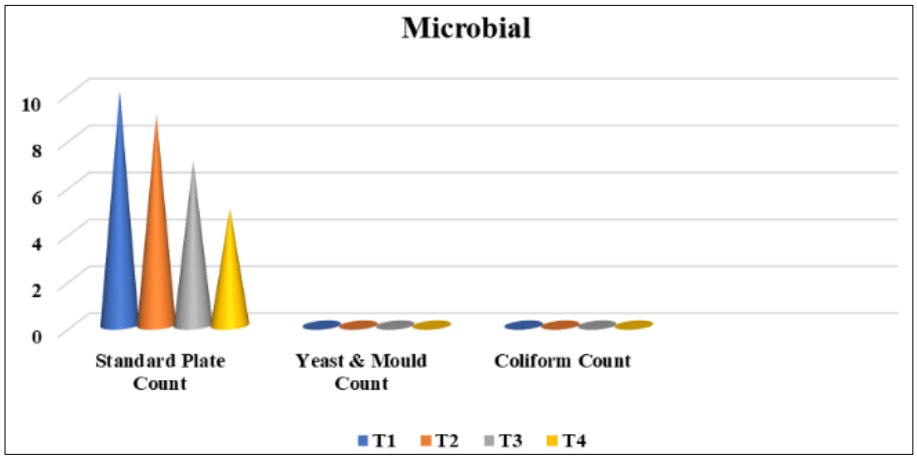

Fig 3: Microbial quality of *peda* blended with kidney bean paste

Conclusions

From present investigation it was observed that sensory parameters such as colour and appearance and overall acceptability had positive effect on *peda*. However, addition of 7.5 per cent kidney bean paste decreased flavour and body and texture scores as compared to control. Standard plate count in fresh product decreased significantly towards addition of kidney bean paste as compared to control. Yeast and mould count and coliform count was found to be absent.

From the results of sensory scores it could be concluded that 2.5 per cent kidney bean paste could be successfully added in *peda* without affecting flavour and overall acceptability of finished product.

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