

The Role of Cheese in Nutrition and Health: A Focus on Probiotic Enrichment and Composition

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Probiotics are defined as live microorganisms that, when administered in sufficient quantities, confer health benefits to the host.

These beneficial microbes play vital roles in enhancing immunity, protecting against pathogenic infections, improving lactose digestion, and reducing cholesterol levels. A variety of dairy products—such as yogurt, cheese, and other fermented milk items—are commonly used as vehicles for probiotic delivery. For probiotics to exert their beneficial effects, their concentration at the time of consumption should typically range between 5.0 and 7.0 log cfu/g. Among dairy products, cheese is considered one of the most effective carriers of probiotic bacteria due to its

buffering capacity, which protects the probiotics in the acidic environment of the gastrointestinal tract. This buffering effect increases the pH during digestion,



creating a favorable condition for probiotic survival. Various types of cheeses—such as Karish, Cheddar, Gouda, Ras, Cottage cheese, and other fresh or white cheeses—have been developed using specific

probiotic strains. These strains are selected based on the type of cheese and its manufacturing parameters. Fresh cheese or cheese in the early ripening phase typically has a higher count of lactic acid bacteria, whereas non-lactic acid bacteria tend to increase with extended ripening time. Importantly, incorporating

probiotics should not compromise the cheese's sensory or textural quality.

Cheese offers unique advantages over yogurt and fermented milk as a delivery system for probiotics. Its inherent buffering action in the gastrointestinal tract enhances the survival of probiotics by mitigating the effects of gastric acidity, thus promoting their efficacy.

Nutritional and Functional Attributes of Cheese

Cheese has played a significant role in human diets since ancient times, initially serving as a concentrated form of milk with extended shelf life. Its high fat and protein content made it a valuable energy source for early populations. Today, scientific research continues to highlight cheese as a nutritionally dense food, abundant in essential nutrients such as proteins, amino acids, bioactive peptides, fats, fatty acids, vitamins, and minerals. A notable benefit is that ripened cheese contains minimal to no lactose, making it suitable for lactose-intolerant individuals.

Recent studies have identified two bioactive tripeptides—valyl-prolyl-proline (VPP) and isoleucyl-prolyl-proline (IPP)—in fermented milk with *Lactobacillus helveticus*, which exhibit blood pressure-lowering effects. These peptides have also been detected in certain cheese types in significant amounts.

Cheese is widely appreciated for its sensory appeal and versatility, making it suitable for all age groups and dietary applications. Its popularity and

multifunctionality also create avenues for its commercial development as a probiotic food. However, successful production of probiotic cheeses requires detailed knowledge of their processing steps and a comprehensive understanding of how these steps affect the viability of probiotic cultures during storage and consumption.

Cheese Composition

Cheese varieties can be categorized based on multiple factors:

Milk Source: Cow, goat, sheep, buffalo

Manufacturing Technique: Rennet-based, sour milk cheese, ultrafiltration

Consistency: Extra-hard, hard, semi-hard, semi-soft, soft, fresh

Fat Content: Ranging from double cream to quarter fat

Fermentation Type: Lactic acid, propionic acid, butyric acid

Surface Characteristics: Washed rind, bloomy rind, mold ripened

Interior Features: Eye formation, internal mold development

In addition to variations in texture and flavor, cheese also contains a wide range of bioactive compounds formed during ripening, primarily through fermentation, proteolysis, and lipolysis of lactose, proteins, and fats.

Average Composition of Different Cheese Types

Cheese Type	Water (g/kg)	Protein (g/kg)	Fat (g/kg)	Lactose (g/kg)	Minerals + Vitamins (g/kg)
Fresh Cheese	700	110	80	30	80

Soft Cheese	520	200	220	0	60
Semi-hard Cheese	400	250	270	0	80
Hard Cheese	350	270	310	0	70
Extra-hard Cheese	300	290	330	0	80

Cheese Manufacturing Process

1. Milk Preparation and Standardization

Raw milk is adjusted to ensure the desired ratio of casein to fat, which influences yield and quality.

2. Coagulation

Coagulation is induced by adding rennet (chymosin) or food-grade acid (e.g., lactic acid), causing milk proteins to curdle.

3. Cutting, Draining, and Curd Handling

Once curds are formed, they are cut to facilitate whey expulsion. Depending on the cheese type, processes like heating, stretching, or pressing (e.g., Cheddaring or Mozzarella-style stretching) are applied.

4. Salting and Molding

Salt is either added directly to the curd or applied externally to influence flavor, texture, and microbial stability.

5. Ripening

Cheese undergoes maturation under controlled conditions, leading to microbial, biochemical, and sensory transformations. Ripening methods vary by cheese type: surface mold (e.g., Brie), internal mold (e.g., Roquefort), bacterial smear (e.g., Limburger), or propionic fermentation (e.g., Swiss-type).

Health Benefits of Probiotic-Enriched Cheese

Probiotic cheeses are associated with a broad spectrum of health-promoting effects. These include:

- Alleviation of gastrointestinal disorders
- Antimicrobial properties
- Enhancement of lactose metabolism
- Lowering of serum cholesterol levels
- Modulation of immune responses
- Antimutagenic and anticancer potentials
- Reduction in diarrheal episodes
- Management of inflammatory bowel disease
- Suppression of *Helicobacter pylori* infection

Nutritional Advantages and Functional Components

- **Macronutrients:** Cheese is rich in high-quality protein and saturated fats, providing essential amino acids and fat-soluble vitamins.
- **Bioactive Components:** Contains functional lipids like CLA and phytanic acid. Ripening enhances the formation of peptides with antihypertensive, antioxidative, and anti-inflammatory activities.
- **Micronutrients:** An excellent source of calcium, phosphorus, vitamin A, B-complex vitamins (especially B12 and riboflavin), and sometimes vitamin D.

Potential Health Risks

Despite its benefits, cheese may pose certain health risks due to:

- High levels of saturated fat and sodium
- Accumulation of biogenic amines (e.g., histamine) during ripening
- Possible presence of mycotoxins in mold-ripened varieties

Conclusion

Cheese stands out among dairy products as an effective medium for delivering viable probiotics into the human digestive tract. A viable count of at least 6.0 log cfu/g

is considered sufficient for probiotics to offer their health benefits. Importantly, incorporating probiotics generally does not alter the chemical composition of cheese, though it may impact sensory properties such as flavor and texture. Therefore, probiotic strains must be carefully selected in accordance with the specific cheese type and its processing conditions to ensure both microbial viability and product quality.

References

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