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Physico-Chemical and nutritional significance of rice bran oil and its blends with sesame and palm oils in panner

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Abstract
Highest overall acceptability was found in T_0C_1 (8.51) followed by T_1C_1 (8.50), However, the difference in overall acceptability between Toc_1 and T_1C_1 was found to be non-significant. The flavor and taste score of 8.46 in T_oC_1 was found to be most acceptable followed by T_oC_2 (8.38) and T_1C_1 (8.38) the treatment combination T_1C_1 (8.5) was found to be most acceptable in terms of body and texture as it has the highest score of 8.50. The filled milk paneer T_oC_1 (8.65) was found to be most acceptable regarding colour and appearance followed by T_1C_1 (8.26).
Among the different treatment combinations T_1C_1 paneer contained the highest %age of moisture (53.58), fat (8.34) as well as yield (52.12). The treatment combination T_4C_3 contained the highest %age of protein (7.68). The highest %age of carbohydrate (31.08) was found in the treatment combination T_1C_3. The treatment combination T_oC_3 was found in the treatment combination T_1C_3. The treatment combination T_oC_3 contained the highest %age of ash (0.89).
However, the difference was found to be non-significant in all treatment combinations. Among the other treatment combinations the highest total solids %age of 47.70 was found in T_oC_3 to be highest followed by T_2C_3 (47.62). The production cost Rs. 57.75/kg. of the experimental paneer T_3C_1 was less as compared to other treatment combination. The energy value of paneer varied from 223.73 to 228.74 Treatment combination T_oC_3 had the highest energy value.

Keywords: rice bran oil, paneer, palm oil

Introduction
Indian is considered as an agrarian country in which major proportion of population is vegetarian. Milk plays an important role in the diet of such persons as a source of animals proteins. India is the largest milk producer in the world with a production of 112 MT, which increased by 3.3 present in the last fiscal. About half the milk produced is consumed in the liquid form and the remaining is used to prepare products such as ghee, curd, butter, khoa, Paneer, Cheese, Chhana, ice-cream and milk powders. Paneer is an important indigenous product which is obtained by heat treating the milk followed by acid coagulation using suitable acid viz, citric acid, lactic acid, tartaric acid, sour whey. The whey formed is removed to some extent through filtration and pressing. Paneer represents one of the soft varieties of cheese family and is used in culinary dishes/ snakes. About 5% of milk produced in India is converted in to Paneer. According to Prevention of Food Adulteration Act (1954)" Chhana or Paneer is the product obtained form cow or buffalo milk or a combination of these, by precipitation with sour milk, lactic or citric acids. It should not contain more than 10 percent moisture and the milk fat content should not be less then 50 percent of the dry matter."
Researches and medical boards have considered milk fat is a more saturated as compared to vegetable oils containing PUFA. Excessive fat (saturated) intake is a major causative factor in obesity and high blood pressure. Coronary heart disease has been linked of a number or other disorders as well as reports revealed that high dietary fat intake shortens clotting time of blood. High intake of fat increase risk of heart attack because of high proportions of saturated fat in the diet. Many nutritionist believe that if fat intake is reduced to provide less than 30 percent of the calories through fat and oil, dietary fat would not be risk factor at all in heart disease. In view of the increasing occurrence of coronary complications there is considerable interest to reduce / replace the milk fat in paneer with vegetable fat.
Edibles vegetables oils are the major sources of essential fatty acids in the diet. One of the vegetables oils which gained popularity in India in recent times is rice bran oil (RBO). Rice bran oil comes from the thin brown coating between the rice kernel and the protective husk. This coating called 'bran', bran contains valuable nutritious components such as proteins, vitamins, minerals and lecithin, Oil is extracted from this bran. During the extraction process, oils is carefully separated with the highly valued vitamins intact, As a result the oil is naturally fortified with an abundance of vitamin E, gamma oryzanol and the essential fatty acid. In comparison to other edible oils, rice bran oil has high content of squalene which is reported to be a quencher of singlet oxygen and free redical scavenger. Thus, rice bran oils one of the healthiest oil having desirable fatty acid composition with higher oxidative stability along with better cholesterol reducing power than all other edible oils. It contains certain unique micro-nutrients which are important for promotion and maintenance of good health Palm oil is dark yellow to yellow-red oil (high carotene content) of boiling the flesh of the fruit of the palm (*Elaeis guineensi*). Palm oil is rich in carotene from which it derives its bright, tropical, red colour. In fact carotene content of palm oil is 16 times higher than levels found in a carrot with the same mass and weight. This makes palm oil one of the main and richest sources of carotene and as such is important in combating vitamin A deficiency common in many developing countries. Sesame oil is of vegetable origin

and is obtained from sesame seeds by pressing. Then the sesame plant is similar in type to oil-seed rape and is cultivated in particular in the East Indies. Cold pressed sesame oil is light yellow, has a mild flavor and is odorless whereas hot pressed sesame oil is darker and has a more pungent taste. Sesame oil is know for its healing power.

Materials and Methods

The present study was undertaken with the objectives to develop suitable technology for preparation of filled milk Paneer, to assess the feasibility of using filled milk chhana for the preparation of paneer, to optimize level of fat replacement in paneer, to evaluate the organoleptice quality, chemical quality of filled milk paneer and cost of the product. There different ration of milk fat and vegetable oil i.e. 1:0, 1:1 and 2:1, indicated as T_o, T_1, T_2, T_3, and T4, respectively and there different types of coagulant i.e. sour chhana whey, lactic acid and citric acid indicated as C1, C2 and C3 respectively were used in the present study, Fifteen treatment combinations used in the study namely T_oC_1, T_oC_2, T_oC_3, T_1C_1, T_1C_2, T_1C_3, T_2C_1, T_2C_2, T_2C_3, T_3C_1, T_3C_2, T_3C_3, T_4C_1, T_4C_2, T_4C_3, were replicated six times. Sensory evaluation of the prepared paneer was carried out by using the nine point hedonic scale. Product was tested for moisture, fat, protein, carbohydrate, ash and total solids. Yield, energy value and cost of the product were also worked out for different treatment combinations. The data obtained during investigation were statistically analyzed by using factorial design and critical difference between combinations.

The materials and methods used for the preparation of paneer, the analytical proceedings and sequences of operation employed.

- Collection of ingredients.
- Analysis of milk.
- Standardization of Whole milk and Skim milk.
- Preparation of paneer.
- Plan of work.

Chemical analysis of Paneer

- Fat per cent.
- Protein per cent.
- Carbohydrate per cent.
- Ash per cent.
- Moisture per cent.

Sensory analysis of paneer.

- Flavour and taste.
- Body and texture.
- Colour and Appearance.
- Overall acceptability.

Statistical analysis of data

Yield and Cost of product.

Plan of experiment

Three different vegetable oil (Rice bran oil, Sesame oil, Plam Oil) were used for making paneer in the present experimental work. Paneer prepared from different treatment combinations were compared with each other. Fat and SNF content milk were at 5.5% and 8.5% respectively in all treatment combinations.

The different combinations used in the experiment were represented as follows:

Nations

- T_o: Paneer (fat and SNF %) from milk.
- T_1: Paneer prepared from filled milk containing rice bran oil.
- T_2: Paneer prepared from filled milk containing sesame oil.
- T_3: Paneer prepared from filled milk containing palm oil.
- $T_1\,C_1$: Paneer prepared from filled milk in which 50% milk fat was replaced by Rice bran oil.
- $T_2\,C_2$: Paneer prepared from filled milk in which 50% milk fat was replaced by Sasame oil.
- $T_3\,C_3$: Paneer prepared from filled milk in which 50% milk fat was replaced by Palm oil.
- $T_1\,R_1$: Paneer prepared from filled milk in which 25% milk fat was replaced by Rice bran oil.
- $T_2\,R_2$: Paneer prepared from filled milk in which 25% milk fat was replaced by Sasame oil.
- $T_3\,R_3$: Paneer prepared from filled milk in which 25% milk fat was replaced by Palm oil.

Sensory evaluation of Paneer.

Sensory evaluation of paneer was done on the basis of organoleptic tests by panel of five judges using hedonic score card based on the 9 point hedonic scale, scores were allocated for various parameters like flavor and taste, body and texture, colour and appearance and overall acceptability of filled milk paneer.

- Flavor and taste Scores.
- Body and Texture Scores.
- Colour and Appearance scores.
- Overall Acceptability.

Statistical analysis of data

The experimental design used will be (6×6×2) factorial. Statistically analysed using analysis of variance and three way classification with replication (r_n = 6, observation per experiment.

1. No. of treatment : 12
2. No of Replication : 06
3. Total Treatment combinations : 72

The standard error of mean and critical difference at 5 % and 1% level of significance will be also used.

Results and Discussion

This chapter deals with the results obtained during the experiments of the research work. The chemical composition and organoleptic parameters of filled milk Paneer was studied. Various experiments were conducted to obtain optimum values of the different parameters for good quality of Paneer. The finding are also illustrated diagrammatically. The results obtained from the analysis during the course off investigation are presented In this chapter and discussed in detail, in the following sequences:

Chemical evaluation of filled milk Paneer.

- Moisture percent
- Fat percent
- Protein percent
- Lactose percent
- Ash percent
- Total solids percent
- Organoleptic evaluation of Paneer

- Flavour and taste Scores.
- Body and Texture scores.
- Colour and Appearance scores.
- Overall Acceptability.
- Statistical analysis of paneer.
- Yield and Cost of product
- Moisture present in paneer.

The average percent moisture in paneer samples T_o, T_1, T_2, T_3, T_1C_1, T_2C_2, T_3C_3, T_1R_1, T_2R_2, and T_3R_3, were 51.18, 52.25, 51.42, 51.38, 52.48, 51.25, 52.30, 52.58, 51.18, and 51.26 respectively. The average percent moisture in paneer sample T_1R_1, (52.58) was higher than other samples. From the AVONA table, it was observed that the moisture percentage in Paneer samples reveals that the calculated values of F due to treatment (T) = 5200.06 due to oil (o) = 10366.66, as well as due to interactions between oil & concentration (O×C) = 4366.67, are greater than their respective table value F at 5 percent as well as I percent probably level. Hence, it can be concluded that there is high significant difference. Whereas, the calculated that there is high significant difference. Whereas, the calculated value of F values at 5 percent as well as I percent probability levels. Therefore, it can be concluded from the experimental data that there is non significant difference between concentration.

Fat in Paneer

The average percent fat in paneer samples T_o, T_1, T_2, T_1C_1, T_2C_2, T_3C_3, T_1R_1, T_2R_2 and T_3R_3 were 25.68, 24.68, 25.54, 25.64, 24.76, 25.67,24.60,24.58, 24.55 and 25.50 respectively. The average percent fat in paneer sample T_o (25.68) was higher than other samples. From the AVONA table, it was observed that the fat percentage in Paneer samples reveals that the calculated values of F due to treatment (T) = 2205.969, due to oil (o) = 4226.494, Due to concentration © = 812.2072 as well as due to interactions between oil & concentration (O×C) = 1660.294, are greater than their respective table value of Fat 5 percent as well as I percent probability level. Hence, it can be concluded that there is high significant difference.

Protein Content in Paneer

The average percent protein in paneer samples T_o, T_1, T_2, T_1C_1, T_2C_2, T_3C_3, T_1R_1, T_2R_2 and T_3R_3 were 18.69, 18.71, 18.61, 18.61, 18.55, 18.67, 18.70, 18.55, 18.62 and 18.60 respectively. The average percent protein in paneer can be observed that the sample, T_o (18.69) was higher than other samples. From the AVONA table, it was observed that the Protein percentage in Paneer samples reveals that the calculated values of F due to treatment (T) = 100.05, due to oil (O) = 116.05, due to concentration (c) = 60 as well as due to interactions between oil & concentration (O×C) = 106, are greater than their respective table value of F at 5 percent as well as 1 percent probability level. hence, It can be concluded experimental data that there is high significant difference.

Lactose in Paneer

The average percent lactose in paneer samples T_o, T_1, T_2, T_1C_1, T_2C_2, T_3C_3, T_1R_1, T_2R_2 and T_3R_3 were 2.51, 2.43, 2.49, 2.41, 2.30, 2.46, 2.48, 2.40 and 2.49 respectively. The average percent in paneer can be observed that the Lactose T_o (2.51) was higher than other samples. From the ANOVA table, it was observed that the Lactose percentage in Paneer samples reveals that the calculated values of F due to treatment (T) = 12.05, due to oil (O) = 214.05, Due to concentration (C) = 28.33 as well as due to interactions between oil & concentration (O×C) = 114.6, are greater than their respective table value of F at 5 percent as well as 1 percent probability level. Therefore, it can be concluded from the experimental data that there is high significant effect/

Ash in Paneer

The average percent Ash in paneer samples T_o, T_1, T_2, T_1C_1, T_2C_2, T_3C_3, T_1R_1, T_2R_2 and T_3R_3 were 1.94, 1.93, 1.94, 1.96, 1.91, 1.95, 1.92, 1.90, 1.90 and 1.89 respectively. The average percent Ash in paneer sample T_1 (1.93) was higher than other samples. From the AVOVA table, it was observed that the Ash percentage in Paneer samples reveals that the calculated values of F due to treatment (T) = 49.07 due to oil (O) = 37.78, as well as due to interactions between oil & concentration (O×C) = 30.28, are greater than their respective table value of F at 5 percent as well as 1 percent probability level. There fore, it can be concluded from the experimental data that there is significant effect. Whereas the calculated values of F due to concentration (C) = 125.08 greater than their respective table value of F at 5 percent as well as I percent probability level. Therefore, it can be concluded from the experimental data that there is significant difference.

Total Solids in Paneer

The average percent Total solids in paneer samples T_o, T_1, T_2, T_1C_1, T_2C_2, T_3C_3, T_1R_1, T_2R_2 and T_3R_3 were 48.82, 47.75, 48.58, 48.62, 47.52, 48.75, 47.70, 47.42, 48.82 and 48.74 respectively. The average percent Total solids in paneer sample T_o (48.82) and T_2R_2 (48.82) are similar and higher than other samples. From the ANOVA table, it was observed that the Total solids percentage in paneer samples reveals that the calculated values of F due to treatment (T) = 11022 due to oil (O) = 14252, due to concentration (C) = 14117 as well as due to interactions between oil & concentration (O×C) = 8375, are greater than their respective table value of F at 5 percent as well as I percent probability level. There fore, it can be concluded from the experimental data that there is high significant difference.

Overall Acceptability in Paneer

The average percent overall acceptability in paneer samples T_o, T_1, T_2, T_1C_1, T_2C_2, T_3C_3, T_1R_1, T_2R_2 and T_3R_3 were 8.43, 7.91, 8.50, 8.42, 7.87, 8.43, 8.37, 7.64, 8.34 and 8.38. respectively. The average percent overall acceptability in paneer sample T_2 (8.50) was higher than other samples. From the ANOVA table, it was observed that the overall acceptability percentage in Paneer samples reveals that the calculated values of F due to treatment (T) = 2740, due to oil (O) = 9408. due to concentration (c) = 483.2 as well as due to interactions between oil & concentration (O×C) = 159, are greater than their respective table value of F at 5 percent as well as 1 percent probability level. Therefore, it can be concluded from the experimental data that there is high significant difference.

Yield of Paneer

The average percent yield of paneer samples T_0, T_1, T_2, T_3, T_1 C_1, T_2 C_2, T_3 C_3, T_1 R_1, T_2 R_2, and T_3 R_3, were. respectively. 20.69, 20.67, 20.25, 20.14, 20.21, 19.97, 20.38,20.11, 20.05 and 19.89. The average percent yield of paneer sample T_0 (20.69) was higher than other samples. From the ANOVA table, it was observed that the yield percentage in Paneer samples reveals that the calculated values of F due to treatment (T) = 2985, due to oil

(O) = 7258, due to concentration (C) = 2073 as well as due to interactions between oil & concentration (O×C)=1152, are greater than their respective table value of F at 5 percent as well as 1 percent probability level. Therefore, it can be concluded from the experimental data that there is high significant difference.

Cost of Product

The average percent cost of paneer samples T_0, T_1, T_2, T_3, T_1 C_1, T_2 C_2, T_3 C_3, T_1 R_1, T_2 R_2 and T_3 R_3, were. 150.5, 100.70, 100.61, 110.56, 100.09, 100.89, 108.92, 100.70, 100.99 and 108.50 respectively. The average percent cost of paneer sample T_0 (150.5) was higher than other samples. From the ANOVA table, it was observed that the cost percentage in Paneer samples reveals that the calculated values of F due to treatment (T) = 68225.09, due to oil (O) = 250136.78, due to concentration (C) = 325.844 as well as due to interactions between oil & concentration (O×C) = 986.5929, are greater than their respective table value of F at 5 percent as well as 1 percent probability level. Therefore, it can be concluded from the experimental data that there is high significant difference. Similar observation made by Srilakshmi (2002) [1], Srinivasan and Anantatrisham (2004), Venkateswarly, *et al*. (2003) [3], Zobkova *et al*. (2007), Anita and Abraham (2000) [5].

Conclusion

- On the basis of results obtained in the present investigation, it was concluded that the different treatment combinations of filled milk paneer on the basis of overall acceptability was found to be best combination ratio was T_1R_1 (2:1).
- The chemical properties of different treatments of products varied to a great extent.
- The cost of the products was found to be satisfactory, whereas the prepared filled milk panneer was acceptable. Therefore, it was concluded that skim milk and rice bran oil ratio (T_1R_1 =2:1) was found to be the best for preparing good quality of paneer.

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