YOUGURT: PREPARATION, CHARACTERISTICS AND RECENT ADVANCEMENTS

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ABSTRACT
Yoghurt is a fermented dairy product, having several health benefits. Yoghurt starter culture consists of a blend of *Streptococcus thermophilus* and *Lactobacillus delbrueckii* subsp *Bulgaricus*. Yoghurt is mainly of two types i.e. set yoghurt and stirred yoghurt. Yoghurt properties can be enhanced by the addition or treatment with various additives. Alternative methods to improve quality of low-fat yoghurt become an area of considerable research interest. Lactic acid can be produced by the yoghurt. Yoghurts that have past their ‘best before’ date constitute a waste that has to be environmentally treated. It can be used as a source for lactic acid production by *Lactobacillus casei*. Yoghurt can be supplemented with various useful ingredients. Addition of herbs or their active components like oils could be an effective strategy to improve functionality of milk and milk products with respect to the health benefits, food safety and biopreservation. Recent developments in this regard have been thoroughly discussed.

Key Words: Rheology, pH, Sensory attributes, Syneresis, Microbiology and Recent advancements.

INTRODUCTION
Yoghurt is a fermented milk product obtained from the milk or the milk products by the lactic acid fermentation through the action of *Streptococcus salivarius* subsp. thermophilus, *Lactobacillus delbrueckii* subsp. bulgaricus (FAO/WHO, 1977). When a sufficient quantity of lactic acid is produced then the milk coagulates and this coagulated milk is called yoghurt. The probiotic yoghurt, having probiotic effect is a fermented milk product with adjuvant microorganisms. There is numerous advantages of consuming fermented dairy products containing probiotic bacteria. A high population of probiotic organisms in the colon contributes to good intestinal health. Consequently consumption of products such as yoghurt containing viable probiotic organisms adds benefit to human gut health. Moreover, yoghurt supplies good quality proteins, also an excellent source of calcium, phosphorus, potassium and contains significant quantities of general vitamins. Yoghurt could be used for feeding, owing to its higher Ca/Na ratio (Demott, 1985). Yoghurts vary in appearance, flavor and ingredients. The quality and composition of yoghurt of applied bacterial cultures affects the quality of the yoghurt obtained as the result of the milk fermentation processes. There is a symbiotic relationship between the two species of bacteria. E *Lactobacillus bulgaricus* and *Streptococcus thermophilus* that’s why there is more rapid acid development than in the single strain culture (Rasic et al., 1978; Tamime et al., 1980). Various combinations of starter cultures are selected during manufacturing of yoghurt to achieve desirable characteristics of product and also to provide the consumers with a wide choice of therapeutic benefits. Depending on its activity, manufacturer usually adds 2-4 % yoghurt starter culture. Now a days, there has been increasing trends to fortify the dairy product with fruits (natural fruit juice, pulp, dry fruits) (Desai et al., 1994; Ghadge et al., 2008). Aesthetic value of new product can be increased by using fruit juice as a functional pigment in fermented milks with array of colors and flavor properties. Coisson et al., (2005) used Euterpeoleracea juice as functional pigment for yoghurt, which is dark purple in color having high anthocynin and phenolic content. Yoghurt is a functional food. The functional food includes probiotics, prebiotics and synbiotics. Probiotics can be defined as “live microbial feed supplements that beneficially affect the host animal by improving its intestinal microbial balance” (Champagne et al., 2005). Prebiotics as “non-digestible food ingredient that beneficially affects the host by selectively stimulating the growth and/or activity of one or
a limited number of bacteria in the colon”. Synbiotic is a combination of probiotics and prebiotics that “beneficially affects the host by improving the survival and the implantation of live microbial dietary supplements in the gastro-intestinal tract by selectively stimulating the growth and/or by activating the metabolism of one or a limited number of health promoting bacteria” (DiRienzo et al., 2000).

**Production of Different Types of Yoghurt**

![Flowchart of Yoghurt Production](image)

**Processing of Set and Stirred Yoghurt** (W.J Lee and J.A Lucey, 2010)

![Flowchart of Set and Stirred Yoghurt](image)

**Figure 1: Processing of Yoghurt**

**Figure 2: Processing of Set and Stirred Yoghurt**
Characteristics of the coagulum may be influenced by the processing conditions. Characterization of milk homogenization is done by breaking of the milk fat globules into smaller sizes. This improves the consistency and viscosity mainly because it prevents the rise of milk fat to the surface in the incubation tanks or in the retail container (it reduces syneresis and the tendency of the small fat globules to coalesce, because fat becomes coated with casein). The protein network has interstitial spaces containing the liquid phase and void spaces in which starter culture is present. After incubation, the coagulum of stirred yoghurt is broken up mechanically before cooling and packaging, thus inducing considerable changes in the rheological properties (Tamime et al., 1980).

**Nutritional Information of Yoghurt**

<table>
<thead>
<tr>
<th>Components</th>
<th>Value (per 100g)</th>
</tr>
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<tbody>
<tr>
<td>Energy</td>
<td>257KJ</td>
</tr>
<tr>
<td>Carbohydrates</td>
<td>4.7g</td>
</tr>
<tr>
<td>Fat</td>
<td>3.3g</td>
</tr>
<tr>
<td>Protein</td>
<td>3.5g</td>
</tr>
<tr>
<td>Vitamin A equiv.</td>
<td>27 μg (3%)</td>
</tr>
<tr>
<td>Riboflavin (vit. B2)</td>
<td>0.14 mg (12%)</td>
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<tr>
<td>Calcium</td>
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The word “yoghurt” is derived from Turkish “jugurt”, used to describe any fermented food with an acidic taste (Younus et al., 2002). Historically, yoghurt was made by fermenting milk with indigenous microorganisms. Yoghurt having high nutritional and therapeutic properties is being highly consumed and produced (Karagul et al., 2004). Yoghurt is stored at 2- 4°C throughout the distribution chain for avoiding risk of spoilage from yeasts (Tamime et al., 2000) and also for preventing further activity by starter culture.
Different Types of Yoghurts
Yoghurt is typically classified into the following groups

Set Yoghurt
This type of yoghurt is incubated and cooled in the final package and is characterized by a firm jelly like texture.

Stirred Yoghurt
This type of yoghurt is incubated in a tank and the final coagulum is "broken" by stirring before cooling and packing. The texture of stirred yoghurt will be less firm than a set yoghurt somewhat like a very thick cream. A little reformation of coagulum will occur after packaging.

Drinking Yoghurt
It also has the coagulum "broken" prior to cooling. In drinking yoghurt the agitation used to "break" the coagulum is severe. Very little reformation of coagulum may occur.

Frozen Yoghurt
Frozen yoghurt is inoculated and incubated in the same manner as stirred yoghurt. However cooling is achieved by pumping through a Whipper / chiller / freezer in a fashion similar to ice-cream. The texture of the finished product is mainly influenced by the whipper/freezer and the size and distribution of the ice crystals produced.

Concentrated Yoghurt
This type of yoghurt is inoculated and fermented in the same manner as stirred yoghurt. Following the "breaking" of the coagulum the yoghurt is concentrated by boiling off some of the water, this is often done under vacuum to reduce the temperature required. Heating of low pH yoghurt can often lead to protein being totally denatured and producing rough and gritty textures. This is often called strained yoghurt due to the fact that the liquid that is released from the coagulum upon heating used to be "strained" off in a manner similar to making soft cheese.

Flavoured Yoghurt
The flavours are usually added at or just prior to filling into pots. Common additives are fruit or berries, usually as a puree or as whole fruit in syrup. These additives often have as much as 50% sugar in them, however with the trend towards healthy eating gaining momentum, many manufacturers offer a low sugar and low fat version of their products. Low or no sugar yoghurts are often sweetened with saccharin or more commonly aspartame.

Classification of Yoghurt
There are different types of yoghurt produced worldwide. However a particular yoghurt may be subdivided into different groups based on the following aspects

<table>
<thead>
<tr>
<th>Sl. No.</th>
<th>Basis of Classification</th>
<th>Different Groups of Yoghurt</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Chemical standards(Fat)</td>
<td>Full, skimmed/medium or skimmed/low fat</td>
</tr>
<tr>
<td>2.</td>
<td>Physical nature of product</td>
<td>Set, stirred or fluid/drinking; the latter is considered Stirred yoghurt of low viscosity</td>
</tr>
<tr>
<td>3.</td>
<td>Flavors</td>
<td>Plain/natural, fruit or flavored;</td>
</tr>
<tr>
<td>4.</td>
<td>Post fermentation processing</td>
<td>Enzyme hydrolysis, vitamin fortification, vegetable oils, heat treatment</td>
</tr>
</tbody>
</table>

Set yoghurt is fermented in a retail container, filled after milk inoculation and is incubated in an incubation room at a suitable temperature normally 40- 43°C for approximately 2:30 to 4 hrs (Desai et al., 1994). Stirred yoghurt is a non-Newtonian fluid, obtained by promoting the growth of Lactobacillus delbrueckii subsp. bulgaricus and Streptococcus salivarius subsp. thermophilus at a mild temperature (between 40°C and 43°C) until a desired acidity level is reached. In stirred yoghurt, milk is inoculated and
incubated in a fermentation tank, the yoghurt gel being broken up during the stirring, cooling and packaging stages. Due to several factors there may be variations in the rheological properties of stirred yoghurt. These can be of a physical nature such as those related with total solid content, milk composition and type of starter culture or processing conditions-related such as homogenization, thermal pre-treatment of the milk and post-incubation stages (including: stirring, pumping, cooling and packaging) (Tamime et al., 1980).

**Health Benefits of Yoghurt**

Probiotic yoghurt is aimed at reducing medical conditions by restoring the beneficial microbial population in the colon, medical conditions such as constipation and diarrhea. It is beneficial to our digestive system, especially stomach and colon. Cow’s milk is preferred for preparing yoghurt as having low fat. It provides immunity, protect us from cold, cough and strengthen body’s defense mechanism. It strengthens the collagen in the skin and is good for our skin. It lowers the blood pressure, bad cholesterol and risk of heart attacks. Yoghurt is a source of natural proteins; it is safer for those having problem in tolerance of lactose. Yoghurt is rich in calcium so; it protects the bones against osteoporosis and arthritis. It discourages vaginal infections. It helps in cutting down calorie and thus helps in burning fat. By daily consumption of yoghurt, disease causing bacteria are flushed out from the colon and thus help in protecting against colon cancer. Consumption of yoghurt can shut down *Helicobacter pylori*; the bacterium responsible for most ulcers.

**Microbiology of Yoghurt**

**Starter cultures**

There is a symbiotic relationship between the two species of bacteria i.e. *Lactobacillus bulgaricus* and *Streptococcus thermophilus* that’s why there is more rapid acid development than in the single strain culture (Rasic et al., 1978; Tamime et al., 1980).

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**Figure 4:** Symbiosis between *Streptococcus thermophilus* and *Lactobacillus delbrueckii* Subsp. bulgaricus

*Streptococcus thermophilus* produces lactic acid and small quantities of formic acid, which promotes outgrowth of *Lactobacillus delbrueckii* Subsp. Bulgaricus. On the other hand *Lactobacillus delbrueckii* Subsp. bulgaricus species produce aminoacids to stimulate the growth of *Streptococcus thermophilus*. Chemical composition of the milk base (total solids and fat content) have significant effects on the activity of starter cultures. Ozer and his co-worker have studied the behavior of starter cultures in...
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concentrated yoghurt produced by different methods. They discovered that production method and milk total solids content influenced the growth and activity of starter cultures (Ozer and Robinson, 1999).

Lactobacillus delbrueckii subsp. bulgaricus

It is a gram-positive rod shaped, filamentous, non motile, non spore forming bacteria. It requires a low pH (around 5.4 - 4.6) to grow effectively so the bacterium is regarded as aciduric or acidophilic. The bacterium has complex nutritional requirements including the inability to ferment any sugar except lactose, from which it produces lactic acid that helps to preserve yoghurt. It is often helpful to sufferers of lactose intolerance whose digestive systems lack the enzymes to break down lactose to simpler sugars. While fermenting milk, it produces acetaldehyde, which is one of the main yoghurt aroma components (www.wikipedia.com).

Streptococcus thermophilus

The genus Streptococcus comprises several harmful pathogenic species such as Streptococcus pyogenes or Streptococcus pneumoniae, together with a single ‘Generally Recognized As Safe species’ S. thermophilus. S. thermophilus since this bacterium is widely used for the manufacture of dairy products (Cvetan, 1998; Fox, 1993)

Lactobacillus acidophilus

Lactobacillus acidophilus shows a range of health benefits which include: providing immune support for infections and cancer, reducing occurrence of diarrhea in human, aiding in lowering cholesterol, improving the symptoms of lactose intolerance. Studies have shown that dietary supplementation with L. acidophilus decrease the number of colon cancer cells in a dose dependent manner (Rao, 1999). The better survival of L. acidophilus when added along with the starter was presumably due to the transient tolerance of the culture to hydrogen peroxide (Speck, 1976).

Bifidobacterium bifidum

Bifidobacteria are one of the most important group of intestinal organisms with regard to human health. Bifidobacterium spp. belongs to the dominant anaerobic flora of the colon. The main species present in human colon are Bifidobacterium adolescentis, B. bifidum, B. longum subsp.infantis, B. breve and B. longum (Holzapfel, 2001). B. bifidum was found to be tolerant to the acidity of a model gastrointestinal tract system, with only a 20 % decrease in numbers as the pH decreased from 5.0 to 1.8 over an 80 min period (Holzapfel, 2001). Important property of probiotic bifidobacteria is acid tolerance, enabling the cells to survive gastric acidity and volatile fatty acids produced during fermentation in the intestine (Charteris, 1998). In the presence of yoghurt starter organisms the growth of bifidobacteria seems to be suppressed. Bifidobacteria have a higher resistance to acid and bile present in the gastrointestinal tract than yoghurt bacteria. The ingestion of bifidus fermented milk led to an increase in total bifidobacteria which was related to the colonic transit of the exogenous bifidobacteria (Bouhnik, 1996). In yoghurt like product, addition of probiotic cultures to the normal starters generally results in slower growth of the probiotic strains than if they were added alone in milk (Roy, 1996; Samona, 1994). These starters produce environments that inhibit the growth of not only pathogens and spoilage microorganisms but also of probiotic (Vinderola, 2002). The phenomenon could partially be related to the production of bacteriocins or other inhibitors such as lactic and other organic acids and hydrogen peroxide produced by the starter cultures (Maus, 2003; Vinderola, 2000). In addition, starter cultures grow faster, acidification occurs rapidly, and fermentation times are much shorter in their presence which resulted in reduced availability of nutrients (Shah, 2000); thus probiotic cultures do not have time to grow extensively. Many authors also reported the capacity of bifidobacteria to synthesize galactooligosaccharides (Hung and Lee, 2002; Lamoureux, 2002; Saxelin, 1999).

pH of Yoghurt

The ideal pH of the finished product of yogurt should be between 4 to 4.1. However this pH also depends on if we add fruits or flavoring agent to the yogurt. But after fermentation when the yogurt is ready to eat, the pH should be 4. The pH of yoghurt is decreased if the amount of skimmed milk powder is increased. The yogurt mixture coagulates during fermentation due to the drop in pH. The streptococci is responsible
for the initial pH drop of the yogurt mix to approximately 5.0. The lactobacillus are responsible for a further decrease to pH 4.5.

Shaker et al studied the effect of milk fat content on the acid development during fermentation and rheological properties of plain yoghurt. They indicated that increasing milk fat content, increased the initial pH of the samples and the rate of decreasing pH during incubation of high fat samples was lower than others (Shaker et al, 2000).

**The Effect of pH on Yoghurt**

**Change in pH from 6.6 to 6.0**

When the pH of the milk is decreased from 6.6 to 6.0 then the electrostatic repulsion decreases; as the net negative charge on the casein micelles decreases. The size of the casein micelles remains unchanged as the small amount of Colloidal calcium phosphate is solubilized at pH>6.0.

**Change in pH from 6.0 to 5.0**

When the pH changes from 6.0 to 5.0 then there is decrease in electrostatic repulsion and steric stabilization occurs, which are responsible for the stability of casein micelles in the original milk. Due to the decrease in the pH, the negative charge on casein micelles decreases and the charged “hairs” of casein curls up or may shrink.

**At pH 6.0**

At this pH, the electrostatic repulsion between the exposed phosphoseriene residues increases, due to the increase in the rate of solubilization of colloidal calcium phosphate, which weakens the internal structure of casein micelles.

**At pH 5.0**

The decrease in electrostatic repulsion between casein molecules occurs at pH 5; as the net negative charge on the casein decreases. When the pH of milk becomes close to the isoelectric point (pH 4.6) then casein-casein attractions increase due to increased hydrophobic and electrostatic charge interactions (Horne, 1998). The three dimensional network is formed consisting of clusters and chains of caseins due to the acidification process (Mulvihill and Grufferty, 1995).

**Rheological Property of Yoghurt**

Food rheology is the study of the deformation and flow of food materials (Rao, 1999). It can be classified as a pseudoplastic material (contains a yield stress that has to be exceeded for flow to be initiated) that can be either a viscoelastic fluid (stirred yoghurt) or viscoelastic solid (set yoghurt). Viscoelastic indicates that the material is having some of the elastic properties of an ideal solid and some of the flow properties of an ideal (viscous) liquid. Yogurt exhibits time-dependent shear thinning behavior but is not a true thixotropic material, since structural breakdown due to shear is not completely reversible once the shear stops.

**Physical Properties of Yoghurt**

It has been found that addition of protein (i) improves water holding capacity (ii) decreases the syneresis effect and (iii) stabilizes the pH of the samples during storage (Athanasios G. Stefanakis et al).

The physical and sensory properties of yoghurt gels are highly influenced by the protein content and the total solids content of the yoghurt milk. A study on the effect of milk supplementation (whey, casein hydrolysate and milk protein) on the acidification and microbiological stability of fermented milks showed that acidifying activity was greatly improved with casein hydrolysate, with a reduction of the fermentation time by about 55% by comparison with the other supplementation (Oliveria et al., 2001).  

Despite of the above results; Abd-El Salam et al., (1982) showed that total solids content had no adverse effect on starter activity or coagulation time. Increasing milk total solids from 16 to 23% had significant effect on decreasing rate of pH during fermentation (Ozer et al., 1998). The incubation time for the milk at 4.6 pH was shorter than the time of retentate (Tamine et al., 1989). The Increase in milk fat content influences the growth and activity of starter cultures in samples with 2 levels of total solid (12 and 23%) (Mahdian et al., 2007). The chemical composition of the milk base especially total solids has the major effect on the acceptability of concentrated yoghurt. Concentrated yoghurt containing < 20% total solid
was assessed as "thin and tasteless" and that with > 25% total solid became gummy and bitter (Robinson, 1977).

**Effect on Syneresis of Yoghurt**

Syneresis is the extraction or expulsion of a liquid from the gel. It is the collection of whey on the surface of yoghurt. Syneresis can be observed when the amount of diluents in a swollen polymer exceeds the solubility limit as the temperature changes. Syneresis is undesirable; it is the separation of the liquid phase in gels (Harwalkar et al., 1983).

Major factors contributing syneresis in yoghurt includes:
- Low acidity (pH >4.6) or with high acidity (pH <4.0) product.
- High incubation or storage temperature.
- Agitation at the time of manufacture or final product transportation.
- Mixture having Low total solids content (protein and/or fat).
- Milk treatment at low heat.
- Excessive heat treatment of the final mix.
- Milk is not homogenized prior to fermentation.
- Acidification at rapid rate.
- Sloping wall containers or an excessive height to width ratio.
- Using rennet enzyme.

Heating of milk destined for yoghurt production is one of the processing measures, which prevents the development of syneresis in the finished product.

**Effect on Sensory Attributes**

Set-style yoghurt should have smooth consistency without cracks or holes, custard like, semi solid consistency without any surface whey. The heat treatment given to yoghurt made from milk at 90°C for 30 min is ‘grainy’, while the heat treatment given to the yoghurt made from milk at 80 or 85°C for 30 min is described as ‘smooth and firm bodied’. These defects may be due to the rearrangement of the network just after the gel formation.

Textural defects may rise if excessive heat treatment is given to the milk or by addition of the whey proteins. In stirred-type yoghurt, for controlling textural defects stabilizers are being added and prevent whey separation but stabilizers are not normally added to plain, set-style yoghurt.

**Immunostimulatory effects of yogurt**

The preventive effects of yoghurt are investigated on the diseases such as cancer, infection, gasterointestinal disorders and asthma. It enhances the immune response, which would in turn increase resistance to immune-related diseases (Meydani et al., 2000).

**Recent advancements**

1. **Enriched probiotic yoghurt with passion fruit fiber**

   The passion fruit fiber is a neutral ingredient for the design of new value-added yoghurt. As compared to the control the apparent viscosity was significantly higher in fiber yoghurts co-fermented by the lactobacilli at the end of cold storage. In passion fruit fiber yoghurts the casein gel was more compact and overlaid the fiber, whilst filaments of exopolysaccharides were more frequent in control yoghurts, demonstrated by the Photomicrographs. Appearance, odor and color of the passion fruit fiber yoghurts received scores as ‘good’, and the intensity of the passion fruit flavor was considered weak by the sensory assessors. Thixotropy of enriched yoghurts was higher than that of their respective controls in the two cycles of shear rate (Espírito-Santo et al., 2012).

2. **Addition of acai pulp improves fatty acid profile and probiotic viability in yoghurt**

   Study has demonstrated that acai pulp addition increased monounsaturated and polyunsaturated fatty acid contents in probiotic yoghurt and enhanced the production of α-linolenic and conjugated linoleic acids during fermentation of skim milk prepared with *B. animalis* ssp. *lactis* Bl04 and B94 strains (Ana Paula do EspíritoSanto et al., 2010).
3. Improving Yoghurt consistency by addition of some plant polysaccharides

Six plant polysaccharides (PS) were extracted from mature okra fruits (Hibiscus esculents), whole plant Jew’s-mallow (Corchorusolitorius) and taro corm (Arum colocasia). The resultant yoghurt was analyzed organoleptically (appearance, body and texture and flavour) and chemically after production as well as during cold storage (0, 3, 5 and 7 days) at 5 ± 1 °C. Results showed that yoghurt with good appearance, body and texture and flavour could be produced by using PS extracted from taro at concentration 0.3%, okra at concentration 0.1% and Jew’s-mallow at concentration 0.1 % (Hussein et al., 2011).

4. Enriched yoghurts for lowering cholesterol

In France, a lab experiment was being conducted to evaluate the impact of health information on consumers’ choices for functional food. Successive messages revealing benefits and uncertainties of consuming yoghurts with added plant sterols for reducing cholesterol were delivered (Stéphan Marette et al., 2010).

Effects on Rheological Properties of Yogurt

Rheological properties of yoghurt are determined by their production conditions and composition. If there is any disturbance in the balancing of milk components then it directly impacts on the rheological properties of prepared yoghurt (Penna et al., 2006).

For example-
(a). Elevation of protein content leads to increased thixotropy of the yoghurt (Lankes et al., 1998)

(b). Incorporation of milk fat in emulsified state results the yoghurt an increased viscoelastic properties (Houze et al., 2005; Xiong et al., 1991).

As there is increase in the demand for reduced fat yoghurt, efforts have been paid to improve its texture and rheology. The two conventional methods are - Elevation of non-fat total solids level of the yoghurt milk or addition of some natural or synthetic gums as stabilizers into the yoghurt milk (Guzmán-González et al., 2000; Shukla et al., 1986). However addition of stabilizers are restricted in some area. Enzyme-induced protein interaction in yoghurt milk is thus suggested as an applicable approach to improve the rheological properties of yoghurt products (Barbaros et al., 2007).

Texture of the yoghurt was being enhanced by the addition of lactoperoxidase (LPO). Yoghurt after treatment with lactoperoxidase becomes softer and smoother in texture. Its apparent viscosity is also reduced by addition of LPO (Hirano et al., 2008).

The apparent viscosity of yoghurt is also reduced by the addition of chicory inulin. It also reduces the yield stress, complex viscosity, storage modulus and loss modulus of nonfat yoghurt (Paseephol et al., 2008).

By the Addition of Horseradish Peroxidase in the skimmed milk leads to the preparation of the Set yoghurt having enhanced apparent viscosity, storage modulus and viscous modulus (Yan Wen et al., 2011).

Effects on the Physico-Chemical Properties of Yoghurt Containing Probiotic Bacteria

Physicochemical properties of yoghurt is effected by the addition of tetrasodium pyrophosphate (TSPP). It reduces the soluble calcium content of the milk and increased casein bound calcium values. It has been found that 0.125% TSPP resulted in reduction in the turbidity because of micelle dispersion but at 0.15% TSPP there is increase in turbidity due to the aggregation of the casein particles. Addition of 0.05 to 0.125% TSPP to milk resulted in a reduction in the yield stress values of yoghurt compared with untreated yoghurt. High TSPP levels resulted in the increment in the pore size of gels (Ozcan et al., 2008).

Different types of milk and storage time affects the physiochemical characteristics of Stirred Yoghurt

Yoghurt produced from goat’s milk is characterized by its lower number of grains, mean perimeter of grains, roughness, viscosity and water holding capacity in comparison to that of the yoghurt developed using cow’s milk. Yoghurt with half cow’s and half goat’s milk has a higher viscosity and water holding capacity than that only containing goat’s milk and also has a lower number of grains, mean perimeter of grains and roughness than that only containing cow’s milk (Küçükçetin et al., 2011).
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**The physical properties of the yoghurt also changes by the treatment with the proteolytic enzymes**

The yoghurt made from milk when treated with the plasmin results in lower firmness, and apparent viscosity, lower water holding capacity and protein hydration. The yoghurt made from milk when pretreated with the microbial protease has higher firmness, syneresis, and apparent viscosity, lower water holding capacity and protein hydration (Mustafa Gassem et al., 1991).

**Enhancement in the Nutritional quality of the yoghurt**

On addition of whey protein hydrolysate [WPH] in the milk, the growth of some probiotic bacteria significantly improves, however not affecting the growth of *Lactobacillus delbrueckii* ssp. bulgaricus18, *Lactobacillus delbrueckii*ssp. bulgaricus 10442, and *Streptococcus thermophilus* (MCCOMAS et al., 2006).

The addition of fish oil in the yoghurt resulted in the enhancement in nutritional quality of the yoghurt, helping people meeting daily nutritional requirements.

**Changes in the sensory characteristic of yoghurt produced from mixture of cow’s and goat’s milk**

The addition of goats’ milk led to smaller changes in pH, a higher whiteness index, lower syneresis and a significant decrease in the firmness and consistence of the gel during storage. The physicochemical properties of yoghurts were correlated with gel microstructure. Sensory evaluation has shown that incorporating goats' milk had a significant impact on the whiteness, flavour, syneresis and lumpiness of yoghurts. In general, the higher the goats’ milk content, the greater the physicochemical and sensory differences with regard to the 100% cows’ milk yoghurt. Samples with half and half cows'/goats' milk were preferred by the sensory panel (Maria Vargas et al., 2008).

**CONCLUSION**

Yoghurt is a fermented dairy product. It is having several health benefits. The intake of yoghurt can improve lactose maldigestion, it lowers bad cholesterol and is also good for skin. Yoghurt having several health benefits so, is healthier for consumption. Yoghurt supplies good quality proteins, also an excellent source of calcium, phosphorus and potassium and contains significant quantities of general vitamins. Different types of yoghurt are present and having different properties. By adding different additives or different substances in the yoghurt its property is affected like its rheological, physical, sensory, textural, physiochemical properties and its quality is enhanced.

**Future Aspects**

Alternative methods to improve quality of low-fat yoghurt becomes an area of considerable research interest. Lactic acid can be produced by the yoghurt. Yoghurts that have past their ‘best before’ date constitute a waste that has to be environmentally treated. It can be used as a source for lactic acid production by *Lactobacillus casei*. Production of yoghurt generates a residue highly supplemented with sugar and fruits syrups that can be metabolized to lactic acid. To develop a satisfying, calcium-rich food for consumption in space, white skim yoghurt, both plain and with added blueberries, was subjected to freeze-drying. Optimised freeze-drying parameters were extracted from the thermal analysis of the yoghurts, taking into account the role of the added ingredients. Rheological properties were not seriously affected by freezing, while the drying step resulted in an overall structural weakening of the reconstituted products, possibly as a consequence of the mechanical energy required for mixing with water. However, its viscoelastic properties were retained and the original strength could be recovered by modulating the amount of water. The freeze-drying process affected survival of the lactic acid bacteria, resulting in a 2–3 log population reduction. Mortality levels were reduced when sucrose and blueberries were added as ingredients.

Addition of herbs or their active components like oils could be an effective strategy to improve functionality of milk and milk products with respect to the health benefits, food safety and biopreservation. These components should improve therapeutic quality without any adverse effect on sensory and rheological attributes.
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