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Sensory evaluation of manufacturing functional kalakand by using inulin and wheatgrass powder

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Abstract
Kalakand is a traditional milk product prepared by heating milk and then adding sugar and the appropriate coagulant. Despite the fact that the two forms of milk had the same nutritional value, it observed that Kalakand made from cow milk and acidic milk had lower acceptance than Kalakand made from buffalo milk. Traditional Kalakand is produced with Danedar Khoa, and buffalo milk is preferred over cow milk due to its higher fat content. It's also crucial to use the right amount of citric acid and sugar in the mix, as these ingredients have a big impact on the texture and flavour of the finished product. The goal of this study was to optimize/ standardise the levels of inulin and wheatgrass powder in kalakand. In this investigation, 1.0 percent inulin powder was combined with 4%, 6%, and 8% wheat grass powder in the O_a, O_b, and O_c treatments, respectively, with the addition of powdered sugar in the Kalakand preparation. O_d, O_e, and O_f treatments used 2.0 percent inulin powder with 4 percent, 6 percent, and 8 percent wheat grass powder, respectively; O_g, O_h, and O_i treatments used 3.0 percent inulin powder with 4 percent, 6 percent, and 8 percent wheat grass powder, respectively; and O_j, O_k, and O_l treatments used 4.0 percent inulin powder with 4 percent, 6 percent, and 8 percent wheat grass powder, respectively.

Keywords: Organoleptic properties, wheatgrass powder, inulin, milk products, overall acceptability

1. Introduction
Kalakand is one of the indigenous milk products that is made by heating the milk and then adding sugar and the correct coagulant. We found that Kalakand prepared from cow milk and acidic milk had lower acceptance than Kalakand made from buffalo milk, despite the fact that the two types of milk had the same nutritional content. Kalakand is traditionally made with Danedar Khoa, and buffalo milk is preferable than milk of cows because of its greater fat content. It is also critical to add the correct quantity of citric acid and sugar to the mix, since these components considerably influence the product's texture and flavor (David, 2015) [1]. Consumption of dietary fibre has grown in recent years as awareness of the benefits it provides to health has spread. Chicory root, garlic, wheat, bananas, and artichokes all contain inulin, a naturally soluble dietary fibre that humans have long consumed (Tewari, 2019). [8] Several studies have shown that inulin has a therapeutic effect in the treatment of obesity. Wheatgrass powder is an excellent source of vitamins, minerals, cancer prevention agents (Landon, 2014) [5], compounds, and phytonutrients (Kumar & Singh, 2017) [4]. Wheatgrass powder is also a powerful liver and blood cleanser (Mishra *et al.,* 2020) [6]. It rids the body of poisons and environmental toxins. This is because wheatgrass powder includes beneficial components that protect us from cancer-causing toxins, such as Superoxide Dismutase (SOD), which reduces the effects of radiation and other poisons in the body. Metals and poisonous substances may be removed from the body from head to toe by this method. Following sensory examination, the treatment combination O_h was deemed to be more overall agreeable than the other treatment combination. The greatest range of O_h in overall acceptability is 8.47, which is higher than the other treatment combinations' mean. As a result, it's been determined that the 'Buffalo milk (100 ml) + 10% sugar + 3% inulin + 6% wheat grass powder' treatment combination formula is standardised for kalakand preparation. The objective of the present study is to optimize/ standardize the levels of inulin and wheatgrass powder in kalakand.

2. Methods and Materials
The current research was conducted in the research lab of the Department of Dairy Technology, Warner College of Dairy Technology, Sam Higginbottom University of Agriculture, Technology and Sciences, Prayagraj-211007, Uttar Pradesh (India). All of the raw ingredients were obtained from local market, Prayagraj.

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Potable water was used to make the product. It was ensured that the materials utilised were free of any diseases. Information about the course of treatment, 1.0% percent of inulin powder with 4%, 6% and 8% wheat grass powder were used in O_a, O_b and O_c treatments, respectively, with the addition of powdered sugar in the making of Kalakand. 2.0% percent of inulin powder with 4%, 6% and 8% wheat grass powder were used in O_d, O_e and O_f treatments, respectively, 3.0% percent of inulin powder with 4%, 6% and 8% wheat grass powder were used in O_g, O_h and O_i treatments, respectively, 4.0% percent of inulin powder with 4%, 6% and 8% wheat grass powder were used in O_j, O_k and O_l treatments, respectively. Inulin powder was omitted from the Kalakand produced as a control (O_0). Kalakand is made in this manner. Buffalo milk was purchased for the production of the control Kalakand and the experimental Kalakand. Before making Kalakand, the fat content of this milk was regulated at 6%. In accordance with De's instructions, Kalakand was prepared (1982). To ensure the accuracy of the results, only analytical-grade substances were utilized in this investigation. Organoleptic quality (Colour and appearance, Body and texture, Flavour, Overall acceptability) – "Kalakand is fortified with wheat grass and Inulin was standardized and evaluated for organoleptic properties by using 9-point hedonic scale. The samples were analysed for physiochemical qualities as per ICAR manual in Dairy Chemistry (1972) [2] and Indian standard (1980) [3].

2.1 Treatment combination
O_0– Buffalo milk (100 ml) +10% sugar (Normal Kalakand)
O_a – Buffalo milk (100 ml) + 10% sugar + 1% inulin + 4% wheat grass powder
O_b – Buffalo milk (100 ml) + 10% sugar + 1% Inulin + 6% wheat grass powder
O_c – Buffalo milk (100 ml) + 10% sugar + 1% Inulin + 8% wheat grass powder
O_d – Buffalo milk (100 ml) + 10% sugar + 2% Inulin + 4% Wheat grass powder
O_e – Buffalo milk (100 ml) + 10% sugar + 2% Inulin + 6% Wheat grass powder
O_f– Buffalo milk (100 ml) + 10% sugar +2% Inulin + 8% wheat grass powder
O_g – Buffalo milk (100 ml) + 10% sugar + 3% Inulin + 4% wheat grass powder
O_h – Buffalo milk (100 ml) + 10% sugar + 3% Inulin + 6% wheat grass powder
O_i – Buffalo milk (100 ml) + 10% sugar + 3% Inulin + 8% wheat grass powder
O_j – Buffalo milk (100 ml) + 10% sugar + 4% Inulin +4% wheat grass powder
O_k – Buffalo milk (100 ml) + 10% sugar + 4% Inulin + 6% wheat grass powder
O_l – Buffalo milk (100 ml) + 10% sugar + 4% Inulin + 8% wheat grass powder
No. of treatments= 12+1
No. of replication= 5
Total no. of trials= 65

3. Results and Discussion

Table 1: Table exhibit the mean value of organoleptic quality of final prepared kalakand

Treatment combinations	Colour and appearance	Flavour	Body and Texture	Overall acceptability
O_0	5.78	6.12	7.14	6.34
O_a	7.50	7.45	7.84	7.59
O_b	7.54	7.51	7.90	7.65
O_c	7.47	7.43	7.81	7.57
O_d	7.49	7.47	7.89	7.61
O_e	7.55	7.55	7.90	7.66
O_f	7.43	7.42	7.85	7.56
O_g	8.14	8.17	8.91	8.40
O_h	8.26	8.24	8.93	8.47
O_i	8.12	8.14	8.90	8.38
O_j	8.10	8.09	8.90	8.36
O_k	8.12	8.13	8.91	8.38
O_l	8.11	8.10	8.89	8.36

Table 2: Table exhibit Colour and Appearance level of final prepared Kalakand

Treatments	R1	R2	R3	R4	R5	Mean
O_0	5.75	5.76	5.81	5.80	5.77	5.78
O_a	7.00	7.95	7.53	7.52	7.49	7.50
O_b	7.51	7.52	7.57	7.56	7.53	7.54
O_c	7.44	7.45	7.50	7.49	7.46	7.47
O_d	7.46	7.47	7.52	7.51	7.48	7.49
O_e	7.52	7.53	7.58	7.57	7.54	7.55
O_f	7.40	7.41	7.46	7.45	7.42	7.43
O_g	8.11	8.12	8.17	8.16	8.13	8.14
O_h	8.23	8.24	8.29	8.28	8.25	8.26
O_i	8.09	8.10	8.15	8.14	8.11	8.12
O_j	8.07	8.08	8.13	8.12	8.09	8.10
O_k	8.09	8.10	8.15	8.14	8.11	8.12
O_l	8.17	8.00	8.14	8.13	8.10	8.11
Mean	7.60	7.67	7.69	7.68	7.65	7.66
Minimum	5.75	5.76	5.81	5.80	5.77	5.78
Maximum	8.23	8.24	8.29	8.28	8.25	8.26
F- test				S		
S. Ed. ($\pm$)				0.060		
C. D. (P = 0.05)				0.120		

The above ANOVA table is exhibit that the mean value of control (O_0) is 5.78. The above table also exhibit that treatment combination (O_h) & (O_0) contains highest and lowest Colour and Appearance level than the other treatments respectively.

Table 3: Table exhibit ANOVA Colour and Appearance level in final prepared Kalakand

ANOVA						
Source	d. f.	S.S.	M.S.S.	F. Cal.	F. Tab. 5%	Result
Replication	4	0.0647	0.0162	1.780	2.57	NS
Treatment	12	25.5702	2.1308	234.705	1.96	S
Error	48	0.4358	0.0091	-	-	-
Total	64	26.0706	-			-

The above ANOVA table is exhibit that the F. Cal. Value is higher than the F. Tab. value on their respective d.f at 5% significant level. due to treatments. The above table also exhibit significant difference ($P<0.05$) between various therapies.
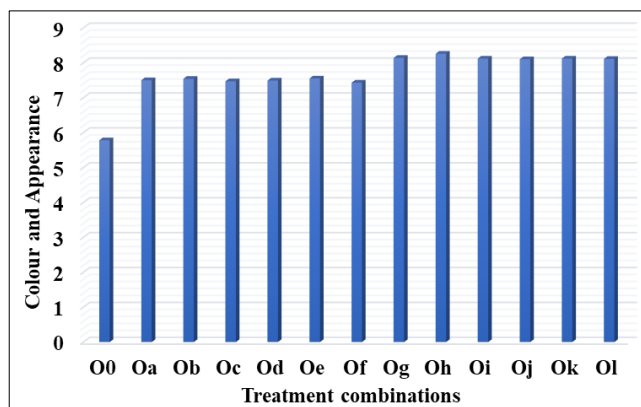
Fig 1: Graphical illustration of Colour and Appearance level of final prepared Kalakand

Table 4: Table exhibit Flavour level of final prepared Kalakand

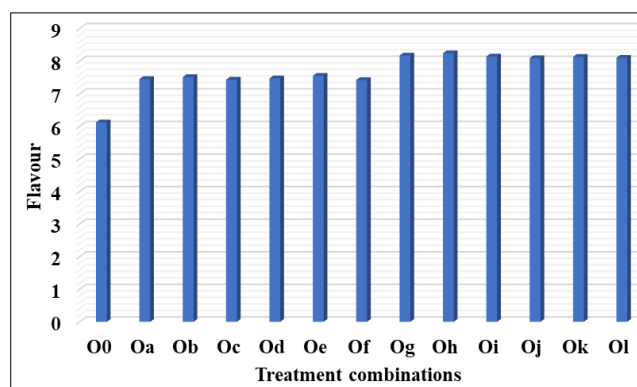| Treatments	R1	R2	R3	R4	R5	Mean
O_0	6.00	6.29	6.11	6.10	6.09	6.12
O_a	7.47	7.48	7.44	7.43	7.42	7.45
O_b	8.03	7.04	7.50	7.49	7.48	7.51
O_c	7.45	7.46	7.42	7.41	7.40	7.43
O_d	7.49	7.50	7.46	7.45	7.44	7.47
O_e	7.57	7.58	7.54	7.53	7.52	7.55
O_f	7.44	7.45	7.41	7.40	7.39	7.42
O_g	8.19	8.20	8.16	8.15	8.14	8.17
O_h	8.26	8.27	8.23	8.22	8.21	8.24
O_i	8.16	8.17	8.13	8.12	8.11	8.14
O_j	8.11	8.12	8.08	8.07	8.06	8.09
O_k	8.15	8.16	8.12	8.11	8.10	8.13
O_l	8.12	8.13	8.09	8.08	8.07	8.10
Mean	7.73	7.68	7.67	7.66	7.65	7.68
Minimum	6.00	6.29	6.11	6.10	6.09	6.12
Maximum	8.26	8.27	8.23	8.22	8.21	8.24
F- test			S			
S. Ed. ($\pm$)			0.066			
C. D. (P = 0.05)			0.131			

The above ANOVA table is exhibit that the mean value of control (O_0) is 6.12. The above table also exhibit that treatment combination (O_h) & (O_0) contains highest and lowest Flavour level than the other treatments respectively.

Table 5: Table exhibit ANOVA for Flavour level in final prepared Kalakand

ANOVA						
Source	d. f.	S.S.	M.S.S.	F. Cal.	F. Tab. 5%	Result
Replication	4	0.0476	0.0119	1.100	2.57	NS
Treatment	12	20.0938	1.6745	154.788	1.96	S
Error	48	0.5193	0.0108	-	-	-
TOTAL	64	20.6607	-			-

The above ANOVA table is exhibit that the F. Cal. Value is higher than the F. Tab. value on their respective d.f at 5% significant level. Due to treatments. The above table also

exhibit significant difference ($P<0.05$) between various therapies.

Fig 2: Graphical illustration of Flavour level of final prepared Kalakand

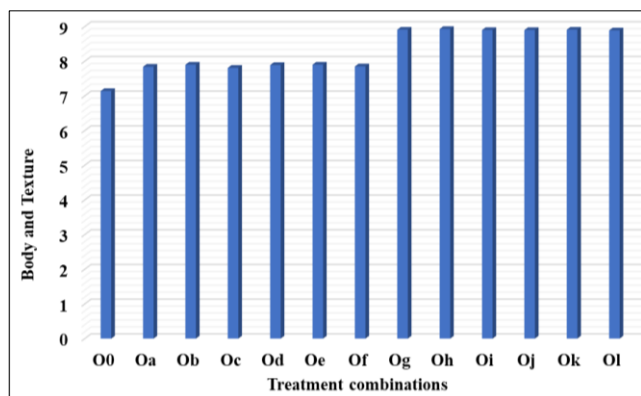**Table 6:** Table exhibit Body and Texture level of final prepared Kalakand

Treatments	R1	R2	R3	R4	R5	Mean
O_0	7.00	7.33	7.13	7.12	7.11	7.14
O_a	7.86	7.87	7.83	7.82	7.81	7.84
O_b	7.92	7.93	7.89	7.88	7.87	7.90
O_c	7.73	7.94	7.80	7.79	7.78	7.81
O_d	7.91	7.92	7.88	7.87	7.86	7.89
O_e	7.92	7.93	7.89	7.88	7.87	7.90
O_f	7.87	7.88	7.84	7.83	7.82	7.85
O_g	8.93	8.94	8.90	8.89	8.88	8.91
O_h	8.95	8.96	8.92	8.91	8.90	8.93
O_i	8.92	8.93	8.89	8.88	8.87	8.90
O_j	8.92	8.93	8.89	8.88	8.87	8.90
O_k	8.93	8.94	8.90	8.89	8.88	8.91
O_l	9.41	8.42	8.88	8.87	8.86	8.89
Mean	8.33	8.30	8.28	8.27	8.26	8.29
Minimum	7.00	7.33	7.13	7.12	7.11	7.14
Maximum	9.41	8.96	8.92	8.91	8.90	8.93
F- test			S			
S. Ed. ($\pm$)			0.068			
C. D. (P = 0.05)			0.136			

The above ANOVA table is exhibit that the mean value of control (O_0) is 7.14. The above table also exhibit that treatment combination (O_h) & (O_0) contains highest and lowest Body and Texture level than the other treatments respectively.
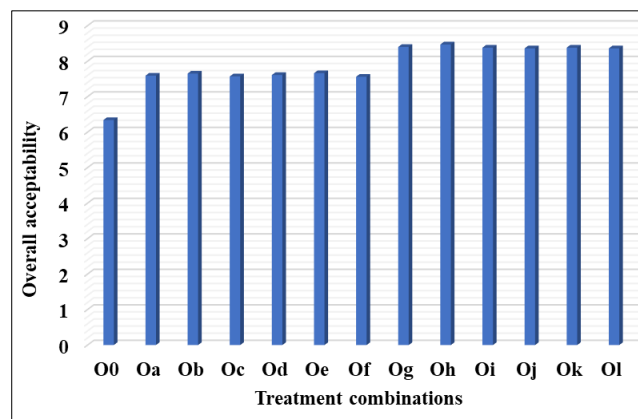
Table 7: Table exhibit ANOVA for Body and Texture level in final prepared Kalakand

ANOVA						
Source	d. f.	S.S.	M.S.S.	F. Cal.	F. Tab. 5%	Result
Replication	4	0.0389	0.0097	0.830	2.57	NS
Treatment	12	23.4790	1.9566	167.010	1.96	S
Error	48	0.5623	0.0117	-	-	-
TOTAL	64	24.0802	-			-

The above ANOVA table is exhibit that the F. Cal. Value is higher than the F. Tab. value on their respective d.f at 5% significant level. Due to treatments. The above table also exhibit significant difference ($P<0.05$) between various therapies.

Fig 3: Graphical illustration of Body and Texture level of final prepared Kalakand

Table 9: Table exhibit Overall acceptability level of final prepared Kalakand

Treatments	R1	R2	R3	R4	R5	Mean
O_0	6.00	6.67	6.32	6.37	6.36	6.34
O_a	7.58	7.56	7.57	7.62	7.61	7.59
O_b	7.64	7.62	7.63	7.68	7.67	7.65
O_c	7.56	7.54	7.55	7.60	7.59	7.57
O_d	7.60	7.58	7.59	7.64	7.63	7.61
O_e	7.65	7.63	7.64	7.69	7.68	7.66
O_f	7.55	7.53	7.54	7.59	7.58	7.56
O_g	8.39	8.37	8.38	8.43	8.42	8.40
O_h	8.46	8.44	8.45	8.50	8.49	8.47
O_i	8.37	8.35	8.36	8.41	8.40	8.38
O_j	8.35	8.33	8.34	8.39	8.38	8.36
O_k	8.37	8.35	8.36	8.41	8.40	8.38
O_l	8.68	8.00	8.34	8.39	8.38	8.36
Mean	7.86	7.84	7.85	7.90	7.89	7.87
Minimum	6.00	6.67	6.32	6.37	6.36	6.34
Maximum	8.68	8.44	8.45	8.50	8.49	8.47
F- test				S		
S. Ed. (±)				0.062		
C. D. (P = 0.05)				0.123		

The above ANOVA table is exhibit that the mean value of control (O_0) is 6.34. The above table also exhibit that treatment combination (O_h) & (O_0) contains highest and lowest overall acceptability level than the other treatments respectively.

Table 10: Table exhibit ANOVA for Overall acceptability level in final prepared Kalakand

ANOVA						
Source	d. f.	S.S.	M.S.S.	F. Cal.	F. Tab. 5%	Result
Replication	4	0.0332	0.0083	0.874	2.57	NS
Treatment	12	21.9421	1.8285	192.447	1.96	S
Error	48	0.4561	0.0095	-	-	-
Total	64	22.4314	-			-

The above ANOVA table is exhibit that the F. Cal. Value is higher than the F. Tab. value on their respective d.f at 5% significant level. Due to treatments. The above table also exhibit significant difference ($P<0.05$) between various therapies.

Fig 4: Graphical illustration of Overall acceptability level of final prepared Kalakand

4. Conclusion
After sensory evaluation, it was found that the treatment combination O_h is highly overall acceptable than the other treatment combination. The mean value of O_h in overall acceptability is 8.47 that is maximum range than the other mean of treatment combination. So, it is concluded that the 'Buffalo milk (100 ml) + 10% sugar + 3% Inulin + 6% wheat grass powder' this treatment combination formula is standardized to prepare kalakand.

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