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Studies on sensorial and physico-chemical properties of optimized almond supplemented paneer kheer

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Abstract

Almond supplemented paneer kheer was prepared using different levels of almond, milk paneer ratio and sugar levels to optimized (control and optimized almond supplemented paneer kheer) process for its manufacture and to study its sensory and chemical Characteristics. Initially, there are 45 treatment combinations used for preliminary trials were conducted by the blending of the different ingredients of almond as paste form i.e. 0, 2, 4, 6, & 8%, milk paneer ratio viz; 850:150g, 900:100g and 950:050g and 2, 3, & 4% sugar used to finalize for the further analysis. After the analysis of these treatment combinations, that control and optimized almond supplemented paneer kheer combinations were found significantly ($p < 0.05$) higher i.e. A0B2C2 (almond 0% milk paneer ratio 900:100 and sugar 3%) and A3B2C2 (almond 6% milk paneer ratio 900:100 and sugar 3%) respectively for further analysis. The mean sensory score for flavor, sweetness, colour & appearance, consistency and overall acceptability showed significant ($p < 0.05$) differences. The mean score for flavor, sweetness, colour & appearance, consistency and overall acceptability of control and optimized almond supplemented paneer kheer viz; 8.10, 8.40, 8.05, 8.15 and 8.22 and 8.60, 8.65, 8.65, 8.60 and 8.63 score were found respectively. In this present investigations, the control and optimized almond supplemented paneer kheer. The optimized kheer were found statistically ($p < 0.05$) significantly for moisture, fat, protein, lactose, sucrose, ash, total solid, titratable acidity and pH. The value were found in percentages that is 46.46, 18.55, 13.96, 7.20, 3.95, 1.94, 53.53, 0.46 and 5.69 and 33.55, 31.16, 1680, 10.07 5.53, 2.25, 66.45, 0.31, 6.22 respectively.

Keywords: Cucumber, boron, yield, quality, konkan

Introduction

India is the largest milk producer in the world with a production of 176.3 million tonnes of milk per annum and per capita availability of milk in India is 375g/day in 2017-18 (NDDB 2017-18) as against the recommended level of 280 g/per capita per day by (ICMR). The dairy sector in India grew at a rate of 6.4% annually in the last four years against the global growth rate 1.7 percent (PIB, 2019). The 50-55% of whole milk that is converted into various traditional milk products such as khoa, curd, malia, desi butter, paneer, ghee, sweet dessert, etc. (Patil *et al.* 2015) [16]. Kheer, a cereal based particulate dairy dessert is a unique product representing dairy and food processing going hand in hand. It has been the premier milk delicacy associated with festivities and celebration from the time immemorial and it has the status of a royal treat. No feast is considered complete without kheer. The different variety of sweet desserts prepared for distinguish occasions, mainly in unorganized sector across the country (Gupta *et al.* 2014; Bankar *et al.* 2012) [16, 11]. The recipe of kheer can be varied by replacing rice with wheat, makhana, vermicelli, semolina, carrot and even paneer (Gupta *et al.* 2014; Jha *et al.* 2013) [16, 4]. Paneer kheer is the base material for incorporating many types of dry fruits and different medicinal materials. Conventional Indian products include several innovative blends used in the preparation of different variety of milk based delicacies. Among them Kheer (heat desiccated and sweetened milk) is one which is popular in the northwest, central and eastern part of India, and is popular as payasam in the southern part. Kheer is also a cereal based particulate dairy dessert. It is a unique product representing dairy and food processing going hand in hand (Thompson *et al.* 1995; Shivakumar *et al.*, 2014) [22, 18]. Chhana is an acid coagulated dairy product. The concentrated & preserved milk solids in form

of Chhana provide healthy nutrition and peculiar flavor and texture to consumers. Pattern of milk consumption in India indicates that about 6 percent of milk is coagulated for production of Chhana (Chattopadhyay *et al.*, 2014) [2]. Chhana kheer which is a dessert containing Chhana and sugar is very famous in the Indian subcontinent (Gautam *et al.* 2013) [4]. In the traditional kheer which was made from rice, the dry fruits has added only for garnishing and made attractive but on the health point of view, that amount did not fulfilled body energy requirement. But gradually or day-by-day modern kheer development process adopted. Nowadays almond paneer replaced rice and semolina, which has provides sufficient nutrients for sound health. In view of the above that attempt was made to almond supplemented paneer kheer so that it would serve as a nutritious food for consumer and simultaneously offer the same delicacy as traditional products.

Materials & Methods

The experiment was conducted in the Laboratory of the Department Dairy Science and Food Technology, Institute of Agricultural Sciences, Banaras Hindu University, Varanasi. Raw milk was collected from the Dairy Farm (GOSHALA), BHU, Varanasi, UP, 221 005. Standard quality Almond and sugar were procured from local market of Varanasi. Paneer

was made in the department laboratory through standard of Procedure (SOP). All together there were 45 treatments each of which were replicated 3 times. The experimental techniques were employed as under:

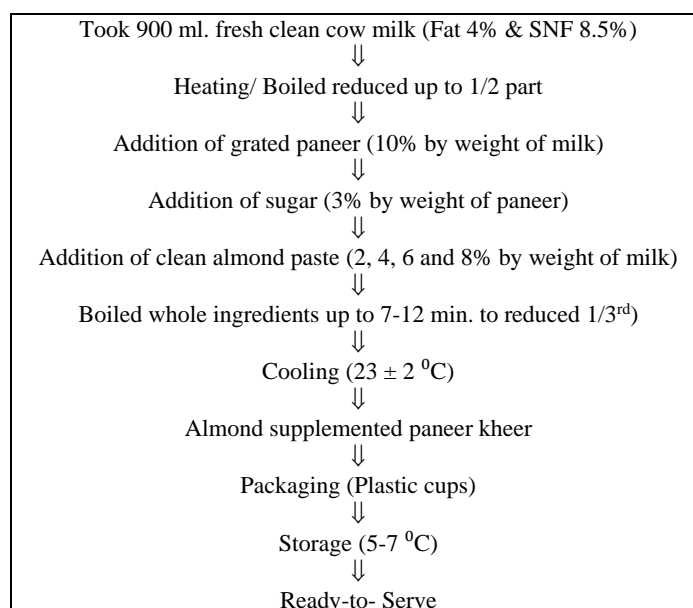
After optimized, the best treatment of control paneer kheer is A0B2C2 at the same time, optimized almond supplemented paneer kheer is A3B2C2 was found highly acceptable for further analysis.

Preparation of Almond paste

In the paneer kheer, almond required as paste form. First all almond weight required amount on weighing balance then take a clean bowl for soaked almond and left for overnight. After that peeling-off the almond shell to get clean white form kernels. Before made of paneer kheer, almonds grinding and mixing in proper way and get good paste.

2.3 Preparation of paneer

Chhana is prepare from cow or mixed milk is heated in Stainless steel on a LPG gas Chullah, to 80 °C to 85 °C and then cooled to about 72 °C and simultaneously coagulated with 1-2% citric acid solution by gentle and continuous stirring with ladle until all the milk gets precipitated in lumps and settle down at the bottom with clear whey floating on the top which was filtered through a sterile muslin cloth.



Flow Diagram of almond supplemented paneer kheer
Almond supplemented paneer kheer

Sensory Evaluation

Sensory evaluation of Almond supplemented Paneer kheer was done on the basis of organoleptic tests by a meritorious panel of five judges of Department of Dairy Science and Food Technology, Institute of Agricultural Sciences, Banaras Hindu University, Varanasi. Samples were given code nos. to avoid bias opinion and individuality. The judges evaluated the samples taking in the consideration of Sweetness, Flavor, Sweetness, Color and Appearance, Consistency and overall acceptability of almond supplemented Paneer kheer.

Physico-Chemical Parameter

Analysis of physico-chemical characteristics of control and optimized almond supplemented paneer kheer were done by

on the basis of these method, Moisture (AOAC, 1995), Fat (AOAC, 1995), Protein (AOAC, 2005), Lactose (Nielsen, 1994), Sucrose (Lane and Eyon Volumetric method), Ash (AOAC, 2005), Total solid (AOAC, 2005), Titratable Acidity (AOAC, 2000) and pH (AOAC, 2005).

Statistical approach

Product optimization was done by FCRD using ANOVA. All the data were expressed as mean and standard error. It was calculated of data on the basis of three independent experiments T-test was performed to measure the test of significance. (IBM, SPSS, version 22).

Table 1: Experimental runs and actual values for factors used for control and optimized almond supplemented paneer kheer

Variables				Sensory Attributes on 9 point hedonic scale						Texture Profile Analysis (TPA)			Physico-Chem.	
SN	Attributes	Almond (%)	M:P (g)	Sugar (%)	Flavors	sweetness	Col.& App.	Consistency	OAA	Chewiness	Gumminess	Springiness	TA%	pH
1	A0M1S1	0	850:150	2	8.25	8.35	8.5	8.1	8.26	71.964	71.318	0.904	0.44	5.93
2	A0M1S2	0	850:150	2	8	8.3	8.25	8.25	8.2	70.044	70.995	0.915	0.41	5.95
3	A0M1S3	0	850:150	2	8.35	8.32	8.2	8.3	8.30	65.888	71.307	0.895	0.36	5.91
4	A0M2S1	0	900:100	3	8.25	8.25	8.1	8.4	8.25	66.489	71.205	0.818	0.46	5.95
5	A0M2S2	0	900:100	3	8.75	8.65	8.7	8.7	8.70	70.508	71.671	0.985	0.29	5.69
6	A0M2S3	0	900:100	3	8.6	8.4	8.34	8.5	8.46	69.402	70.028	0.898	0.32	6.24
7	A0M3S1	0	950:050	4	8.5	8.5	8.4	8.5	8.48	67.701	71.410	0.901	0.36	6.16
8	A0M3S2	0	950:050	4	8	8.25	7.75	8	8.00	69.914	71.315	0.925	0.34	5.93
9	A0M3S3	0	950:050	4	7.5	8	7.5	7.8	7.69	69.511	71.015	0.932	0.32	5.95
10	A1M1S1	2	850:150	2	8.15	8.00	8.00	8.00	8.04	91.079	110.101	0.302	0.36	5.93
11	A1M1S2	2	850:150	2	8.30	8.10	8.25	8.20	8.21	93.255	110.008	0.314	0.39	5.92
12	A1M1S3	2	850:150	2	8.40	8.27	8.40	8.40	8.36	101.677	110.028	0.306	0.34	5.91
13	A1M2S1	2	900:100	3	8.50	8.40	8.50	8.50	8.44	106.177	109.225	0.315	0.38	5.95
14	A1M2S2	2	900:100	3	8.30	8.30	8.50	8.40	8.35	108.386	110.855	0.326	0.34	5.94
15	A1M2S3	2	900:100	3	8.20	8.15	8.43	8.25	8.24	106.525	110.104	0.312	0.32	5.97
16	A1M3S1	2	950:050	4	8.03	8.00	8.20	8.1	8.09	107.158	109.209	0.301	0.35	5.93
17	A1M3S2	2	950:050	4	7.90	7.85	8.00	8.00	8.00	108.118	109.858	0.315	0.33	5.94
18	A1M3S3	2	950:050	4	7.75	7.75	7.75	7.80	7.76	108.025	109.878	0.318	0.36	5.90
19	A2M1S1	4	850:150	2	7.90	8.00	8.00	7.90	7.95	105.525	214.159	0.621	0.35	5.93
20	A2M1S2	4	850:150	2	8.00	8.10	8.15	8.20	8.11	209.505	220.724	0.631	0.39	5.93
21	A2M1S3	4	850:150	2	8.30	8.25	8.25	8.35	8.29	213.605	219.569	0.632	0.37	5.92
22	A2M2S1	4	900:100	3	8.40	8.50	8.40	8.55	8.46	212.212	219.101	0.630	0.33	5.93
23	A2M2S2	4	900:100	3	8.50	8.45	8.60	8.65	8.53	214.772	221.711	0.652	0.32	5.97
24	A2M2S3	4	900:100	3	8.55	8.55	8.65	8.50	8.45	212.886	219.811	0.614	0.33	5.93
25	A2M3S1	4	950:050	4	8.60	8.40	8.40	8.40	8.45	213.565	218.987	0.645	0.35	5.91
26	A2M3S2	4	950:050	4	8.65	8.25	8.20	8.30	8.35	214.015	220.006	0.590	0.34	5.92
27	A2M3S3	4	950:050	4	8.60	8.20	8.00	8.10	8.23	216.015	218.018	0.602	0.31	5.93
28	A3M1S1	6	850:150	2	8.35	8.35	8.30	8.35	8.35	267.446	324.656	0.906	0.36	5.93
29	A3M1S2	6	850:150	2	8.40	8.45	8.40	8.45	8.43	317.444	327.675	0.904	0.30	6.00
30	A3M1S3	6	850:150	2	8.50	8.50	8.50	8.60	8.49	317.528	321.787	0.955	0.31	6.00
31	A3M2S1	6	900:100	3	8.55	8.60	8.60	8.68	8.56	318.585	324.444	0.926	0.34	6.14
32	A3M2S2	6	900:100	3	8.80	8.75	8.80	8.75	8.73	326.158	332.566	0.978	0.28	6.22
33	A3M2S3	6	900:100	3	8.60	8.60	8.63	8.60	8.59	326.948	322.456	0.936	0.31	5.98
34	A3M3S1	6	950:050	4	8.55	8.50	8.50	8.50	8.51	317.985	324.846	0.925	0.31	5.93
35	A3M3S2	6	950:050	4	8.45	8.40	8.40	8.40	8.41	316.583	317.846	0.913	0.37	5.95
36	A3M3S3	6	950:050	4	8.35	8.25	8.25	8.30	8.28	317.659	324.448	0.922	0.30	5.98
37	A4M1S1	8	850:150	2	8.25	8.23	7.93	8.20	8.14	308.456	312.466	0.910	0.34	5.94
38	A4M1S2	8	850:150	2	8.20	8.25	8.03	8.10	8.14	322.448	316.559	0.943	0.31	5.93
39	A4M1S3	8	850:150	2	8.15	8.22	8.20	8.05	8.16	319.945	439.444	0.865	0.35	5.98
40	A4M2S1	8	900:100	3	8.05	8.10	8.15	8.00	8.08	321.258	319.444	0.864	0.31	5.95
41	A4M2S2	8	900:100	3	8.00	8.10	8.10	8.00	8.05	312.544	320.422	0.898	0.37	5.94
42	A4M2S3	8	900:100	3	7.90	8.05	8.00	7.90	7.96	319.444	318.489	0.810	0.32	5.94
43	A4M3S1	8	950:050	4	7.70	8.00	8.00	7.80	7.86	314.589	320.259	0.887	0.3	5.92
44	A4M3S2	8	950:050	4	7.60	7.75	7.80	7.60	7.69	320.456	314.495	0.810	0.35	5.94
45	A4M3S3	8	950:050	4	7.50	7.50	7.75	7.50	7.61	319.005	313.058	0.843	0.29	6.10
S.E.(m)	A	-	-	-	0.017	0.030	0.018	0.014	0.013	1.576	0.192	0.004	0.008	0.008
	M	-	-	-	0.013	0.023	0.014	0.011	0.010	1.221	0.149	0.003	0.006	0.006
	AxM	-	-	-	0.029	0.052	0.031	0.024	0.023	2.731	0.332	0.008	0.013	0.013
	S	-	-	-	0.013	0.023	0.014	0.011	0.010	1.221	0.149	0.003	0.006	0.006
	AxS	-	-	-	0.029	0.052	0.031	0.024	0.023	2.731	0.332	0.008	0.013	0.013
	MxS	-	-	-	0.022	0.040	0.024	0.018	0.018	2.115	0.257	0.006	0.010	0.010
AxMxS	-	-	-	0.050	0.090	0.053	0.041	0.040	4.729	0.576	0.013	0.023	0.023	
C.D.	A	-	-	-	0.047	0.086	0.051	0.038	0.038	4.430	0.539	0.012	0.021	0.021
	M	-	-	-	0.037	0.066	0.039	0.030	0.029	3.431	0.418	N/A	0.016	0.017
	AxM	-	-	-	0.082	0.149	0.088	0.066	0.066	7.673	0.934	0.021	0.037	0.037
	S	-	-	-	0.037	0.066	0.039	0.030	0.029	3.431	0.418	0.010	N/A	0.017
	AxS	-	-	-	0.082	N/A	0.088	0.066	0.066	N/A	0.934	0.021	N/A	0.037
	MxS	-	-	-	0.064	0.011	0.068	0.051	0.051	5.943	0.724	0.016	N/A	0.029
AxMxS	-	-	-	0.142	N/A	0.075	0.115	0.114	13.290	1.618	0.037	N/A	0.064	

Note: all the values are average of three determinations

M. P. - Milk Paneer Ratio

OAA- Overall Acceptability

Table 2: Estimated value of physico-chemical properties of optimized almond supplemented paneer kheer

Chemicals parameters	Control		Optimized ASPK*		
	Mean	SE	Mean	SE	P value
Moisture	47.46	0.24	33.55	0.23	0.001
Fat	18.55	0.40	31.16	0.12	0.001
Protein	13.96	0.11	16.80	0.55	0.001
Lactose	7.20	0.46	10.07	0.69	0.023
Ash	1.94	0.11	2.25	0.17	0.001
Sucrose	3.95	0.40	5.53	0.34	0.002
Total solid	52.53	0.24	66.45	0.23	0.004
Titratable acidity	0.46	0.17	0.31	0.17	0.001
pH	5.69	0.17	6.22	0.17	0.004

Note: All the values are average of three determinations

* ASPK: Almond Supplemented Paneer kheer

Table 3: Sensory properties of control and optimized almond supplemented paneer kheer

Variables	Control		Optimized ASPK*		
	Mean	SE (m)	Mean	SE (m)	p value
Flavor	8.10	0.057	8.60	0.057	0.004
Sweetness	8.40	0.056	8.65	0.057	0.038
Colour & app.	8.05	0.057	8.65	0.057	0.001
Consistency	8.15	0.056	8.60	0.057	0.005
Overall acceptability	8.22	0.057	8.63	0.057	0.007

Note: All the values are average of three determinations

* ASPK: Almond Supplemented Paneer kheer

Results and Discussions

Physico-chemical characteristics

Moisture

The moisture content of almond supplemented paneer kheer was found 47.46 per cent whereas the control paneer kheer found 33.55 per cent. The optimized almond supplemented paneer kheer was found statistically significant ($p < 0.05$) as compare to control paneer kheer. The moisture content of almond supplemented *paneer* kheer was found low due to incorporated 6 per cent almond of the whole ingredients. Similar data was found by (Solanki *et al.* 2018) [21], during study the analysis of finger millet kheer.

Fat

The fat per cent of control paneer kheer and optimized almond supplemented paneer kheer was found 18.55 per cent and 31.16 per cent respectively. Almond have near about 50 per cent and good source of fat and are considered peculiar taste as well as highly nutritious. (Singh *et al.* 2018) [19], was observed highest fat percentage was recorded in the Chhana kheer sample of 25.12 per cent.

Protein

It was observed that the percentage of protein content of control and optimized almond supplemented paneer kheer were found to be 13.96 and 16.80 per cent respectively. It is confirmed that the protein content of the optimized almond supplemented paneer kheer was significantly ($p < 0.05$) differ from the control paneer kheer. Similar data was found by (Singh *et al.* 2018) [20], in control paneer kheer during their research study.

Lactose

In the present investigation, the lactose content of control paneer kheer and optimized almond supplemented paneer kheer was scored as 7.20 and 10.07 respectively. It is confirmed that the optimized almond supplemented paneer kheer was found significantly ($p < 0.05$) differ from the control paneer kheer. The percentage increased of optimized almond supplemented paneer kheer were solidity more than the

control paneer kheer and some amount of sugar was found in the almond paste. Gaikwad *et al.* 2016) [3], was studied that lactose content was found 4.45 per cent in fiber fortified *basundi* using date fruit.

Sucrose

The sugar content of control paneer kheer and optimized almond supplemented paneer kheer was found is 3.95 and 5.53 per cent respectively. Optimized almond supplemented paneer kheer contains significantly ($p < 0.05$) higher percentage of sucrose as compare to control paneer kheer. (Kumar *et al.* 2017) [10], 14.7 per cent was found in benzoate and potassium sorbate on the shelf life of kheer. And (Solanki *et al.* 2018) [21], the highest carbohydrate content of finger millet kheer was found 24.88 per cent.

Ash

The percentage ash content of control paneer kheer was 1.94 per cent and 2.25 was found in optimized almond supplemented paneer kheer. the optimized almond supplemented paneer kheer was found significantly ($p < 0.05$) different from the control paneer kheer. the percentage increases of ash content in optimized almond supplemented almond supplemented paneer kheer due to increase the amount of solid content and incorporated of almond paste as compare to control paneer kheer. (Shankla *et al.* 1990), also reported that the as content in kheer was 1.40 per cent, and (Jha *et al.* 2000), who observed that the ash content in kheer mix was 2.64 per cent.

Total solid

It was observed that the total solid content in control paneer kheer was 52.53 per cent whereas optimized almond supplemented paneer kheer 66.45 per cent was found. The per cent total solid of optimized almond supplemented paneer kheer was found significantly ($p < 0.05$) different from the control paneer kheer. it might be due to the incorporated 6 per cent almond paste of the whole ingredients and also dehydrated up to one third part of the paneer kheer product during manufacturing. (Gite *et al.* 2017) [5], reported that the

total solid content 46.11 per cent in standardized custard apple *basundi*.

Titratable acidity

It was observed that the value of control paneer kheer and optimized almond supplemented paneer kheer were found 0.46 and 0.31 respectively. Titratable acidity of optimized almond supplemented paneer kheer was significantly ($p < 0.05$) different as compared to the control paneer kheer. Lower value of the acidity in optimized almond supplemented paneer kheer could be due to the incorporated almond paste in optimized kheer because of the lower availability of acidity in the almond and neutralize the acidity percent as compared to control paneer kheer. The acidity percentage was found in high amount in control paneer kheer due to only milk paneer ratio and sugar added only. (Perry 1974) [15], stated that the decrease in pH and increase in acidity.

pH

In the present investigation, the pH value of control paneer kheer was found to be lower (5.69) as compared to the optimized almond supplemented paneer kheer. (6.22). the difference in pH value of the optimized almond supplemented paneer was due to almond added in this product as compare to control paneer kheer. In the control paneer kheer. The similar data were observed by (Parmar *et al.* 2018) [14], pH of *basundi* decrease from 6.62-6.42-6.43 and from 6.57-6.41-6.43 for control sample and OH *basundi*. And similar observation was found by (Mittal and Bajwa 2014) [11].

Sensory parameters

Sensory attributes of control and optimized almond supplemented paneer kheer were evaluated using 9 point hedonic scale on the basis of flavor, sweetness color and appearance, consistency and overall acceptability.

Flavour

The score (8.60) for flavor of optimized almond supplemented paneer kheer was found statistically significant whereas the value of control paneer kheer is (8.10). The highest flavor in almond supplemented paneer kheer was due to incorporated of almond. (Pariskar *et al.* 2015a) [13], reported that the mean score for flavor of kheer ranged between 8.62 to 6.50.

Sweetness

Sweetness is basic taste most commonly perceived when eating food rich in sugar. Showed the score awarded for sweetness of control and almond supplemented as 8.40 & 8.65 respectively. The significance ($p < 0.05$) level of sweetness score of almond supplemented paneer kheer higher due to the whole ingredients were dehydrated and converted into 1/3rd part, hence sweetness has been increases.

Colour & appearance

The colour and appearance of any products are thus the primarily indicators of perceived quality. The score awarded for colour and appearance of control and optimized almond supplemented paneer kheer as 8.05 and 8.65 respectively. The colour and appearance of optimized almond supplemented paneer kheer was found significantly ($p < 0.05$) higher as compare to control paneer kheer. (Shivendra *et al.* 2018), investigated that the significant different between control and experimental Chhana kheer.

Consistency

Consistency works like viscosity. Consistency plays a major role in heterogeneous liquid and semisolids. The score awarded for consistency of control and optimized almond supplemented paneer kheer is 8.15 to 8.60. The consistency of optimized almond supplemented paneer kheer found significant ($p < 0.05$) as compare to the control paneer kheer. It could be reason of in optimized kheer incorporated almond 6 percent of the whole ingredients as compare to control paneer kheer. In almond, there are many constituents found like fat, protein, carbohydrates and fibers, these constituents were impact on the consistency. (Pariskar *et al.* 2015), find the nearly value.

Overall acceptability

Acceptability is the distinctiveness of a food being subject to acceptance for some point. The score of overall acceptability was 8.63 of almond supplemented paneer kheer were found maximum in comparison to the control sample of paneer kheer, that obtained a score (8.22) for overall acceptability. The optimized almond supplemented paneer kheer was found significant ($p < 0.05$) from the control paneer. All the sensory parameters optimized almond supplemented paneer kheer like, (flavor, sweetness, color & appearance, consistency and overall acceptability) were scored more than acceptable and extremely like. (Gite, 2017) [5], was notified that the results which was showing same trend for kheer as found in their study for overall acceptability.

Conclusions

The best quality of almond supplemented paneer kheer was prepared by incorporated 6 per cent almond 900:100g milk paneer ratio and 3 per cent sugar. This kheer were highly nutritious along with flavor, color & appearance and consistency found to be good due to almond incorporated. Therefore from the present investigations, it can conclude that the rising demand for fresh dairy products especially paneer based supplemented products is widening the base of the modern dairy sector. There is a need to standardized such products so that will help in generating high profits and also generated much more employments.

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