



Standardize The Technology For Preparation Of Chhanapodo For Shelf Life Extension

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Abstract

India has one of the largest livestock populations in the world. Fifty percent of the buffaloes and twenty percent of the cattle in the world are found in India, most of which are milk cow and buffaloes. Dairy development in India has been acknowledged the world over as one of the modern India's most successful development programmes.

The national commission on agriculture (1976) recommended that the production of various indigenous milk product and sweets derived therefore should be taken up by the organized dairy plants. The commission also suggested that efforts should be made to standardise the technique of production of various indigenous milk products and explore the possibility of improving their keeping quality and packaging with minimum expenses.

A base product for a large variety of Indian delicacies, namely, rasogolla, sandesh, cham-cham, rasamalai, pantoha, rajbhog, chhana-murki etc. is a heat and acid coagulated products. Acid coagulated products are having export potential. One of them traditional acid coagulated dairy product of eastern region of India is chhanapodo, commonly prepared in Orissa. Chhanapodo is well known for chhana based delicacies acid coagulated product and the production involves slow baking of chhana mixed with 25% sugar and 5% maida burnt by using flat bottom cast iron plate or cooked after wrapping in sal leaf by keeping on low fire. It takes more time and cost depending on sizes, shape of products. It has pleasant cooked flavour and rich taste with cake like body & texture.

Latest technology for baking through microwave oven, quick processing of food with high organoleptic, nutritional and keeping quality. Using this to develop the baking process for the chhanapodo product. The cow and buffalo milk were mixed together according to the cow & buffalo milk ratio (r) that are 1:1, 1:2, 1:3, 2:1 & 3:1 respectively. Attempts were made to standardize the production of chhanapodo. The binding agents used at, maida (5%) and sugar (20%) (based on chhana) adjudged most suitable for chhanapodo production.

Chhanapodo product is best at the cow and buffalo ratio was (2:1), at 170°C temp for the 12 min baking period. The recorded a shelf life up to 45 days at refrigerated temperatures.

Keywords: chhanapodo, baking temperature, microwave oven, period, coagulant, maida, shelf life.

I. INTRODUCTION

The dairy sector is economically and socially very significant in India due to the multi-functionality of dairy animals performing output, input, asset and socio-cultural functions. The dairy sector however, India is characterized by very large number and low productivity. India possesses over 16% of world cattle and some 57% of buffalo population but accounts for 14.20% of world population. The sector is highly livelihood intensive and provides supplementary income to 60-70 % of rural households. Milk production takes place in millions of small and very small holdings, approximate

million household scattered through this country are involved. The small marginal farmers and landless constitute the core milk producing group owing over 60% of milch animals (**Bhasin, 2004**).

India has emerged as the largest milk producing country in the world with present level of annual milk production estimated as 94.5 million tones. We expect a production level of 135 million tones by the year 2015. The livestock population is projected to increase to 322 million by the year 2015. The livestock population is raised primarily on crop residues and grazing in the common property including basement. The forest area, which was a major source of grazing, is no longer available to livestock breeder especially landless people. As a consequence, the available feed resources fall short of the nutritional requirement. The shortfall is essential as 59.90 million tonnes for the green fodder and 19.90 million tones for dry fodder. This shortfall is likely to increase by year 2015 to 63.50 million tons of green fodder and 23.56 million tons of dry fodder (**Dairy India, 2007**).



Fig 1: A view of the ChhanaPodo

A number of traditional techniques developed at home for preparing foods have been modified and improved. They are now being converted into technologies that are science and engineering based to make these products commercially in larger quantities for institutional uses and for establishing economically viable food industries to meet the emerging socio-economic conditions. India's total production of Chhana a heat acid coagulated product is 2 million tonnes valued at Rs 7000 million (Aneja, *et al.*, 2002). As per ISI specification (1964) Chhana is a coagulated product obtained by the acid coagulation of whole or standardized milk of cow, buffalo or their admixtures. The coagulant used can be sour Chhana whey, lactic acid or citric acid. Chhana shall not contain any ingredients foreign to milk. According to Prevention of Food Adulteration (PFA) rules (1976), the Chhana product shall not have more than 70% moisture and not less than 50% fat on dry matter basis. Chhana serves as a base material and filler for a large variety of Indian sweet-meats like Rosogolla, Sandesh, Chum-Chum, and Chhana- Murki, etc. The production of Chhana is confined mostly to the eastern region of the country notably West Bengal, Bihar and Orissa. This is mainly due to technological development for the preservation and packaging, leading to enhanced shelf life, better buying capacity and versatile food habits etc.

The only milk based indigenous dairy product prepared by baking the Chhana is ChhanaPodo the product is popular to Orissa and is prepared throughout the state. ChhanaPodo has been served to Lord Jagannath in Puri (Orissa) as offerings “*Prasad*” for hundreds of years. During a survey an attempt was made to find out the origin of ChhanaPodo by interaction with milk sweet product and dealers. As per the information collected Mr. KeluBehera in Pahel and Pratihari family in Puri (Orissa) were the first to prepare Podo delicacy. Podo means “burning” in Oriya- the official language of Orissa. Since burning of

Chhana on slow fire is the traditional method of preparation it is presumed that the delicacy has acquired the nomenclature based on its method of preparation. However, the some sweet manufacturer also informed that Podo name has come from the village of Podomari in Gunjam district. (Ghosh, *et al.*, 2002). ChhanaPodo is being prepared since the end of nineteenth century. The product has not been characterized with respect to flavour, body and texture.

The traditional method of preparation ChhanaPodo from Chhana is mixed with half of its quantity of sugar and about 5% suji based on the quantity of Chhana. This is made into smooth dough by kneading and then resultant product is then taken in aluminium vessels and baked in traditional manner by using red hot burning wood. Some hot burning charcoal pieces are kept on the top and some at the bottom. The process of cooking is continued for 2 to 4 hour depending on size and shape of product. In some places slow baking is done for overnight by continued burning of wood/charcoal. It was also observed that the Chhana mixed with sugar and suji was cooked after wrapping in leaves by using fire wood. The type of leaves varied from place to place and it was common to see Sal leaves used for baking. In urban areas this has been replaced by rigid metal containers made of aluminium (Ghosh, *et al.*, 2002).

II. MATERIALS AND METHODS

Chhana was prepared as per method recommended by **De and Ray (1954)**. In the experiment 500 ml of standardized cow milk of fat 3.5% & SNF 8.5% and 500 ml of standardized buffalo milk of fat 6.0 & SNF 9.0 was taken. After that both the quantities were mixed together in aluminium vessel. In the cow milk : buffalo milk ratio (R) is 1:1, 1:2, 1:3, 2:1 and 3:1. The mixed milk was filtered, and heated to boil for few seconds and then allowed to cool up to 70°C. Citric acid solution (2%) was heated to about 70°C, was slowly added the milk with gentle stirring till the milk coagulated, showing a greenish yellow tinge in whey. The content was left in hot whey for about 5 to 10 min. Then the whey was drained with the help of a muslin cloth and the Chhana collected was immersed in luke warm water for 5-10 minutes so that it became acid free. It was then hung for 2 hour for whey drainage. After the passage of the above period raw Chhana was collected.

The Chhana, thus obtained was mixed with sugar (20%) and maida (5%) of the weight of the Chhana. All the ingredients were kneaded thoroughly by hand, till the sugar dissolved in the Chhana and made smooth dough. The Chhana dough was then cut into small pieces (12-15 g). The kneaded Chhana pieces were moulded into round balls by revolving between palms and were slightly pressed to make the tops flat.



Fig. 2 A view of the Microwave oven used for baking.

A silver foil was spread on the lower rack of microwave oven. The microwave oven was set on convection mode cooking and then pre heated to (T) 160°C temp. After that, the milk ratio (1:1) samples

were put in the microwave oven on the rack, which are rapped by aluminium foil paper. Then the microwave oven was run for 8 minutes. Again, a fresh sample was then loaded in oven and the same process was repeated for different period (P) of baking like 10, 12, and 14 min. This process were repeated for different cow and buffalo milk ratio like 1:2, 1:3, 2:1, and 3:1.

Again, for the microwave oven temperature 170°C, the microwave oven was set on convection mode and maintained temp (T) 170°C in microwave oven by setting temp on 170°C temp as above process. Then all experiment was done at temp 170°C. Same process also adopted for the temp 180°C.

PLAN OF EXPERIMENT

The cow milk and buffalo milk were mixed together according to the ratio(R) that are 1:1, 1:2, 1:3, 2:1 & 3:1 respectively. In each treatment ratio of milk was at different baked temperature (T) are 160°C, 170°C & 180°C and each temperature maintained different baking time periods (P) 8 min, 10 min, 12 min & 14 min in the microwave oven.

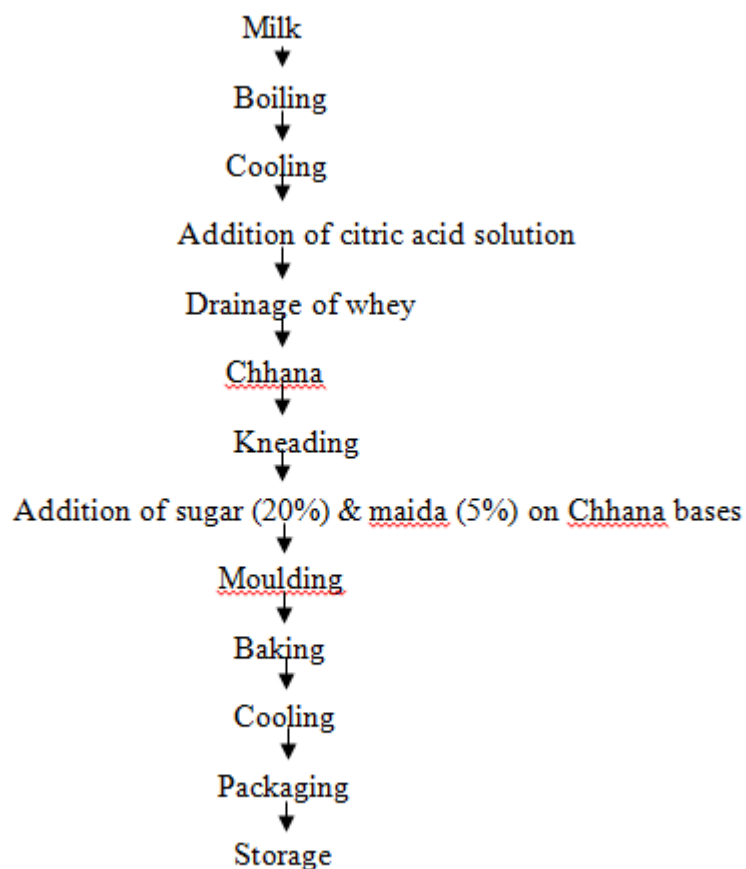


Fig. 3 Flow diagram for preparation of Chhana Podo.

METHODOLOGY

The experimental design used will be (5×4×3) factorial. The certain data from the experiments on different parameter will be statistically analysed using analysis of variance (ANOVA) and three way classification with replication three, observation per cell.

1. No. of Treatments : 60
2. No. of Replication : 03
3. Total Treatment combinations : 180

The standards error of mean and critical difference at 5% level of significance will be also used Imran and Coover (1983).

If the calculated value of F due to cow & buffalo ratio (R), temperature (T) and baking period (P) were greater than their respective value of F at 5% probability level, then, we can reach the conclusion that there are significant effect of different milk ratio, temperature and period.

If the calculated value of F due to cow & buffalo ratio (R), temperature (T) and baking period (P) were less than their respective value of F at 5% probability level, then we can conclude that there are non-significant effect of the different treatment, temperature and period.

Table 1		Effect of different ratios, temperatures and periods on fat, protein, lactose, moisture, ash and yield percentage in ChhanaPodo				
Factor		Fat (%)	Protein (%)	Carbohydrate (%)	Moisture (%)	Yield (%)
Ratio (R) (Cow : Buffalo Milk)						
R₁	1 : 1	24.591	16.457	27.955	29.030	17.203
R₂	1 : 2	25.417	16.610	28.194	27.806	18.100
R₃	1 : 3	25.739	16.643	28.630	27.003	18.544
R₄	2 : 1	23.704	16.400	27.330	30.653	16.302
R₅	3 : 1	23.151	16.329	27.171	31.444	15.853
	F - test	S	S	S	S	S
	S. Ed. (±)	0.0031	0.0002	0.0003	0.0031	0.0002
	C.D. at 5%	0.0061	0.0005	0.0006	0.0062	0.0004
Temperature (T)						
T₁	160°C	24.352	16.475	26.862	30.362	17.219
T₂	170°C	24.508	16.489	27.832	29.222	17.198
T₃	180°C	24.701	16.500	28.874	27.976	17.185
	F - test	S	S	S	S	S
	S. Ed. (±)	0.0024	0.0002	0.0002	0.0024	0.0002
	C.D. at 5%	0.0048	0.0004	0.0005	0.0048	0.0003
Period (P)						
P₁	8 Minutes	24.264	16.461	27.602	29.724	17.227
P₂	10 Minutes	24.351	16.475	27.768	29.457	17.206
P₃	12 Minutes	24.611	16.496	27.935	29.008	17.191
P₄	14 Minutes	24.855	16.519	28.118	28.559	17.177
	F - test	S	S	S	S	S
	S. Ed. (±)	0.0028	0.0002	0.0003	0.0028	0.0002

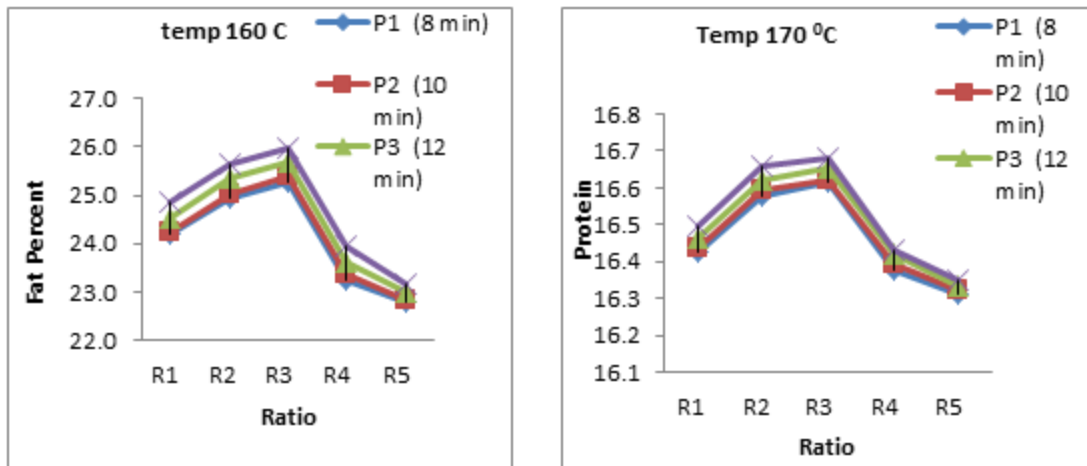
	C.D. at 5%	0.0055	0.0004	0.0006	0.0055	0.0004
Interaction R x T						
	F - test	S	S	S	S	S
	S. Ed. (±)	0.0054	0.0004	0.0005	0.0054	0.0004
	C.D. at 5%	0.0106	0.0008	0.0011	0.0107	0.0008
Interaction T x P						
	F - test	S	S	S	S	S
	S. Ed. (±)	0.0048	0.0004	0.0005	0.0048	0.0003
	C.D. at 5%	0.0095	0.0007	0.0010	0.0096	0.0007
Interaction R x P						
	F - test	S	S	S	S	S
	S. Ed. (±)	0.0062	0.0005	0.0006	0.0062	0.0004
	C.D. at 5%	0.0123	0.0009	0.0012	0.0124	0.0009
Interaction R x T x P						
	F - test	S	S	S	S	S
	S. Ed. (±)	0.0107	0.0008	0.0011	0.0108	0.0008
	C.D. at 5%	0.0213	0.0016	0.0022	0.0214	0.0015

The significant and non-significant effects are also observed at 5% probability level between the interaction of different milk ratio (R), temperature (T) and baking period (P).

Fat percentage of ChhanaPodo

The fat percent at cow & buffalo milk ratio (1:1) R₁ varies from 24.194 to 25.012, at temperature 160°C for baking period 8 min and at temperature 180°C for baking period 14 min respectively.

Similarly, for milk ratio (1:2) R₂, fat percent varies from 24.948 to 25.985, at temperature 160°C for baking period 8 min and at temperature 180°C for baking period 14 min respectively. For milk ratio (1:3) R₃, fat percent varies from 25.268 to 26.218, at temperature 160°C for baking period 8 min and at temperature 180°C for baking period 14 min respectively. For milk ratio (2:1) R₄, fat percent varies from 23.234 to 24.127, at temperature 160°C for baking period 8 min and at temperature 180°C for baking period 14 min respectively. For milk ratio (3:1) R₅, fat percent varies from 22.817 to 23.644, at temperature 160°C for baking period 8 min and at temperature 180°C for baking period 14 min respectively.



From the ANOVA Table , it was observed that the fat percentage (F) in ChhanaPodo samples reveals that the calculated values of F due to ratio (R) = 251481.9, due to temperature (T) = 10563.01, due to period (P) = 18587.70, as well as due to interaction between ratio & temperature (R×T) = 18587.70, due to interaction between temperature & period (T×P) = 57.11, due to interaction between ratio & period (R×P) = 59.32 and due to three factor interaction ratio, temperature & period (R×T×P) = 45.84 are greater than their respective table value of F at 5% probability level. Hence it can be concluded that there is significant difference between five ratios, three temperatures and four periods and also there is significant effect of interaction between (R×T); (T×P); (R×P) as well as between (R×T×P).

There, after to compare all possible combinations of two interactions between (R×T) were compared against the CD value of 5%, that is all possible combination of two interactions between (R×T) were observed to be significant.

All possible combinations of two interactions between (T×P) were compared against the CD value of 5% i.e., all possible combination of two interactions between (T×P) was observed to be significant.

Similarly, to all possible combinations of two interactions between (R×P) were compared against the CD value at 5% that is all possible combination of two interactions between (R×P) were observed to be significant except for (R₂P₄, R₃P₃) were non- significant.

The mean value of fat percent in ChhanaPodo sample of cow & buffalo ratio R₃ (1:3) = 25.739, is highest showing it is the best ratio followed by R₂ =25.417.

Protein percentage of ChhanaPodo

The protein percent at cow & buffalo milk ratio (1:1) R₁ varies from 16.415 to 16.512, at temperature 160°C for baking period 8 min and at temperature 180°C for baking period 14 min respectively.

Similarly, for milk ratio (1:2) R₂, protein percent varies from 16.562 to 16.657, at temperature 160°C for baking period 8 min and at temperature 180°C for baking period 14 min respectively. For milk ratio (1:3) R₃, protein percent varies from 16.609 to 16.692, at temperature 160°C for baking period 8 min and at temperature 180°C for baking period 14 min respectively. For milk ratio (2:1) R₄, protein percent varies from 16.361 to 16.445, at temperature 160°C for baking period 8 min and at temperature 180°C for baking period 14 min respectively. For milk ratio (3:1) R₅, protein percent varies from 16.305 to 16.349, at temperature 160°C for baking period 8 min and at temperature 180°C for baking period 14 min respectively.

The mean value of protein percent in ChhanaPodo sample ratio R₃ (1:3) = 16.643, is highest showing it is the best ratio followed by R₂.

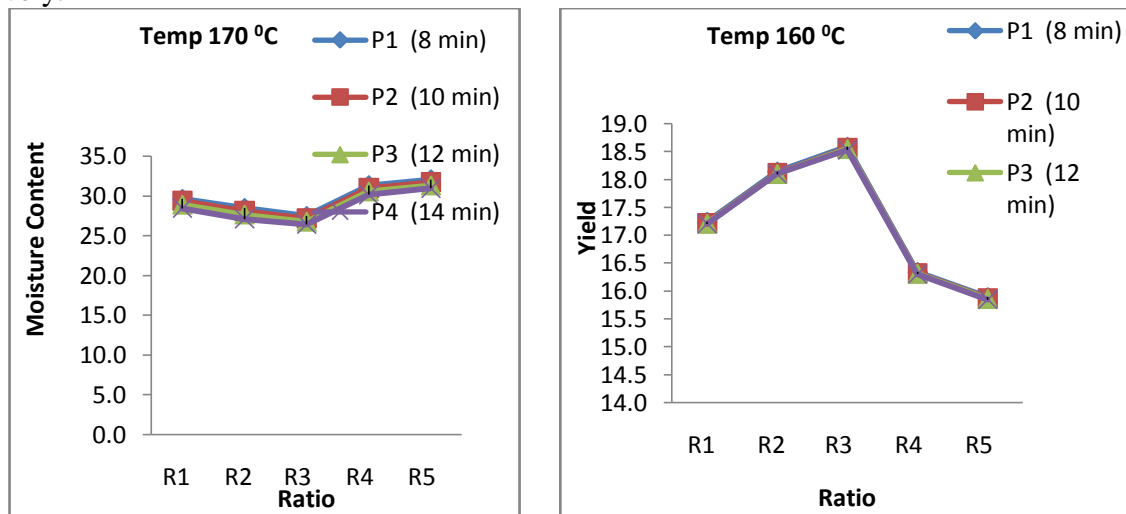
Carbohydrate percent of ChhanaPodo

The carbohydrate % at cow & buffalo milk ratio (1:1) R₁ varies from 26.728 to 29.124, at temperature 160°C for baking period 8 min and at temperature 180°C for baking period 14 min respectively. Similarly, for milk ratio (1:2) R₂, milk ratio (1:3) R₃, milk ratio (2:1) R₄ and milk ratio (3:1) R₅, carbohydrate percent varies from 26.898 to 29.543, from 27.364 to 29.818, from 26.011 to 28.715 and from 26.022 to 28.415 at temperature 160°C for baking period 8 min and at temperature 180°C for baking period 14 min respectively.

The mean value of carbohydrate percent in ChhanaPodo sample ratio R₃ (1:3) = 28.630, is highest showing it is the best ratio followed by R₂.

Moisture percent of ChhanaPodo

The moisture percent at cow & buffalo milk ratio (1:1) R₁ varies from 27.384 to 30.697, at temperature 180°C for baking period 14 min and at temperature 160°C for baking period 8 min respectively.



Similarly, for milk ratio (1:2) R₂, moisture percent varies from 25.842 to 29.618, at temperature 180°C for baking period 14 min and at temperature 160°C for baking period 8 min respectively. For milk ratio (1:3) R₃, moisture percent varies from 25.287 to 28.774, at temperature 180°C for baking period 14 min and at temperature 160°C for baking period 8 min respectively. For milk ratio (2:1) R₄, moisture percent varies from 28.799 to 32.482, at temperature 180°C for baking period 14 min and at temperature 160°C for baking period 8 min respectively. For milk ratio (3:1) R₅, moisture percent varies from 29.685 to 32.953, at temperature 180°C for baking period 14 min and at temperature 160°C for baking period 8 min respectively.

The mean value of moisture percent in ChhanaPodo sample ratio R₅ (3:1) = 31.444, is highest showing it is the best ratio followed by R₄.

Yield percent of ChhanaPodo

The yield of ChhanaPodo at cow & buffalo milk ratio (1:1) R₁ varies from 17.156 to 17.246, at temperature 180°C for baking period 14 min and at temperature 160°C for baking period 8 min respectively.

Similarly, for milk ratio (1:2) R_2 , yield of ChhanaPodo varies from 18.063 to 18.147, at temperature 180°C for baking period 14 min and at temperature 160°C for baking period 8 min respectively. For milk ratio (1:3) R_3 , yield of ChhanaPodo varies from 18.503 to 18.592, at temperature 180°C for baking period 14 min and at temperature 160°C for baking period 8 min respectively. For milk ratio (2:1) R_4 , yield of ChhanaPodo varies from 16.266 to 16.344, at temperature 180°C for baking period 14 min and at temperature 160°C for baking period 8 min respectively. For milk ratio (3:1) R_5 , yield of ChhanaPodo varies from 15.819 to 15.892, at temperature 180°C for baking period 14 min and at temperature 160°C for baking period 8 min respectively.

The mean value of yield percent in ChhanaPodo sample ratio R_3 (1:3) = 18.544, is highest showing it is the best ratio followed by R_2 .

The differences in the yield of product were due to the different in the ratio of cow & buffalo milk. The ratio of buffalo milk increased, the yield was increased, but the temperature and baking period increased, yield of the product decreased.

Five different cow & buffalo milk ratios i.e., R_1 (1:1), R_2 (1:2), R_3 (1:3), R_4 (2:1) & R_5 (3:1), and the three different levels of temperatures i.e., T_1 (160°C), T_2 (170°C) & T_3 (180°C), and four baking periods i.e., P_1 (8 min), P_2 (10 min), P_3 (12 min) & P_4 (14 min) were used in the present experiment work.

III. SUMMARY & CONCLUSIONS

Fat percentage of the ChhanaPodo ranges from 22.817 to 26.218. The minimum fat percent obtained for the formulation that the ratio R_5 (3:1) at temp 160°C for baking period 8 min (i.e., $R_5T_1P_1$). The maximum fat percentage contain was obtained by the milk ratio R_3 (1:3) at temp 180°C for baking period 14 min (i.e., $R_3T_3P_4$). Difference in the fat content of different treatment combinations were attributed due to the ratios variation of cow milk & buffalo milk, baking temperature and baking periods of ChhanaPodo.

Protein percentage of the ChhanaPodo ranges from 16.05 to 16.692. The minimum protein percent obtained for the formulation that the ratio R_5 (3:1) at temp 160°C for baking period 8 min (i.e., $R_5T_1P_1$). The maximum protein percentage contain was obtained by the milk ratio R_3 (1:3) at temp 180°C for baking period 14 min (i.e., $R_3T_3P_4$). Difference in the protein content of different treatment combinations were attributed due to the ratios variation of cow milk & buffalo milk, baking temperature and baking periods of ChhanaPodo.

Carbohydrate percentage of the ChhanaPodo ranges from 26.011 to 29.818. The minimum carbohydrate percent obtained for the formulation that the ratio R_5 (3:1) at temp 160°C for baking period 8 min (i.e., $R_5T_1P_1$). The maximum protein percentage contain was obtained by the milk ratio R_3 (1:3) at temp 180°C for baking period 14 min (i.e., $R_3T_3P_4$). Difference in the carbohydrate content of different treatment combinations were attributed due to the ratios variation of cow milk & buffalo milk, baking temperature and baking periods of ChhanaPodo.

Moisture percentage of the ChhanaPodo ranges from 25.287 to 32.953. The minimum moisture percent obtained for the formulation that the ratio R_3 (1:3) at temp 180°C for baking period 14 min (i.e., $R_3T_3P_4$). The maximum moisture percentage contain was obtained by the milk ratio R_5 (3:1) at temp 160°C for baking period 8 min (i.e., $R_5T_1P_1$). Difference in the moisture content of different treatment combinations were attributed due to the ratios variation of cow milk & buffalo milk, baking temperature and baking periods of ChhanaPodo.

Yield percentage of the ChhanaPodo ranges from 15.819 to 18.592. The minimum yield percent obtained for the formulation that the ratio R_5 (3:1) at temp 180°C for baking period 14 min (i.e., $R_5T_3P_4$). The maximum yield percentage contain was obtained by the milk ratio R_3 (1:3) at temp 160°C for baking period 8 min (i.e., $R_3T_1P_1$). Difference in the yield content of different treatment

combinations were attributed due to the ratios variation of cow milk & buffalo milk, baking temperature and baking periods of ChhanaPodo.

The quality of ChhanaPodo prepared from the different ratios of cow milk and buffalo milk are 1:1, 1:2, 1:3, 2:1 and 3:1 as indicated by R₁, R₂, R₃, R₄ and R₅ respectively. The three different levels of baking temperature at 160°C, 170°C and 180°C indicated as T₁, T₂, and T₃, respectively and the baking period of the ChhanaPodo were 8 min, 10 min, 12 min and 14 min for each treatment.

Among the different treatment combinations of ChhanaPodo on the basis of overall acceptability was found to be best combination was ratio R₄ (2:1) at 170°C level of temperature for the baking period was 12 min. The chemical properties of different treatments of products varied to a great extent and the microbial quality was found to be satisfactory, whereas the prepared ChhanaPodo was acceptable on the basis of microbial load up to 45 days under refrigerated storage condition. Therefore, it is concluded that cow milk and buffalo milk ratio R₄ (2:1) is best for good quality of ChhanaPodo.

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