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Effect of fat levels in milk on physicochemical attributes of paneer

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Abstract

The present investigation was undertaken to study the effect of Fat Levels in Milk on Physico-Chemical Attributes of Paneer. For the preparation of paneer during the current investigation fresh buffalo milk was standardized for 6% fat (control) and cow milk for 5.0 (T_1), 4.5 (T_2), 3.5 (T_3), and 2.5% fat (T_4). Synthetic citric acid (2.0% w/v) was used as a coagulating agent. The coagulation process was completed at the temperature of 80°C. Paneer was prepared from standardized milk using standardized procedures and yield, nutrient recovery, and composition of paneer were determined. Data obtained were subjected to statistical analysis using suitable models. The level of fat in milk had a significant ($P<0.01$) effect on yield, and nutrients recovered. Paneer yield and recovery of fat, protein, and total solids decreased with the decrease in the level of fat in milk used for preparing paneer. A decrease in the level of fat in milk increased the contents of moisture, fat, calcium, and phosphorus; decreased FDM, and could not affect pH, protein lactose, and ash in manufactured paneer.

Keywords: Buffalo milk paneer, Composition of paneer, Cow milk paneer, Fat levels, Paneer, Recovery of paneer.

Introduction

Paneer, a coagulated milk product, is an important indigenous nutritious and wholesome dairy product of great value in the diet because it is a rich source of high-quality protein, fat, minerals, and vitamins and is similar to an un-ripened variety of soft cheese (Kumar et al 2011). Although it is commonly prepared from buffalo milk (Singh and Kanawjia 1991) but various workers have also successfully utilized cow and goat milk for the preparation of paneer/chhana (Sharma et al 1998). The economics of paneer manufacture work out to be more favorable as compared to fluid milk and other products. (Sachdeva and Singh 1990).

Good quality paneer is characterized by a marble white color in appearance, sweetish, mildly acidic, nutty flavor, cohesive and spongy body, and close-knit texture. Buffalo milk paneer has all these attributes, hence preferred over cow milk paneer which is of inferior quality due to its very compact and fragile body and its pieces lose their identity in cooking (Sachdeva et al 1985).

Good quality paneer is obtained by heating milk to about 90°C, acidifying the hot milk by adding citric acid solution followed by removal of whey and pressing of the curd before cooling the pressed mass in chilled water. The technology of manufacturing this milk product from buffalo milk has been standardized to obtain the most acceptable and safe product with maximum recovery of solids (Sachdeva and Singh 1988). Subsequently, the process of preparing paneer of acceptable quality from cow milk has also been developed (Sachdeva et al 1991).

Good quality paneer has been prepared from goat milk using citric acid (0.15% w/w) and fermented paneer whey as coagulants and packed in polypropylene bags could safely be preserved for three days under refrigeration (4+1°C) (ICAR 2001).

Keeping the importance of this indigenous milk product, the present investigation was undertaken to study the effect of Fat Levels in Milk on the Physico-Chemical Attributes of Paneer.

Materials and methods

For the preparation of paneer (a coagulated milk product) during the current investigation fresh milk from cow and buffalo obtained from local dairies were separated in the laboratory and cow and buffalo skim milk and creams both were used in standardizing milk at different levels of fat as per experimental requirements i.e. buffalo milk testing 6 (control) and cow milk testing 5.0 (T_1), 4.5 (T_2), 3.5 (T_3) and 2.5% fat (T_4). Synthetic citric acid at the rate of 2.0% (w/v) concentration was used as a coagulating agent. The coagulation process was completed at the temperature of 80°C. A lot of 3 lit of standardized milk were formulated every time to manufacture each batch of paneer. The milk product was prepared from standardized milk using the procedure of Bhattacharya et al (1971) as modified by Sachdeva (1983) and yields were recorded. The paneer samples were subjected to analysis chemically for Yield, Moisture, Titratable acidity, pH, Fat, FDM, Protein, Lactose, Ash, Calcium, and Phosphorus (AOAC 1980, ISI 1973, ISI 1977, ISI 1981). Data obtained during the present study were subjected to statistical analysis as described by Snedecor and Cochran (1994).

Results and discussion

Observations recorded (Table 1) revealed that the level of fat in milk affected yield, and nutrients recovered in paneer. The highest yield was obtained in paneer that was made under control whereas the lowest was under T_4. The yield of paneer under T_3 and T_4 and T_1, T_2, and T_3 remained similar to each other. Paneer yield was decreased with the decrease in the level of fat in milk used for manufacturing this milk product (Pal et al 1991).

Table 1: Effect of Fat Levels in Milk on Recovery of Nutrients in Paneer

Parameters (%)	Milk Fat Levels				
	6.0%	5%	4.5%	3.5%	2.5%
Yield	22.42 $\pm 0.15^{C}$	17.65 $\pm 0.46^{B}$	17.77 $\pm 0.18^{B}$	16.8 $\pm 0.07^{A,B}$	15.27 $\pm 0.40^{A}$
Fat	82.22 $\pm 3.55^{B}$	80.76 $\pm 2.25^{A,B}$	78.01 $\pm 4.43^{A,B}$	74.81 $\pm 2.95^{A,B}$	68.77 $\pm 2.86^{A}$
Protein	92.88 $\pm 2.21^{C}$	68.85 $\pm 1.97^{B}$	68.20 $\pm 2.19^{B}$	70.72 $\pm 0.48^{B}$	52.45 $\pm 0.86^{A}$
Total solids	84.67 $\pm 0.18^{C}$	76.64 $\pm 1.68^{B}$	76.09 $\pm 0.32^{B}$	72.26 $\pm 0.68^{A,B}$	66.91 $\pm 0.38^{A}$

^{A,B,C} Values bearing different superscripts within the row differed significantly ($P<0.01$.)

Fat recovery in paneer made under T_1, T_2, T_3, and T_4 and Control, T_1, T_2, and T_3 remained the same each other (Sanyal and Yadav 2000[a]). Fat recovery in paneer decreased with the decrease in fat level in milk. Present findings about fat recovery in paneer confirmed the findings reported earlier (Agnihotri and Pal 1996). Protein recovery in paneer made under T_1, T_2, T_3, and T_4 and Control, T_1, T_2, and T_3 remained similar to each other (Sanyal and Yadav 2000[a]). These observations confirmed the findings reported earlier (Bund and Pandit 2007, Pandya and Ghodke 2007, Kumar et al. 2008, Verma and Khan 2009). Protein recovery in paneer was decreased with the decrease in the level of fat in milk used for manufacturing this milk product. The high content of protein in milk used to manufacture paneer is responsible for high loss and low recovery of the nutrient. The fact could be associated with the reason for the decrease in

protein recovery in the finished product. Total solids (TS) recovery in paneer under T_3 and T_4; and T_2, T_3, and T_4 TS remained similar to each other. Total solids recovery in paneer was decreased with the decrease in the level of fat in milk used for manufacturing this milk product. The observations about the recovery of total solids in paneer confirmed the findings reported earlier (Vishweshwaiah and Ananta Krishnan 1986, Singh and Kanwaji 1988, Sharma et al 2002, Farooquei et al 2008, Kumar et al 2008, Deshmukh et al 2009, Harjai et al 2009; Jadhavar et al 2009, Nalkar et al 2009). The high content of total solids in milk used to manufacture paneer is responsible for the high loss of nutrients.

Highest moisture, titratable acidity, and phosphorus content in paneer (Table 2) were obtained under T_4 and lowest under control; highest fat, FDM, protein, and calcium under control and lowest under T_4, whereas the highest lactose under T_3 and lowest under control and highest ash under T_4 and lowest under T_2.

Table 2: Effect of Fat Levels in Milk on Physico-chemical Attributes of Paneer

Attributes (%)	Milk Fat Levels				
	6.0%	5%	4.5%	3.5%	2.5%
Moisture	49.33 $\pm 0.43^{A}$	50.06 $\pm 0.21^{A}$	52.89 $\pm 0.67^{A,B}$	54.84 $\pm 0.25^{B,C}$	56.12 $\pm 0.93^{C}$
Titratable acidity	0.17 $\pm 0.01^{A}$	0.18 $\pm 0.00^{A}$	0.18 $\pm 0.01^{A}$	0.21 $\pm 0.00^{A,B}$	0.26 $\pm 0.01^{B}$
pH	5.85 ±0.05	5.85 ±0.05	5.93 ±0.05	5.94 ±0.05	5.97 ±0.05
Fat	24.69 $\pm 1.08^{C}$	21.17 $\pm 0.32^{B,C}$	17.4 $\pm 0.55^{A,B}$	16.66 $\pm 0.86^{A}$	15.27 $\pm 0.61^{A}$
FDM	48.7 $\pm 1.80^{B}$	42.4 $\pm 0.79^{A,B}$	37 $\pm 1.69^{A}$	36.86 $\pm 1.71^{A}$	34.84 $\pm 1.60^{A}$
Protein	18.22 $\pm 0.32^{B}$	17.16 $\pm 0.19^{A,B}$	16.87 $\pm 0.38^{A,B}$	18.52 $\pm 0.05^{B}$	15.14 $\pm 0.41^{A}$
Lactose	2.49 $\pm 0.03^{C}$	2.35 $\pm 0.00^{B,C}$	2.2 $\pm 0.05^{B}$	2.03 $\pm 0.01^{A}$	2.45 $\pm 0.04^{C}$
Ash	1.84 $\pm 0.09^{B}$	1.75 $\pm 0.00^{A,B}$	1.54 $\pm 0.02^{A}$	2.04 $\pm 0.01^{B}$	2.13 $\pm 0.04^{C}$
Calcium	0.49	0.5	0.51	0.52	0.53

	±0.00^{A}	±0.00A,^{B}	±0.00^{A,B}	±0.01^{A,B}	±0.01^{B}
Phosphorus	0.54 ±0.00^{A}	0.55 ±0.01^{A,B}	0.56 ±0.01^{A,B}	0.57 ±0.01^{A,B}	0.58 ±0.01^{B}
^{A,B,C} Values bearing different superscripts within the row differed significantly, (P<0.05.)					

The moisture content in paneer obtained under T_4 and T_2, T_3 and T_2, and T_2, T_1, and control remained non-significant to each other. The titratable acidity of paneer was obtained under T_4 and T_3; and T_3, T_2, T_1, and control remained similar to each other. The fat content in paneer was obtained under T_4, T_3, and T_2; T_2 and T_1; and T_1 and control remained nonsignificant to each other. The FDM of paneer was obtained under T_4, T_3, T_2, and T_1; and T_1 and control remained similar to each other. The protein content in paneer was obtained under T_4, T_2, and T_1; and T_3, T_2, T_1, and control remained similar to each other. The lactose content in paneer was obtained under T_2, and T_1; and T_4, T_1, and control remained similar to each other. The ash content in paneer obtained under T_3, and T_1 remained similar to each other. The calcium content in paneer manufactured from milk testing T_4, T_3, T_2, and T_1 and T_3, T_2, T_1, and control remained similar to each other. The phosphorus in paneer was obtained under T_4, T_3, T_2, and T_1; and T_3, T_2, T_1, and control remained similar to each other.

Moisture, fat, calcium, and phosphorus content in paneer was increased with the decrease in the level of fat in milk used for manufacturing (Torres and Chandan 1981, Chawla et al 1985, Vishweshwaiah and Ananta Krishnan 1986, Singh and Kanwaji 1988, Parmar et al 1989, Mistry et al 1990[a], Mistry et al 1990[b], Desai et al 1991, Gupta et al 1992, Pal and Kapoor 2000, Sanyal and Yadav 2000[a], Sanyal and Yadav 2000[b], Sharma et al 2002, Upright and Mishra 2004, Topcua and Saldamlia 2006, Kumar et al 2008, Deshmukh et al 2009, Goyal and Gandhi 2009, Mathare et al 2009, Sahul and Das 2009). FDM of paneer was decreased with the decrease in the level of fat in milk used for manufacturing this milk product (Nalkar et al 2009, Pal et al 1991). Levels of fat in raw milk did not have any significant influence on pH, protein lactose, and ash content in the resultant paneer (Arora and Gupta 1980, Chawla et al 1987, Kanawjia et al 1990, Jindal et al 1993, Agnihotri and Pal 1996, Khan and Pal 1997, Kanawjia and Singh 2000, Nanda et al 2004, Bund and Pandit 2007, Kumar et al 2007, Pandya and Ghodke 2007, Farooquei et al 2008, Nanda et al 2008, Divya and Kumari 2009, Harjai et al 2009, Jadhavar et

al 2009, Verma and Khan 2009, Yadav and Grover 2009, Kandeepan and Sangma 2011, Pawar et al. 2011).

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