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# Paneer: An overview

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**Abstract**
The paneer represents the soft South Asian cheese prepared by the acidity and thermal coagulation of milk. Popular throughout South Asia and is used to prepare several dishes and snacks. A rich source of high quality animal proteins, fats, minerals, and vitamins. Due to the availability of different types of milk, various techniques for the production of paneer have been developed according to consumer requirements, where variations in milk composition significantly improve yield and other quality characteristics.

**Keywords:** Paneer, coagulants, preservatives, heat treatment, sensory quality

## Introduction
Milk is the almost complete ideal food in nature. It provides energy from fat and lactose, proteins and vitamins for body construction and health and minerals for bone development. Milk contains all above nutrients in an easily digested and assimilable form, so it is regarded as most ideal complete food. Milk is a vital diet for pregnant women, growing children, adolescents, adults, invalids, convalescents, and patients because of these characteristics. A single glass of milk is loaded with 15 essential vitamins and nutrients it contains protein, carbohydrate and calcium. Milk is perishable product, it spoils quickly, therefore rural milk producers make a variety of indigenous milk products like as channa, paneer, khoa, dahi, butter, and ghee to preserve milk. It also helps in promoting the consumption of milk solids and in improving nutritional status of rural people (Bhadekar *et al*. 2008) +. For the last decade, India has become the world's largest milk producer. India's total milk production in 2019-20 was 198.4 MT, with a per capita availability of 407 g/day. India constitutes approximately to 22% of world milk production. When there is a surplus of milk, a variety of traditional milk products are produced. Paneer is a soft cheese from South Asia that is made by coagulating milk with acid and heat. It is a form of cheese that is non-fermentative, non-renneted, non-melting, and unripened (Aneja, 2007) [2]. An estimated 5% of milk produced in India is converted to paneer (Chandan 2007) [18]; production was 3,959 MT in 2002-03, and increased to 4,496 MT in 2003-04 (Joshi 2007; Shrivastava and Goyal 2007) [9, 15], representing a 13% increase. In India, 50-55% of milk is converted into traditional dairy products (Singh, 2018). Paneer manufacturing in India has mostly been confined to the unorganised dairy industry. Paneer is made from around 1% of the country's total milk supply, with an annual production of about 1,50,000 tonnes (Aneja *et al*., 2007) [2]. Paneer's popularity has grown in India over the last several decades, spreading from the north to the south. Paneer's estimated market (traditional and organised sectors) was worth Rs.21 crores in 2002-03, and production was 4,496 MT in 2004. (Joshi, 2007) [9]. Except for the loss of some soluble whey proteins, lactose, and minerals, paneer contains all of the milk components (Singh and Kanawjia, 1988) [16]. Paneer has a high fat content (22-25%), a moderate protein content (16-18%), and a low lactose content (2.0 to 2.7%) (Kanawjia and Singh, 1988) [16].
Paneer is a high-quality source of animal protein that is inexpensive. It is a significant source of animal protein for vegetarians. Paneer has a biological value of 80 to 86, which is above and beyond its high protein content and digestibility (Shrivastava and Goyal 2007) [15]. Paneer is also a good source of fat, vitamins, and minerals such as calcium and phosphorus. As a result, a consistent technique for paneer production is required. Milk should be standardised to a fat and SNF ratio of 1:1.65, regardless of kind, to ensure that the end product meets PFA standards.

Chhana or Paneer means the product obtained from any variant of milk, with or without added milk solids, by precipitation with permitted acidulants and heating. It shall not contain more than 60.0% moisture and the milk fat content shall not be less than 50.0% of the dry matter (FSSR, 2011) [8]. Paneer, like other indigenous product is a highly perishable product and suffers from limited shelf life, largely because its high moisture content (Arora and Gupta, 1980) [4]. Paneer is highly susceptible to spoiling, and the microbiological quality of the product is mostly determined by post-manufacturing circumstances, handling, packing, and storage. The shelf-life of paneer is reported to be only 6 days under refrigerated condition (Bhattacharya *et al*. 1971) [6]. While at room temperature it becomes unfit for consumption usually after 1 day (Aneja, 2007) [2]. Paneer spoiling is caused mostly by the growth of microorganisms (Thakral, 1986) [17], which cause different physico-chemical changes in the product, resulting in the formation of an off-flavour. As per the Bureau of Indian standard (IS:10984, Part III, 1983), the total plate count should not exceed 2 x $10^5$, coliform count not more than 90 and yeast and mold count not more than 250 cfu/g of paneer.

**Methods of manufacture**

Traditional method for paneer preparation: Milk is first boiled followed by coagulation and straining to run off the whey completely. Heat is maintained uniformly until complete coagulation. Coagulant was added at the rate of 1-2% with coagulation time of 30 seconds.

Industrial method for preparation of paneer: High quality raw milk was standardised to fat/SNF ratio of 1:1.65 using standardized pasteurized milk and full cream milk and then heat treated at 95 °C for 10-15 min and cooled to 70 °C. Citric acid was added at 1% with proper agitation until coagulation is completed. Then the curd is allowed to settle for 5 minutes without stirring until temperature reaches 63 °C. Then the cured along with whey is hooped and pressed at 3 kg/cm²) for 20 minutes and chilled with water (4 to 6 °C) for 2 hours. Then it is dipped in brine solution (1.14%) for 1 hr. Block is stored at 7±1 °C overnight and the vacuum packed with 3-layer laminated LDPE.

Modern method employed for paneer: Ultrafiltration process increased product yield by up to 35% due to the retention of whey solids as compared to the conventional batch process which resulted in only 15% (Mathur, 1997) [6]. Cow milk concentrated by nanofiltration at 50 °C to about 1.5 and 2.0 folds produced paneer with lower hardness but excessive bitterness than the paneer prepared from un-concentrated cow milk (Pal *et al*., 2002) [14]. Concentration of skim milk up to four times by ultrafiltration after addition of 2.5% starter culture and 0.5% salt resulted in subsequent reduction in the hardness of paneer. Paneer prepared from buffalo milk must be homogenous and have a pleasant white colour with a greenish tinge, but paneer made from cow milk must be light yellow. Paneer has a soft, cohesive, and compact texture, as well as a moderate acidic flavour with a hint of sweetness. It works well as a meat substitute in Indian cuisine. By removing oxygen, vacuum packaging of food products is intended to slow or stop oxidative processes and hinder microbiological growth. Food goods with vacuum packaging have a two-to three-fold increase in shelf life (Andress, 2006) [1]. The majority of milk products come in a variety of packaging types. Low-cost, readily available packaging materials should be used. Many novel packaging techniques, such as vacuum packaging, have flooded the market recently. It's done by removing all of the air from a package and not replacing it with another gas, then closing the pouch under negative pressure. A pressure differential exists between the package exterior and internal environment during vacuum packaging (Brody, 1989) [7]. Because of the action of microorganisms in food, the gaseous atmosphere within the package changes during storage. As a result, vacuum packaging can be thought of as a form of atmospheric modification. Food is not exposed to atmospheric oxygen, moisture, or fluctuating temperatures in vacuum packaging, making it susceptible to bacterial and enzymatic growth, which can lead to contamination, discoloration, and spoilage. Food products are vacuum packaged using high barrier film packaging materials such as 7-layer NYLON/EVOH/70polyethylene and 12-layer PET/70polyethylene pouches, which prevent the growth of aerobic spoilage microbes, lipid oxidation, and moisture evaporation (Kykkidou and Giatrakou, 2009) [3]. It prevents products from coming into contact with ambient oxygen, potentially extending the shelf life of any fresh perishable product by 2 to 3 times at refrigerated temperatures. During storage, lipolysis and proteolysis produce a significant loss of sensory, physico-chemical, and textural qualities of dairy products (such as paneer, cheese, and yoghurt). Temperatures, moisture, and the presence of microorganisms all influence fat lipolysis. In dairy products, lipolysis releases free fatty acids, which induce rancid, butyric, bitter, dirty, soapy, or astringent flavour defects. Free fatty acids (FFAs) increased during storage, according to Arora *et al*. (1996) [3]. Flavour deterioration in dairy products due to lipolysis is a severe issue that affects storage stability. Proteolysis, on the other hand, causes protein to be broken down, resulting in the formation of peptides and free amino acids. Proteolysis has a negative impact on the body and texture of dairy products, as well as flavour problems. Protein proteolysis is characterised by an increase in tyrosine content. Bitterness, uncleanliness, sourness, and tenuous defects are all caused by tyrosine release. Paneer has a short life span of about 2-3 days at refrigeration storage condition without much deterioration in the quality, but freshness of the product is lost after 1 day. Paneer, when vacuum packed, extends its shelf life up to 14 days at refrigerated condition (7-10 °C). But after 14 days, there is an observable spoilage found within those vacuum-packed paneers which includes acid production, off flavour production, souring etc. The major reason behind such spoilage is contaminated by some spoilage bacteria which can either grow or can adapt refrigerated as well as vacuum condition for more than 14 days leading to spoilage. Hence there is a need for understanding the type of spoilage microflora as well as the spoilage characteristics. Organized sector generally maintains intense hygienic practices and hence targeting and thereby identifying those spoilage microbes and hence understanding their biochemical, proteolytic, lipolytic, acid producing properties will help then extend the shelf life of vacuum-packed paneer for more than 14 days at refrigerated condition. Paneer, like other indigenous products, is a highly perishable product and suffers from limited shelf life, largely because of its high moisture content (Arora and Gupta, 1980) [4]. Paneer is a South Asian variety of soft cheese prepared by acid and heat coagulation of milk with suitable coagulating material (Khan and Pal, 2011) [11]. It consists of various high-quality nutrients like fat, protein, minerals, and vitamins. Khan and Pal (2011) [11] suggested that there is a need to adopt a standard procedure for paneer manufacture. Kumar *et al*. (2014) [12]

reported that the paneer has a marble white appearance also having a firm, cohesive, and spongy body with a close-knit texture and a sweetish-acidic-nutty flavour. It can be prepared from various types of milk and also using various types of techniques which result in wide variation in physico-chemical, microbiological, sensorial, and textural quality of the product. Paneer can be kept well for a day at room temperature and a week under refrigerated condition (7 °C). According to Food Safety and Standards Authority of India (FSSAI, 2017), Paneer means the product obtained from any variant of milk with or without added milk solids, by precipitation with permitted acidulants (such as lactic acid, citric acid, malic acid, vinegar, sour whey) and heating. It should contain minimum 50% fat on dry matter basis and moisture should not exceed 60%. The spices and condiments are permitted only in flavoured paneer.

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