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Development and quality assessment of cheese spread prepared by using: Paneer, mozzarella and cheddar cheese

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Abstract
This present study was conducted on the development and quality assessment of cheese spread prepared by using: paneer, mozzarella and cheddar cheese. In the new millennium we are witnessing the upward trend in nutritional and health awareness which has increased the consumer demand for functional foods. Keeping in this view industries are forced to bring processed cheese spread in the market with acceptable sensory characteristics. Control (T_0) was prepared by adding cheddar cheese, stabilizer(Sodium citrate), emulsifier(Glycerol monostearate), salt and required amount of water, to obtain more than 40% total solid and treatments was prepared with paneer, mozzarella and cheddar cheese in the ratio of T_1(50:50:05,)T_2(50:50:10),T_3(50:50:15),T_4(60:40:05),T_5(60:40:10),T_6(60:40:15),T_7(70:30:05),T_8(70:30:10),T_9(70:30:15),T_{10}(80:20:05),T_{11}(80:20:10),T_{12}(80:20:15),T_{13}(90:10:05),T_{14}(90:10:10),T_{15}(90:10:15) respectively with the addition of permitted emulsifier, stabilizer and salt and each treatment was processed at 60 ^{0}C for 3-5 minutes. The different treatments and control sample were analyzed for physic o-chemical analysis (Fat, Moisture, Protein, Carbohydrates and Ash, Total solid). The fat content was increasing from range 19.15%-19.39%(T_1-T_3),18.67%-18.97%(T_4-T_6),18.19%-18.54%(T_7-T_9),17.70%-18.11%(T_{10}-T_{12}), and 17.22%-17.68% (T_{13}-T_{15}). The moisture content was decreasing from 58.38%-58.06%(T1-T3),58.33%-58.27%(T_4-T_6),58.23%-58.21%(T_7-T_9),58.16%-58.14%(T_{10}-T_{12}), and 58.06%-58.08% (T_{13}-T_{15}). The protein content was decreasing from 17.56%-17.39%(T1-T3),18.00%-17.78%(T_4-T_6),18.44%-18.17%(T_7-T_9),18.89%-18.56%(T_{10}-T_{12}), and 19.34%-18.95% T_{13}-T_{15}). Carbohydrate was decreasing from 2.82%-2.73%(T1-T3),2.93%-2.84%(T_4-T_6),3.07%-2.95%(T_7-T_9),3.19%-3.07%(T_{10}-T_{12}), and 3.33%-3.18% (T_{13}-T_{15}). The Ash content was increasing from range2.09%-2.15%(T1-T3),2.07%-2.14%(T_4-T_6),2.07%-2.13%(T_7-T_9),2.06%-2.12%(T_{10}-T_{12}), and 2.05%-2.11% (T_{13}-T_{15}). The total solid content was increasing from range 41.62%-41.66%(T1-T3),41.67%-41.73%(T_4-T_6),41.77%-41.79%(T_7-T_9),41.84%-41.86%(T_{10}-T_{12}), and 41.94%-41.92%($T_{13}T_{15}$). The coli forms and yeast and mould test were negative. Sensory evaluation results indicated that all the cheese spread had high sensory ratings for all the selected attributes evaluated. Treatment T_1 (50:50:05) resulted in the highest scores for color& appearance, flavor & taste, body & texture and overall acceptability. T_1 was liked most by the sensory panelists in comparison to other treatments.

Keywords: Quality assessment, cheese spread, vegetarian cheese

Introduction
Cheese spreads are products used as culinary replacements for cheese. These include vegetarian cheese substitutes as well as some dairy products, such as processed cheese that do not qualify as true cheeses. These foods may be intended as replacements to cheese, which are generally intended to be mistaken for real cheese, but have properties such as different melting points or lower costs that make them attractive to businesses. Paneer, a highly popular traditional Indian dairy product, is obtained by acid-and- heat coagulation of milk. The phenomenon of coagulation involves formation of large structural aggregates of milk proteins in which milk fat and a small fraction of whey carrying soluble milk solids are entrained while the major portion of the whey (the watery liquid) separates from the coagulates. The solid mass resulting from fusing together under pressure, of the coagulated lumps, is paneer. Good quality paneer is characterized by a white colour, sweetish, mildly acidic, nutty flavour, spongy body and close-knit texture. Paneer is highly nutritious since it retains about 90% fat and protein, 50% minerals and 10% lactose of the original milk, Though the composition of market samples of paneer varies to a large extent, the product prepared by adopting a standard method on an average contains approx. 54% moisture, 18% proteins, 25% fats, 2% lactose and

1.5% minerals. According to the prevention of food Adulteration Act (1954), paneer shall contain no more than 70% moisture and the fat content should not be less than 50% of dry matter. Mozzarella cheese was originally manufactured from high-fat buffalo milk in the Battipaglia region of Italy. Mozzarella belongs to the cheese classified as "Pasta filata" or stretched curd cheese. The term 'Pasta-filata' is derived from an Italian phrase that literally means 'spun paste or stretched curd'. Mozzarella cheese is an unripened, soft and white cheese whose melting and stretching properties are highly suitable for Pizza making (Kindstedt, 1955) [6]. Although the demand of Mozzarella cheese is increasing due to expansion of pizza parlors and fast food chains. Therefore to improve the process and quality of local cheese in the dire need have time. Defects associated with mozzarella cheese include a rubbery tough, texture, lack of flavour, paleness or green tint, inability to melt and poor stretch ability (Fife *et al*. 1996) [7]. These functional properties of mozzarella cheese are influenced by a multitude of factors that include cheese composition particularly moisture, fat content, pH, coagulating enzyme, starter culture, cooking and stretching, salt content and the changes occurring during aging and storage. Mozzarella cheese surpasses all other Italian varieties by a significant margin. According to the PFA rules (1976) (Hard) cheese means the product obtained by draining after the coagulation of milk with a harmless milk coagulating agent, under the end influence not found in milk except coagulating agent ,sodium chloride, calcium chloride(anhydrous salt)not exceeding 0.02%by weight ,annatto or carotene colour, and may contain certain emulsifiers and/or stabilizers, namely citric acid, sodium citric or sodium salts of orthophosphoric acid and polyphosphoric acid not exceeding 0.2% by weight ,wax used for covering the outer surface should not contain anything harmful to the health. In case the wax is coloured, only permitted food coloures may be used. Hard cheese should contain no more than 43.0% moisture and not less than 42% milk fat or the dry matter. Hard cheese may contain 0.1%sorbic acid or its sodium, potassium or calcium salts or 0.1% niacin. The present investigation is an attempt to formulate easily digestible Cheese spread with the added health benefit and value addition. The health benefits of Cheese spread include relief from hypertension, osteoporosis. It will also help in maintaining bone health, gaining weight gain and dental care. Cheese spread contains conjugated linoleic acid and sphingolipids which will help in preventing cancer. Cheese Spread was prepared from Paneer, mozzarella and cheddar cheese. This approach gave relatively less expensive and nutritious product which can find popularity in the mass market.

Materials and Methods

The experiment "Development and Quality Assessment of Cheese spread prepared by using; Paneer, Mozzarella and Cheddar cheese'' was carried out in the Student's Training Dairy and research Lab, Warner College of Dairy Technology, Sam Higginbottom University of Agriculture, Technology and Sciences (Formerly Allahabad Agricultural Institute) (Deemed -to-be- University) Allahabad - 211007,U.P. (India). The control and experimental Cheese spread samples were tested and statistically analyzed.

Chemical analysis: Moisture (by hot air oven method, AOAC, 1990), Ash (by Muffle furnace, Rangaana, 1986) Fat (Soxhlet apparatus, AOAC, 1984), Carbohydrate (by difference method and Total solid (by difference method) were determined.

Sensory analysis: Sensory evaluation of control and experimental cheese spread was done by a professional and experienced panel of judges. The panelists, made up of staff of the Department of Dairy & Food Science and Technology, Warner College of Dairy Technology, Sam Higginbottom University of Agriculture, Technology & Sciences, Allahabad-211007(U.P), were familiar with quality attributes of cheese spread. The panel used 9 point hedonic scale for sensory evaluation.

Microbial analysis: Standard Plate Count (SPC), Coli form test, Yeast & Mould count. Pour Plate method was used to determine the coli form, yeast and mould and total viable counts.

Statistical analysis: The data recorded during the course of investigation were statistically analysed by the analysis of variance at 5% level of significance suggested by S.R.S.

Material required for preparation of control & experimental Cheese spread. Mozzarella cheese (Amul), Cheddar cheese, Salt, Stabilizer (Sodium Citrate), Emulsifier (Glyceryl Monostearate), and Acidifying Agent (Citric Acid).

Procurement and collection of ingredients. The materials and methods to be adopted during this investigation are given below: Mozzarella cheese (Amul) Procurement and collection of Mozzarella cheese (Amul) from local market. Cheddar cheese Procurement and collection of

Cheddar cheese from local market. Salt Procurement and collection of Salt from local market. Stabilizer (Sodium Citrate), Emulsifier (Glyceryl Monostearate) and Acidifying Agent (Citric Acid) were collected from Research Lab, Warner College of Dairy Technology, SHUATS, Naini-Allahabad (UP).

Detail treatment combination:

T_0 – Processed cheese was prepared from Cheddar cheese and water (60:40).

T_1 – Cheese spread was prepared by blending Mozzarella, Paneer and Cheddar cheese (50:50:5)

T_2 – Cheese spread was prepared by blending Mozzarella, Paneer and Cheddar cheese (50:50:10)

T_3 –Cheese spread was prepared by blending Mozzarella, Paneer and Cheddar cheese (50:50:15)

T_4 - Cheese spread was prepared by blending Mozzarella, Paneer and Cheddar cheese (60:40:5)

T_5 - Cheese spread was prepared by blending Mozzarella, Paneer and Cheddar cheese (60:40:10).

T_6 - Cheese spread was prepared by blending Mozzarella, Paneer and Cheddar cheese (60:40:15).

T_7 - Cheese spread was prepared by blending Mozzarella, Paneer and Cheddar cheese (70:30:5).

T_8 - Cheese spread was prepared by blending Mozzarella, Paneer and Cheddar cheese (70:30:10).

T_9- Cheese spread was prepared by blending Mozzarella, Paneer and Cheddar cheese (70:30:15)

T_{10}- Cheese spread was prepared by blending Mozzarella, Paneer and Cheddar cheese (80:20:5)

T_{11}- Cheese spread was prepared by blending Mozzarella, Paneer and Cheddar cheese (80:20:10).

T_{12}- Cheese spread was prepared by blending Mozzarella, Paneer and Cheddar cheese (80:20:15).

T_{13}- Cheese spread was prepared by blending Mozzarella, Paneer and Cheddar cheese (90:10:5).

T_{14}- Cheese spread was prepared by blending Mozzarella,

Paneer and Cheddar cheese (90:10:10).
T_{15}- Cheese spread was prepared by blending Mozzarella, Paneer and Cheddar cheese (90:10:15).

Plan of layout
Number of replication : 5
Number of treatment : 16

Preaperation of cheese spread
Cheese spread samples were prepared by using paneer, mozzarella and cheddar cheese. The natural cheese was temper at the temperature 21 ^{0}C, after tempering, cleaning was done to remove outer surface of paraffin layer from cheese and blend the natural cheese and paneer in the proper amount until the all the material gets melt and mixed properly. Accoerding to PFA, Processed cheese spread means the product obtained by heating cheese with permitted emulsifiers and stabilizer namely Glycerol Monostearate ($C_{17}H_{35}COOCH_2CHOHCH_2OH$) and sodium citrate and acidifying agents namely vinegar, lactic acid, acetic acid, citric acid and phosphoric acid. Processed cheese spread may contains not more than 4% of anhydrous permitted emulsifiers and stabilizer, provided that the content of anhydrous inorganic, agents shall in no case exceed 3% of finished product. After mixing, blended mix was process at the temperature of 65 ^{0}C for 3-5 minutes with the addition of stabilizer, emulsifier, salt and water. After mixing hot packaging were done and cooled to room temperature and store @4 ^{0}C into the refrigerated condition.

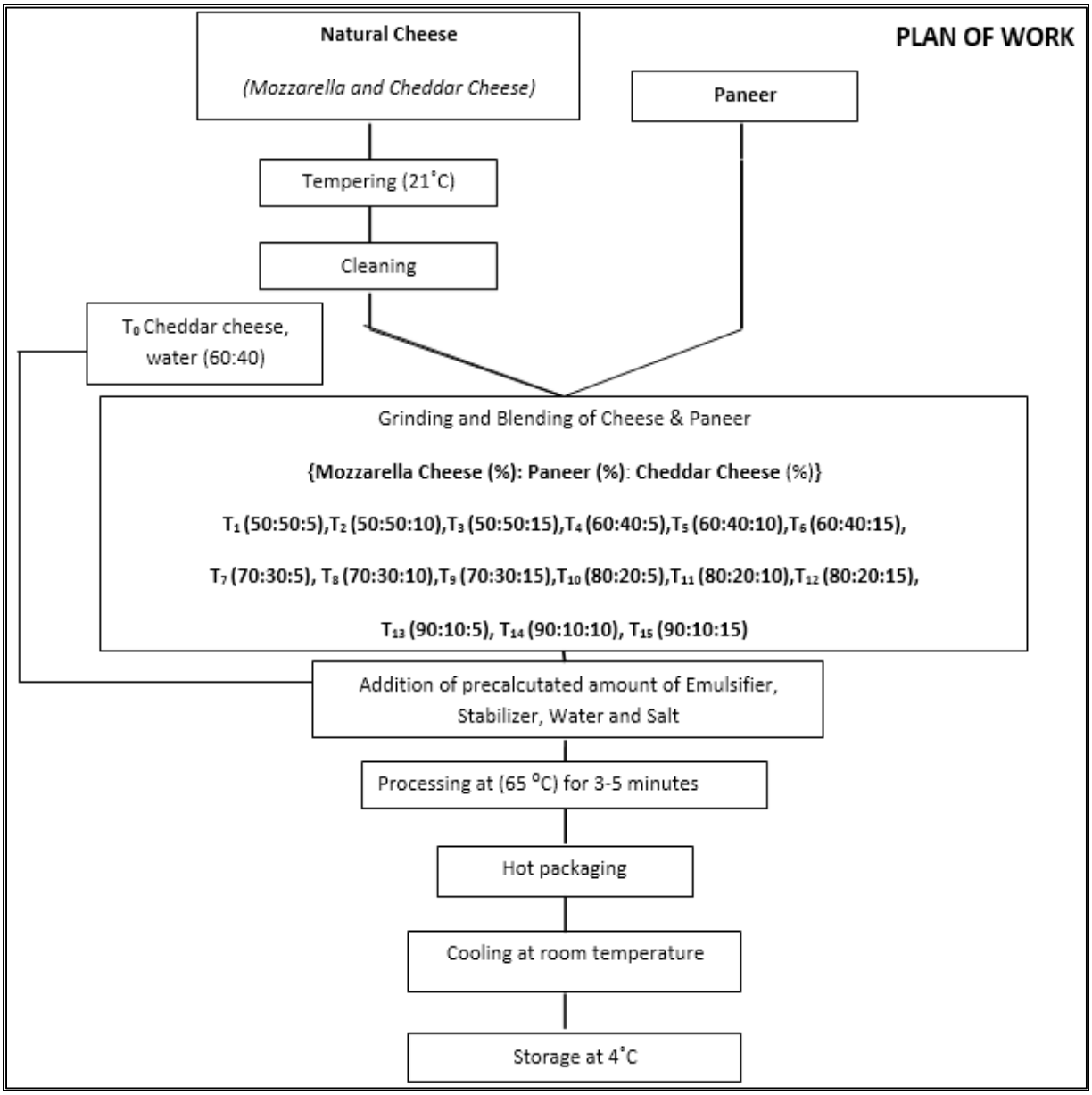

Table: Average of data obtained on different parameters of Cheese Spread samples prepared from Paneer, Mozzarella & Cheddar cheese:

Sl. No.	Parameters	T_0	T_1	T_2	T_3	T_4	T_5	T_6	T_7	T_8	T_9	T_{10}	T_{11}	T_{12}	T_{13}	T_{14}	T_{15}
Chemical analysis																	
1.	Fat (%)	21.22	19.15	19.28	19.39	18.67	18.82	18.97	18.19	18.38	18.54	17.70	17.92	18.11	17.22	17.46	17.68
2.	Protein (%)	16.07	17.56	17.47	17.39	18.00	17.88	17.78	18.44	18.29	18.17	18.89	18.71	18.56	19.34	19.13	18.95
3.	Ash (%)	2.57	2.09	2.12	2.15	2.07	2.11	2.14	2.07	2.10	2.13	2.06	2.09	2.12	2.05	2.08	2.11
4.	Carbohydrate (%)	2.05	2.82	2.77	2.73	2.93	2.89	2.84	3.07	3.01	2.95	3.19	3.13	3.07	3.33	3.25	3.18
5.	Moisture (%)	58.09	58.38	58.36	58.34	58.33	58.3	58.27	58.23	58.22	58.21	58.16	58.15	58.14	58.06	58.08	58.08
6.	Total solids (%)	41.91	41.62	41.64	41.66	41.67	41.7	41.73	41.77	41.78	41.79	41.84	41.85	41.86	41.94	41.92	41.92
Organoleptic characteristics of cheese spread samples																	
7.	Color appearance score	8.03	8.00	7.79	7.51	7.30	7.28	7.48	7.38	7.40	7.54	7.60	7.46	7.60	7.50	7.20	7.48
8.	Flavor & taste score	7.94	7.60	7.30	7.44	7.48	7.56	7.18	7.50	7.14	7.36	7.44	7.34	7.40	7.60	7.34	7.44
9.	Body and texture score	8.04	7.99	7.70	7.56	7.44	7.30	7.54	7.14	7.34	7.62	7.52	7.50	7.48	7.34	7.12	7.26
10.	Overall acceptability	8.04	7.88	7.59	7.50	7.40	7.38	7.54	7.34	7.29	7.50	7.52	7.43	7.51	7.48	7.22	7.39
Microbial Analysis																	
11.	Standard Plate Count ($\times 10^3$ Cfu/gm)	8.40	8.20	8.40	8.60	8.20	8.40	8.20	8.60	8.40	8.60	8.20	8.40	8.40	8.20	8.40	8.40
12.	Yeast & Mould count (Per gm)	4.00	3.80	4.00	3.80	4.00	3.80	4.00	3.80	4.00	3.80	4.00	4.00	3.80	4.00	3.80	4.00
13.	Coli form count	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil

Results and Discussion

Proximate composition of control and experimental cheese spread

Moisture

It was observed that moisture content varied from 58.38to 58.34%.It was also observed that the moisture content in cheese spread decreased with the increase in cheddar cheese level, which may however results in storage life. This may be due to cheddar cheese characteristics in the cheese spread. The water retention capacity was reported to decrease with decreasing level of protein content (Rhee *et al*., 1981).

Ash

The ash content of cheese spread increased as the substitution level increased and it was the highest 2.15% at 50:50:15(M: P: C) substitution level.

Fat

The fat content of cheese spread ranged from 19.15%-19.39%. The increase in fat content was observed with increasing extent of substitution of cheddar cheese as it might be due to high oil absorption capacity of cheddar cheese in comparison with mozzarella and paneer.

Protein

The protein content decreased from 17.56%-17.39% with increasing the concentration of cheddar cheese in the blends. The decrease in protein content of supplemented cheese might be the result of the lower protein content of cheddar cheese.

Carbohydrate

Cheese spread made with 50:50:15 (M: P: C) had lower carbohydrates content than other cheese made with the composites. The control, however, had the lowest carbohydrate content.

Total Solids

It was observed that total solid was increasing with decrease in moisture. It ranged from 41.62%-41.66%.

Microbial analysis of control and experimental cheese spread

Coli forms

It is evident from the data on coli form test in control and experimental cheese spread samples were 100% negative .It shows the absence of coli forms which means that strict hygienic procedure was maintained during the preparation.

Yeast and Mould

From the table it is evident that yeast and mould test in control and experimental cheese spread was 100% negative.

SPC

The data presented in table indicates that least bacterial population 8.20 $x10^3$cfu/g was observed in T_1. The highest bacterial population 8.60$x10^3$cfu/g was observed in T_3. The growth observed could be due to post-processing contamination.

Sensory Evaluation

Color & Appearance

The mean sensory scores for color and flavor of cheese spread are presented in table. The result of sensory scores for color and appearance revealed that the mean sensory score was highest for the T_1 (50:50:05).

Flavor and Taste

The result of sensory scores for flavor and taste revealed that the highest mean sensory score was for T_1 (50:50:05).

Body and Texture

According to Suknark *et al*., (1998), texture of cheese spread products is one of the most important characteristics affecting consumer acceptance. The result of sensory scores for Body and Texture revealed that the mean sensory score was highest for T_1 (50M: 50P:05C).

Overall Acceptability

The result of sensory scores for overall acceptability revealed that the mean sensory score was highest for T_1 (50M: 50P:05C).

The studies demonstrated that incorporation of Mozzarella, Paneer and cheddar cheese influenced physical and chemical properties in cheese spread. It was found that treatment T_1 was best in the chemical analysis because it contained highest amount of protein, fat, carbohydrate and lowest in ash. On the basis of the result of mean sensory score it was concluded that the cheddar may be included successfully up to 05% (T_1) which increased the protein content and lowered the ash without affecting the sensory scores adversely. Although the high mean scores fpr flavor, texture, color and overall acceptability indicated that all the cheese spreads were of good quality.

The result of this research revealed that acceptable cheese spread could be processed from 50% Mozzarella cheese + 50% Paneer + 05% Cheddar cheese. The nutritive value of cheddar cheese in the cheese spread could improve the nutritional status of people who consumes processed cheese /cheese spread as dairy food. So the study had also shown that utilization of Mozzarella, Paneer and cheddar cheese in cheese spread making can be increased and encouraged.

Conclusion

From the investigation, it is evident that Mozzarella, Paneer and Cheddar cheese can be effectively used in the formulation of cheese spread by properly blending it in appropriate proportions with other ingredients like salt, emulsifier and stabilizer.

The data obtained from Organoleptic evaluation showed that the cheese spread sample in the treatment T_1 (50:50:05) was found to be more acceptable in terms of sensory analysis.

On the basis of microbiological analysis the formulated Cheese spread sample in treatment T_1 (5*0:50:05*) showed satisfactory results for SPC and Yeast & Mould counts.

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