CONSEQUENCE OF SUPPLEMENTATION OF SOYMILK TO GOAT'S MILK ON THE CHEMICAL COMPOSITION AND SENSORY CHARACTERISTICS OF YOGHURT

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This is to certify that we have examined the above Master's thesis and have found that is complete and satisfactory in all respects, and that all revisions required by the thesis examination committee have been made.

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DEDICATED TO MY

RESPECTED AND BELOVED

PARENTS AND TEACHERS

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The Author

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Abstract

This study was conducted to investigate the effect of supplementation of goat's milk with soymilk and addition of fruit juices on the quality of yoghurt. The yoghurt was made up of fresh goat's milk with the supplementation of soymilk (10, 15 and 20%), mixed with Sugar (6%) and juices of banana (90 mg/100 ml water) and mango (50 mg/ml water). The results showed that fat, protein, ash content and acidity were high in the plain yoghurt, while the highest value of total solids was obtained in yoghurt supplemented with 10% soymilk. The best score of colour, flavour, consistency and overall acceptability were obtained in the plain yoghurt, while the highest score of taste was obtained in yoghurt supplemented with 15% soymilk. The highest acidity was obtained in mango yoghurt; the highest score of flavour and consistency were obtained in banana yoghurt, while the highest overall acceptability obtained in the mango yoghurt. The highest score of fat, total solids and ash were obtained on the 3rdday of storage period, while the highest score of protein and acidity were found at the 6th day of storage. The highest value of colour, consistency, taste and overall acceptability were obtained on the 3rd day of storage period, while the highest score of flavour were reported on the 6th day of storage period.

Key words: Goat's Milk, Soymilk, Supplementation, Fruit Juices, Storage.

CHAPTER ONE

Introduction

The products of fermented milk are cultured dairy products and made from skim, whole or slightly concentrated milk, that require specific lactic acid bacteria to develop their characteristic flavour and texture. Fermented milks are generally fluid or semi-fluid in nature. All contain lactic acid in fluctuating proportions. Fermentation of milk changes its properties resulting in beverages such as yoghurt; kefir and other cultivated dairy products (Webb et.al, 1980).

In general, fermented milk has a good nutritional value that compares with that of milk from which they are prepared (Abou Dawood et al, 1993).

Yoghurt and other cultivated dairy products are highly nutritious foods which also have therapeutic value (Deeth et.al, 1984). All the elements of nutrition of milk also founds in yoghurt in more palatable form (Abou Dawood et.al, 1993). Yoghurt is always made from cow’s or buffalo’s milk, although production from goat’s milk is economically cheaper than cows and buffalo’s milk (Abbrahamsen et.al, 1981).

In some countries, goat’s milk is consumed as liquid milk, even on a commercial basis and the components of goat’s milk are of considerable market interest (Haenlein et al, 1995). Since the goat is the animal of destitute people and its milk is consumed fresh, as well as the possibility of manufacturing dairy products from this milk, exceptionally being focused on the goat as a major dairy animal in the household.

The aqueous extract of soybeans named Soymilk has been professed as a functional food. Because it provides added health benefits resulting from its hypolipidemic, anti-cholesterolemic, antiatherogenic properties and reduced allergenicity. Protein (3.0%-3.6%), sugar (2.9%-3.5%), fat (2.0%-2.5%), ash (0.5%), and it has a pH value of 6.8 to 7.0 are the proximal composition of soymilk.

Soy yoghurt, produced like as milk fermentation by the addition of *Streptoccocus thermophilus* and *Lactobacillus delbruekii* subsp. *bulgaricus* cultures to soymilk, has become popular for the reason that it appears to reduce cardiovascular disease, can contribute to weight loss, alleviate arthritic symptoms and advance brain function.

Yet, soy products have had limited consumer receiving because of its undesirable or "beany" aftertaste due to the presence of hexanal and pentanal. These aldehydes are formed by hydroperoxidation of polyunsaturated fatty acids which catalysed by lipoxygenase.

In traditional methods, Oxidation of soymilk can occur during the initial soaking and grinding of soybeans, but in commercial methods use steps that either prevent the formation of undesirable volatile compounds by inactivation of lipoxygenase by heating or take out the residual off-flavours using deodorizing techniques.

Fermentation using lactic acid bacteria can also reduce the beany flavour of soymilk. However, addition of sweeteners such as jams and fruit pureé to fermented soymilk may be a better substitute to reduce the aftertaste of soymilk. This aftertaste is an important factor restricting its regional popularity since consumers in Middle Eastern and Western countries are not familiar with this flavour. The making of a soy-flavoured yogurt product is a simple but novel loom to raise the consumption of soymilk-based products.

Therefore, soymilk-based yoghurts offer a significant demand for a growing section of consumers with certain dietary and health concern. Moreover, soymilk yoghurts have numerous nutritional rewards over cow milk yoghurt such as, reduced levels of cholesterol, free of saturated fat and free of lactose. Although some reports are found in the literature dealing with soymilk yoghurt production, not so many data are accessible providing a complete characterization of the products, including the sensory assessment and the residual quantities of phytates and a-galactosides.

Soybeans have been inspected extensively for their role in mitigating symptoms associated with menopause, hyperlipidaemia, and the peril for various chronic diseases, like breast cancer and cardiovascular disease (CVD), upon observation of a lower pervasiveness of these conditions amongst certain cultures wherein soy embodies a substantial component of the diet.

The fermented soy beverage unveiled better antioxidant potential, nutritional value, and health-promoting effects compared to the unfermented soy. Along with, promoting the functional properties, fermentation of soy-based foods has been verified to increase the flavour profile, texture, anti-nutritional constituents (i.e., trypsin inhibitors, phytic acid, and saponin), mineral bioavailability (i.e., zinc, calcium) and digestibility. Fermentation with mixed cultures, may also improve the protein content, solubility, and availability of free amino acids.

For increasing number of people suffering of lactose intolerance, an alternative product to milk is needed. In addition, some people have accepted a strictly vegetarian way of life. Soymilk has been used for a long time by this part of the population; however, it usually has a beany flavour, which can cause some refutation among Hesperian consumers. Fermentation of soymilk for the production of a yogurt-like product expands its sensory characteristics. Lactic acid fermentation has been described as a means to diminish “beany” flavour (Favaro et al, 2001).

Therefore, the objectives of the current study were to develop flavoured yogurt from soybean milk, and measure its microbial quality and acceptability to Bangladeshi and Indian consumers.

The present study was aimed to utilize goat’s milk supplemented with soymilk in the manufacture of yoghurt as with aims to determine.

1) The effect of supplementation of soymilk to goat's milk at three different concentrations on chemical and organoleptic characteristics and shelf life of the product.
2) To investigate the effects of supplementation of juices of different concentrations of two fruits on chemical, organoleptic and shelf life of the product.

CHAPTER TWO

LITERATURE REVIEW

2.1 Milk:

Milk is a nutrient-rich liquid food produced by the mammary glands of mammals for the nourishment of the newly born, which contains three basic components such as water, fat and solids- non-fat (Eckles et al, 1951). It is the primary source of nutrition for young mammals, including breastfed human infants before they are able to digest solid food (Van Winckel and De Bruyne et al,2011). Milk is a significant source of high-quality protein, lactose, vitamin (except vitamin C), calcium and phosphorus, and is the only food in which lactose is naturally found (Woodhill et al, 1961).

2.1.1 Goat's milk

Goat milk naturally has small, well-emulsified fat globules, which means the cream will stay in suspension for a longer period of time than cow's milk; therefore, it does not need to be homogenized. (Amrein-Boyes et al, 2009). The composition of goat's milk and factors affecting it has been studied broadly (Parkash and Jenness et al, 1968; Anifantakis et al,1986). Goats' milk has more oligosaccharides (non-digestible carbohydrates) than cows' milk, with a similar amount and structure to those found in human milk (Kiskini and Difilippo, 2013). Goat milk is naturally slightly lower in dietary cholesterol than whole cows' milk (McCance and Widdowson's, 2004). In temperate countries where goats are used as crucial or exclusively for milk production, claims have been made that goat has important advantages over the cow as milk producer for human nutrition (Jenness et al, 1980). The protein content of goat's milk is much higher than that of cow's milk (Haenlein et al, 1995). The nutritional value of goat's milk has been documented for centuries, having the following nutritional benefits (Pal and Agnihorti, 1995)**.**

1) The main milk protein named casein of Goat's milk, has a unique chemical structure which forms soft curd in the human digestive tract and absorbed more easily than cow's milk.
2) Species-specific antigens and persons allergic to these components of cow's milk can be removed by changing to goat's milk.

3) Goat's milk is naturally homogenized and contains greater proportion of smaller fat globules which are easier to digest than cow's milk.
4) Henceforth, goat's milk is highly suggested for infants, invalids and convalescent people.
5) If consumed regularly, Goat's milk is said to have a role in improving appetite and digestive efficiency.
6) Due to the presence of caproic, caprylic and capric acids in relatively large proportions than bovine milk fat, butter and ghee from goat's milk are reported to have great medicinal value.
7) Goats prefer open-air life which defends them from tuberculosis-causing bacteria. Therefore, Goat's milk can be considered innocuous than cow's milk.
8) Goats can be milked as often as required that prevent milk storage problem. Goat's milk also has lower number of commonly determined species of spoilage bacteria than cow's milk.
9) Calcium, magnesium and phosphorus of Goat's milk is higher than bovine milk.
10) The vitamin content of goat's milk is comparable to cow's milk except folic acid, which is deficient. Therefore, to avoid anaemia in the long run infants fed with goat's milk should be ensured oral supplementation of folic acid.

2.1.1.1 Composition of goat milk and health benefits:

Compositions of goat milk vary with diet, breed, individuals, parity, season, feeding, management, environmental conditions, locality, stage of lactation, and health status of the animal (Park 2012). Goat milk contains 3.8% fat, 3.4% protein, 4.1% lactose, 0.8% ash, 8.9 % SNF and 87% water. Goat milk differs from cow or human milk in having better digestibility, alkalinity, buffering capacity and certain therapeutic values in medicine and human nutrition (Bhattarai 2014; Park 2012).

Many studies show that some components in goat milk has more advantages of specific benefits in human nutrition and food security than other dairy species (Zhou et al. 2016; Cavicchioli et al. 2015). Goat milk is a rich source of protein, carbohydrate, lipid, vitamin and mineral. The superior digestibility of goat milk, the proper composition of fatty acids and its content of bioactive compounds (Zenebe et al. 2014).

2.1.1.2 Nutrition values and health benefits of goats' milk

i Protein:

The protein content in goat milk varies according to the breed, genetics, stage of milking, season, and feed (Park 2012; Park).There two major protein are; Casein (80%) s1, Abbildung in dieser Leseprobe nicht enthaltens2, Abbildung in dieser Leseprobe nicht enthaltenand Abbildung in dieser Leseprobe nicht enthalten-caseins and the rest whey proteins -lactoglubulin and α –lactalbumin and the antigenicity of Abbildung in dieser Leseprobe nicht enthalten-lactoglobulin can be partially eliminated by certain treatments (Silanikove et al. 2010; Serhan, Mattar, and Debs 2016; Zenebe et al. 2014). Goat milk has a small Casein micelles because of its higher concentrations of calcium and phosphorus (Zenebe et al. 2014).Goat milk luck genotype for CSN1S1expression hence making it low in αs1-casein (4 g/L) compared to cow milk (7 g/L) because goats (Wei 2016; Tetens 2014; Prosser et al. 2008).

ii Milk Fats:

Goat milk is a good source of fats, which is nutritionally important and determinant for price milk (Haenlein 2007; Zenebe et al. 2014). Tricacylglycerol over 98% (Kompan and Komprej 2012) and simple lipids such as monoacylglycerol and complex lipids such as phospholipids, sterols hydrocarbs and cholesterol esters are among the largest fats in goat milk. Goats-milk has great portion of conjugated linoleic acid (CLA) which helps to boost body immunity by stimulating immunoglobulns, cytokines and prostaglandins immunity mediators (Zenebe et al. 2014), anticarcinogenic, antiatherogenic, antidiabetic, immunomodulation and antiadipogenic (Kompan and Komprej 2012; Savoini et al. 2010).

iii Milk Carbohydrate:

Goat milk has more lactose content than cow milk. Lactose helps in intestinal absorption of calcium, magnesium and phosphorous and also the utilization of vitamin D (Zenebe et al. 2014; Ceballos et al. 2009). However, oligosaccharides, glycoproteins, glycopeptides, and nucleotides are found in small quantity. Goat milk is high in lactose-derived oligosaccharides compared to cow milk (Horáčková et al. 2014). Oligosaccharides act as prebiotic and anti-inflammatory effects in induced colitis and inflammatory bowel disease control. This is achieved through their increased production of butyrate and the reduction of pro-inflammatory bacterial species by inhibiting their adhesion to the epithelial membrane, reducing bacterial translocation and hence promoting selective growth of beneficial Lactobacillus and Bifidobacteria species (Ulusoy 2015; Viverge, Grimmonprez, and Solere 1997).

iv Milk Vitamin:

Goats convert all Abbildung in dieser Leseprobe nicht enthalten-carotenes from foods into vitamin A. This makes vitamin A to be more in goat's milk than in cow milk (Conesa et al. 2008). Vitamin B6 and vitamin D content is low in cow milk as well as in goat milk (Horáčková et al. 2014). The vitamin A in goat milk similar to that of human milk. Vitamin A boosts body immune responses and antibody responses. Vitamin D in milk is recommended in the dietary management of osteoporosis, diabetes and cancer. Goat milk is high in Vitamin C, which is an antioxidant and has antiviral properties than in cow milk (Geissler 2011).

v Milk Mineral

Goat milk has more potassium, calcium, chloride, phosphorus, selenium, zinc and copper than cow milk (Díaz-Castro et al. 2010). Potassium is important for the acid-base balance, muscles functioning, nerves and kidney health. Chloride is good for liver function, maintains fluid balance, blood pH and osmotic pressure. Calcium is of importance for strong bone structure and blood coagulation. Selenium is good for cell protection against free radicals. Zinc is high in goat's milk and its used for healthy skin, wound healing and it is also having antioxidative properties and a cofactor for the antioxidant enzyme, protein production and it also useful in hormone insulin regulation for carbohydrates breakdown (Griffiths 2010; Díaz-Castro et al. 2010).

2.1.2 Soymilk

The cultivation of soybeans invented in Eastern Asia and soybeans have long been used as a food before the existence of written records. The first Chinese record unfolding soybeans is in the Chinese book. Pen Ts'ao Kong Mu, written in 2838 B.C. (Snith and Circle, 1978a).

Soymilk is traditionally made by soaking soybeans in water overnight, then grinding the beans with adding water during grinding. On the other hand, full fat flakes, grits, or flour can be used to produce the soymilk slurry. The resultant slurry is boiled and stirred for 1–30 min (depending on the temperature). Heating step expands the nutritional value of the milk (by inactivating trypsin inhibitors) and advances the flavour (by inactivating lipoxygenase and volatizing some of the off-flavour compounds that result during grinding). Heating upsurges the shelf-life of the milk by reducing its microbial load. The heated slurry is then filtered through a cloth or nylon bag to separate the undiscernible fibre residue (okara) from the soymilk. Flavoured ingredients added to the resultant soymilk, if desired. Before being bottled, aseptically packaged, or retorted, it may also be pasteurized, homogenized, or sterilized. Naturally, high-protein, clear or yellow hilum, large-seeded soybeans are chosen for soymilk manufacture.

The first remark of soybeans as a crop in American literature was in 1804 by James Mease in Willies Domestic Encyclopaedia, first American Edition. In which he suggested that soybeans could be made in Pennsylvania (Smith and Circle, 1978a). The Perry Expedition in 1854 brought back 2 varieties of soybeans from Asia which were disseminated to concerned people. Some European countries, particularly England, started importing soybeans from Manchuria in 1908 to supplement short supplies of cottonseed and flaxseed. The beans were administered into oil and meal. The oil was used generally for the manufacture of soap and the cake or meal for nourishing dairy cattle. The success in the utilization of soybean cake and oil in Europe was an encouragement for alike usage in the United States (Snith and Circle, 1978a).

Cardiovascular disease contains arteriosclerosis and atherosclerosis. The primary reason and the major risk factor are hypercholesterolemia. In hypercholesterolemia the circulating total cholesterol, LDL-cholesterol and triglycerides are high. Hypercholesterolemia inclines individuals to cardiovascular disease. Studies have found that addition of soy protein in the diet accompanied by low levels of saturated fat and cholesterol may lessen the risk of coronary heart disease (CHD) (Gibson and Williams, 2000).

2.1.2.1 Nutritional values of soymilk

Soymilk is a first-rate source of high-quality protein and B-vitamins. Soymilk naturally holds isoflavones, plant chemicals that benefit lower LDL ("bad" cholesterol) if taken as part of a "heart healthy" eating plan.

Table: Nutritional values of soymilk (per 100g):

Parameters	Value
Water	93.3 g
Energy	33.0 kcal
Protein	2.8 g
Fat (total lipid)	2.0 g
Fatty acids, mono-unsaturated	0.326 g
Fatty acids, poly-unsaturated	0.833 g
Carbohydrates	1.8 g
Fibre	1.3 g
Ash	0.27 g
Magnesium, Mg	19.0 mg
Phosphorus,	49.0 mg
Potassium, K	141.0 mg

[Source: USDA Nutrient Database for Standard Reference]

2.2 Fermentation

Fermentation is any metabolic process in which micro-organisms' activity creates a desirable change in food and beverages, whether it's increasing flavour, preserving foodstuffs, providing health benefits, or more. Fermentation causes the most marked changes. It affects the carbohydrate, protein and vitamin components along with producing flavour compounds particularly acetaldehyde, some enzymes and bacterial mass.

Lactose is broken down, by the enzyme lactase that produced by the starter bacteria, to glucose and the glucose formed is rapidly metabolized to lactic acid (Deeth et al, 1984). Lactic acid gives cultured products their typical sour refreshing taste and causes the milk to gel or clot as a preservative (Deeth et al, 1984).

2.3 Fermented dairy products:

Fermented dairy products are dairy foods that have been fermented with lactic acid bacteria such as *Lactobacillus*, *Lactococcus*. The fermentation process increases the shelf life of the product while enhancing its taste and improving the digestibility of its milk. There is evidence that fermented milk products have been produced since around 10,000 BC (Canadian Dairy Commission. 2007-06-06). Those products have been reported to be more nutritious than the milk from which they are made (Shahani and Chandan, 1979; Ayebo and Shahani, 1980; Deeth and Tamime, 1981).

Fermented milk products are cultured dairy products made from skim, whole or slightly concentrated milk that entail specific lactic acid bacteria to develop their distinctive flavour and texture. These products include cultured buttermilk, sour cream, yoghurt, acidophilus milk, kefir and concentrated fermented milk products (Hargrove and Alford, 1972).

The well-adjusted contents of several vitamins, regulation of cholesterol metabolism, increase of proteins and fat utilization of some cations made fermented milk products among the most valuable natural products suggested for human nutrition (Oberman et al, 1985). The most important factors determining the specific identity of fermented milk products is the flavouring components (Oberman et al, 1995).

Cultured milk products, depend on starter culture bacteria not only for acid development, but also for accumulation of wanted intermediates such as volatile acids, acetone (dimethyl ketol, methyl carbionl) and diacetyl (diketobutane, biacetyl) which act as flavouring agents (Pepper and Robert, 2007).

2.4 The therapeutic effect of fermented dairy products:

People who lack the enzyme lactase can consume culture of milk, in which by the bacterial enzymes, lactose is partly broken into simple sugars (Alpha Laval Dairy handbook). In Russia, some paediatricians and nutritionists prefer yoghurt to fresh milk as a discouraging food for infants (Tatchenko et al, 1972).Fermented milk products are widely used in the Balkan area for medicinal purposes against diseases such as pneumonia, dysentery and less serious complaints such as sore throat and laryngitis (Peterson et al, 1981).

2.5 Yoghurt

Yoghurt is the best known of all fermented milk products, and the most popular worldwide. Consistency, flavour and aroma vary from one district to another. The aromatic substances include small quantities of acetic acid and acetaldehyde. yogurt is generally defined as a cultured milk product made using *Streptococcus thermophilus* and *Lactobacillus bulgaricus*. (Milk and Milk Products. 2nd edn. Rome; 2011, FAO).

Yoghurt made of goat's milk is always economically less expensive than cow's or baffaloes' milk (Abbrahamsen and Holman, 1981).

As stated by FAO/WHO, "yoghurt is a coagulated milk product attained by lactic acid fermentation through the action of *Lactobacillus bulgaricus* and *Streptococcus thermophilus*. The microorganism in the final product should be copious and worthwhile. Soy based probiotic yoghurt is a nutritious product with amplified protein and ample health benefits.

Goat's milk yoghurt is characterized by having "goaty flavour" low viscosity and serum separation during storage, several efforts however, have been made to overcome these difficulties (Abbrahamsen *et al*., 2012).

2.5.1 Starter cultures in yoghurt

The main (starter) cultures in yogurt are *Lactobacillus bulgaricus* and *Streptococcus thermophilus*. The function of the starter cultures is to ferment lactose (milk sugar) to produce lactic acid. The increase in lactic acid decreases pH and causes the milk to clot, or form the soft gel that is characteristic of yogurt. (Tamime and Robinson (1999), Walstra et al. (1999)). *Lactobacillus bulgaricus* has been reported to be the chief flavour contributor in yoghurt (Hamdan *et al*., 1971). The presence of acetaldehyde was very important for good flavour (Sandine and Elliker, 1970a).

2.5.2 Composition of yoghurt

Yogurt (plain yogurt from whole milk) is 81% water, 9% protein, 5% fat, and 4% carbohydrates, including 4% sugars (table). A 100-gram amount provides 406 kilojoules (97 kcal) of dietary energy. As a proportion of the Daily Value (DV), a serving of yogurt is a rich source of vitamin B12 (31% DV) and riboflavin (23% DV), with moderate content of protein, phosphorus, and selenium (14 to 19% DV), (Astrup A, May 2014). It recommends that yoghurt described as low fat should contain not less than 0.5% and not more than 2% fat (Corporate authors, 1983).

The biological worth of the proteins in yoghurt increased by fermentation, and yoghurt protein is superior to milk protein (Shahani and Chardan, 2013). Deeth and Tamime, 2012 found that yoghurt is a particularly rich source of calcium, and that it is better absorbed and utilized than calcium in the normal balanced diets.

2.5.3 Types of yoghurt

There are many types of yoghurt (Tamime and Deeth, 2012; Kosikowski et al, 1982).

2.5.3.1 Flavoured yoghurt:

In the traditional (sundae – style) 15-18% by weight of fruit purees or syrup is layered on the bottom of the container. The worm fortified milk of mix inoculated with starter organisms is poured over, and the full container is sealed and incubated (Kosikoowski et al,1982) Swiss, continental or stirred-style methods of producing yoghurt require blending at 16^{o}C of fruit purees, sucrose and stabilizer into fresh plain yoghurt, previously bulk inoculated in milk cans or vats (Kosikowski et al, 1982). Orange, lemon, vanilla and coffee essences may be incorporated directly into the yoghurt mixes before incubation. Sugar also may be added before or after incubation. Flavoured yoghurt is significantly higher in calories than plain yoghurt because of the extra sugar (7-15%), (Kosikowski et al, 1982).

2.5.3.2 Frozen flavoured yoghurt

Frozen yogurt is a frozen product containing the same basic ingredients as ice cream, but contains live bacterial cultures (Encyclopaedia Britannica, 2020). This type of yoghurt was developed in the late 1960s in North America. Yoghurt on a stick is popular among children because it gives a pleasant taste (Kosikowki et al, 1982).

2.5.3.3 Acidophilus yoghurt

This yoghurt is made with *Lactobacillus acidophilus* cultures. *Lactobacillus acidophilus*, or *acidophilus*, is a naturally occurring "good" bacterium that helps sustain strong intestines and also supports good digestion. Acidophilus micro-organisms are found within the human body but are also found in yogurt, sauerkraut, miso and tempeh. In order to encourage and maintain a healthy digestive tract, a diet rich in these live active cultures are essential.

2.5.3.4 Set yoghurt

This kind of yoghurt is inoculated, packaged and incubated in the retail containers (Tamime and Deeth, 2012).

2.6 Factors affecting the quality of yoghurt

2.6.1 Type of milk

Goat's milk yoghurt had a better digestibility than cow's milk, and the composition varies according to type of milk (Tamime and Deeth, 2012). Goat's milk is naturally homogenized and contains smaller fat globules, which are easier to digest than cow's and buffaloes' milk (Fevrier *et al.,* 2013). Like as cows' milk casein, goat's milk has also the same four fractions (αs1, αs2,b and k-casein), but genetic differences by breed and individuals in αs1- casein occur. Low αs1- casein type of goat's milk has shorter coagulation times and weaker resistance to heat than higher types (Jordana *et al*., 2005).

2.6.2 Starter cultures

Diverse starter cultures are used in the manufacture of dairy products, which may be single strain, mixed strain or multiple strain.

Yogurt starter culture is composed of *Lactobacillus bulgaricus* and *Streptococcus thermophilus*in a 1:1 ratio, these two organisms have a stimulating effect on each other. The growth of lactobacilli results in the breakdown of proteins releasing peptides which encourage the streptococcal growth, leading to the production of formic acid and carbon dioxide that in turn stimulate *Lactobacillus bulgaricus* which is accountable for further production of lactic acid (Corporate, 1983). During incubation, both organisms produce acetaldehyde that gives yoghurt its characteristic flavour.

2.6.3 Heat treatment

From the technological and hygienic point of view, Heating temperature of milk used in yoghurt manufacture has been considered as an important process. It helps to give yoghurt good form and texture as well as satisfactory flavour (Monib *et al*., 2011). Heat treatment of milk takes place by high temperature short time treatment (HTST, at 98^{o}C/0.5-1.87 min) and ultra-high temperature treatment (UHT, 140^{o}C/2-4 seconds). The most feasible heating process investigated was HTST with a residence time of 1.87min (Parnel-Clunies *et al*., 2006). Monib *et al*. (2011) reported that heat treatment of milk had a perceptible effect on the quality of yoghurt, with best quality being that for the product made from milk heated to 85^{o}C for 10 minutes. Vescove (2010) mentioned, making yoghurt from pasteurized milk at 90^{o}C for 30 minutes had increased the amount of acetaldehyde comparative with that made from milk with commercial pasteurization (time and temperature).

2.6.4 Storage of yoghurt

The period of yoghurt storage before its consumption depends on the following factors: a) the interval of storage in a dairy plant (up to 4-6 days), b) the storage time in distribution channels (upto 7 days), c) the home storage by the consumer (upto 4-6 days). This means in total 2-3 weeks of storage time after the manufacture of yoghurt. Therefore, a reasonable effort should be made to produce yoghurt with a storage life of at least 3 weeks. This can normally be achieved in the careful manufacture.

All components regularly increased by storage except pH value and fat, which decreased. It could also be experimental that the rate of changes in chemical composition of yoghurt samples stored at 9-10^{o}C was relatively higher as compared with those stored at 4-5^{o}C. This difference might be accredited to the accelerating effect of temperature (9-10^{o}C) on both bacterial and enzymatic activity. However, keeping at 4-5^{o}C can retard this activity (Shalaby *et al.,* 2009).

Accolas *et al,* (1977) found that yoghurt stored at 14^{o}C showed significant acid production during storage which decayed at 8^{o}C and no acid was produced in samples kept at 0^{o}C. Cold storage and vigilant stock rotation have role in ensuring that consumer always receives uniform, good quality yoghurt (Humphrey and Maurean, 2009).

2.7 Nutritional value of yoghurt

The nutritive value of yoghurt is similar to that of milk from which it is prepared, the differences happening only as a result of fortifications, use of additives and fermentation (Deeth et al, 2014). Some yoghurt may contain small amount of allowed food additives such as preservatives, stabilizers or starch, colours or flavours, although an increasing number of fruit yoghurt is being made with only natural additives. It’s a highly nutritious food fit for everyone. Plain yoghurt would be given to infants who are being weaned from liquid to solid diet, as it provides respected nutrients present in milk (in a more solid form), (Corporate,1983). Yoghurt is also suggested for invalids and elderly because it is easy to digest, those concerned with weight lessening find low- fat plain yoghurt or reduced- calorie yoghurt useful as part of their calorie-controlled diet (Corporate, 1983). Fermentation decreases lactose content in the resultant yoghurt. Alm (2012) said that the fermented milk products should be considered as alternatives in formulation diets for lactose- intolerant people.

2.8 Therapeutic effect of yoghurt

Yoghurt is widely used as a skin lotion. Women made a most effective hair conditioner by mixing yoghurt with eggs and drops of olive oil (Peterson, 2011). The inhibitory effects of lactic acid bacteria have been conveyed by several investigators (Hurts, 2012; Driessen and Stadhoulders, 2012; Sultan *et al*., 2008). The inhibition of contamination organisms by yoghurt starter culture may be attributed to the combined effect of lactic acid and antibacterial substances produced by the starter culture (Mohrand and Said, 2000).

2.9 Stabilizers in yoghurt

Stabilizers are added in order to progress the viscosity of the product and prevent whey syneresis and they are hydrophilic in nature, (Tamime and Robinson, 2008). Numerous additives such as gelatine, pectin, sodium hexa-metaphosphate, gum acacia, starch and Gum Arabic are used at different levels to overwhelmed the problem of whey separation (El-Sobery and Shalaby, 2011). Leder and Thomasow (1973) and Shukla *et al*. (1986) mentioned that gelatin was the best additive in improving the quality of yoghurt. Kosikowski et al, (1982) uttered the opinion that the presence of stabilizers affects the refreshing taste of the product.

Hamdy (1972) and El-Shibiny *et al,* (1978) reported that the addition of gelatine improved the organoleptic properties of yoghurt. Some hydrocolloids cause a visible decrease in volatile fatty acids, acetaldehyde and di-acetyl contents in the resultant yoghurt. This is accredited to the negative effect of additives on the growth of starter culture where total counts of the organism responsible for the production of flavour components called *L. bulgaricus* slightly decreased (El-Sobery and Shalaby, 1991).

2.10 Uses of soymilk in the dairy industry

Soymilk offers the most practical economic substitute to milk for the manufacture of many dairy products (Hofi *et al*. 1976 and Hamad *et al*., 1985). Starter cultures of yoghurt grown on soymilk medium resulted in increasing the total bacterial count, lactic acid bacterial count and titratable acidity of the resultant fermented milk, furthermore the clotting time was decreased (Abou El-Ella *et al*., 1980). Soymilk can also be successful for growing lactic starterculture (Angelles and Marth, 1971; Mital *et al*., 1974; Kothari, 1976). Soymilk offers the most practical economic substitute to milk for the manufacture of many dairy products (Hofi *et al*. 1976; El- Softy Mehanna, 1977; Abou-Donia *et al*., 1980; Hamad *et al*., 1985). Starter cultures of yoghurt grown on soymilk medium resulted in increasing the total bacterial count, lactic acid bacterial count and titratable acidity of the resultant fermented milk, furthermore the clotting time was decreased (Abou El-Ella *et al*., 1980). Soymilk can also be successful for growing lactic starterculture (Angelles and Marth, 1971; Mital *et al*., 1974; Kothari, 1976).

Obara (1968) suggested that an acceptable cheese-like product could be produced form soymilk using a mixture of *Lactococcus Lactis* ssp. *Lactis* and *Lactococcus Lactis* ssp. *Cremoris*. A satisfactory Cheese-like product can also be produced, by incorporating rennet extract and skim milk into soymilk, using *S. thermophilus* as a fermenting bacterium (Hang and Jacks, 1967).

Yamamaka, 1970 developed a sour milk beverage, or yoghurt from an aqueous dispersion of skim milk solids, soy protein and amino acids fermented by *L. bulgaricus* and *S. thermophilus.* They claimed that adding amino acids to the fermented medium masked the characteristic flavour of soy protein.

In Bangladesh, many tries were made to enhance soy protein in the manufacture of some imitated dairy products such as cheese (Ghaleb *et al.*, 1983; Magdob *et al*., 1985), yoghurt (Ghaleb *et al*, 1983; Al-Amin and Hassan, 1987), and ice cream (El-Deeb and Salam, 1984; Hamad *et al*., 1985). Soybeans in the whole- unmodified form are relatively indigestible and not highly acceptable as food (Steinkraus *et al*., 1962). Therefore, many food products have been developed from soybeans after modification such as soymilk (Kanda *et al*., 1981; Aworth *et al*., 1987) and soybean protein isolation (Lee *et al*., 1985). Adam (1996) studied the effect of partial substitution of cow’s milk by soymilk on the composition and sensory characteristics of yoghurt. The minimum percentages of fat, protein, total solids and solids- non- fat were obtained from yoghurt made from cow’s milk substituted by 20% soymilk compared to the maximum percentages in the control sample. The maximum ash content was in 5% soymilk yoghurt and the minimum in 20% soymilk. Yoghurt made from cow’s milk scored the highest in colour, taste and overall acceptability, while 20% soymilk yoghurt scored the best. The flavour score was high in 20% soymilk yoghurt, although there was no significant difference, and the consistency did not show any significant difference.

CHAPTER THREE

MATERIALS AND METHODS

3.1 Materials

Goat's milk was obtained from the M/S Adarsha Dairy Farm. Karnafully Dairy Products Company (KDPC) kindly supplied the starter culture (1:1 combination of *L. bulgaricus* and *S. thermophilus*). Sugar (sucrose), plastic cups (100 ml size) and fruits (banana and Mango) were purchased from the local market.

3.2 Methods

3.2.1 Preparation of soymilk

Soymilk was prepared according to Adam (2016) as follows: Beans (250 gm) were soaked in 1(one) litre boiling water, kept in a refrigerator overnight and homogenized in 1.4 litres boiling water. The subsequent slurry was filtered using cheesecloth to obtain the soymilk.

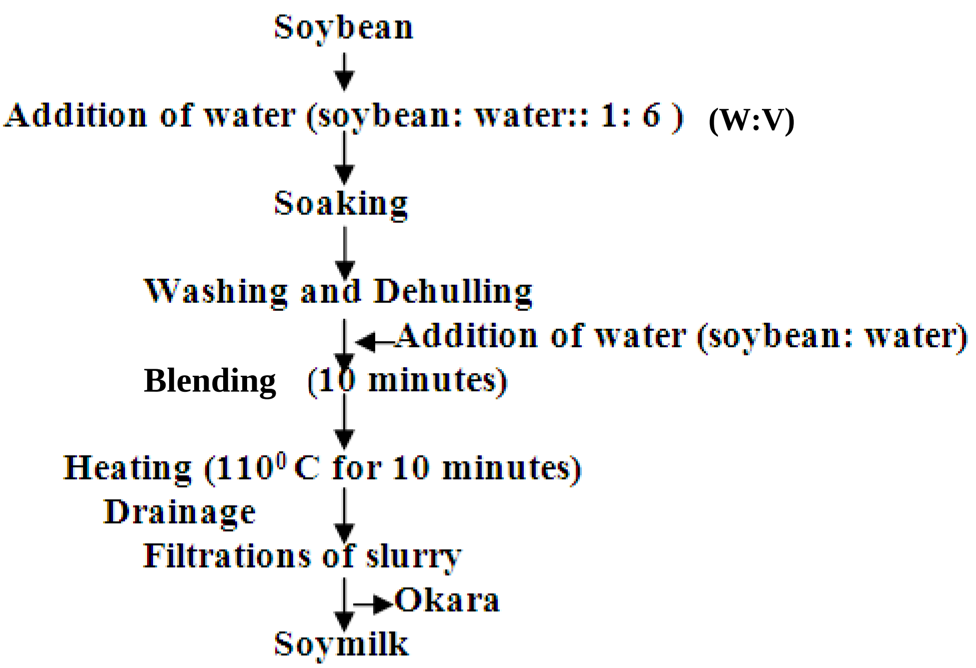


Figure 1- Soymilk making process

3.2.2 Preparation of samples for yoghurt preparation

Yoghurt was manufactured using goat's milk with the addition of soymilk, sugar and fruits. Samples were prepared as follows:

1) The first sample (control) was made from goat's milk only.

2) The 2nd was made with goat's milk supplemented by 10% soymilk.

3) The 3rd was made with goat's milk supplemented by 15% soymilk.

4) The 4th was made with goat's milk supplemented by 20% soymilk.

Sugar at the rate of 6% was mixed to all samples except the control. Furthermore, each sample (except the control) was divided into two parts:

(a) To the first part banana juice (90 gm banana slices/100 ml water) was added,

(b) To the second part, mango juice (50 gm mango slices/100 ml water) was added.

3.2.3 Preparation of yoghurt

Yoghurt samples were prepared as described by Kosikowski (2012). Milk was heated to 90^{o}C for 30 min, followed by cooling to 45^{o}C. Starter culture at the rate of 3% (1:1 combination of *L. bulgaricus* and S. *thermophilus*) was mixed. Soymilk, sugar and banana juicewere added to milk before milk pasteurization, while mango juices were added after pasteurization. The mixture was poured into clean dry plastic cups (100-ml size), covered and incubated at 42-45^{o}C for 4 hr, the cups were then placed in the refrigerator at 4^{o}C. The chemical and sensory studies were carried out at 0, 3 and 6-day intervals.

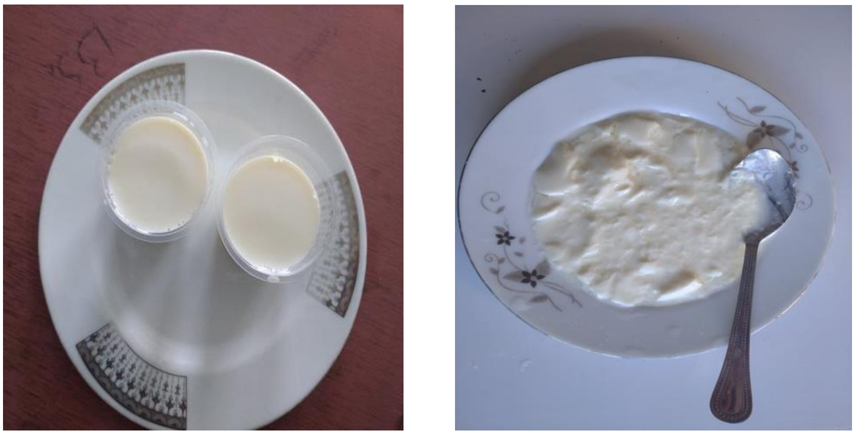


Figure: Soy Yoghurt

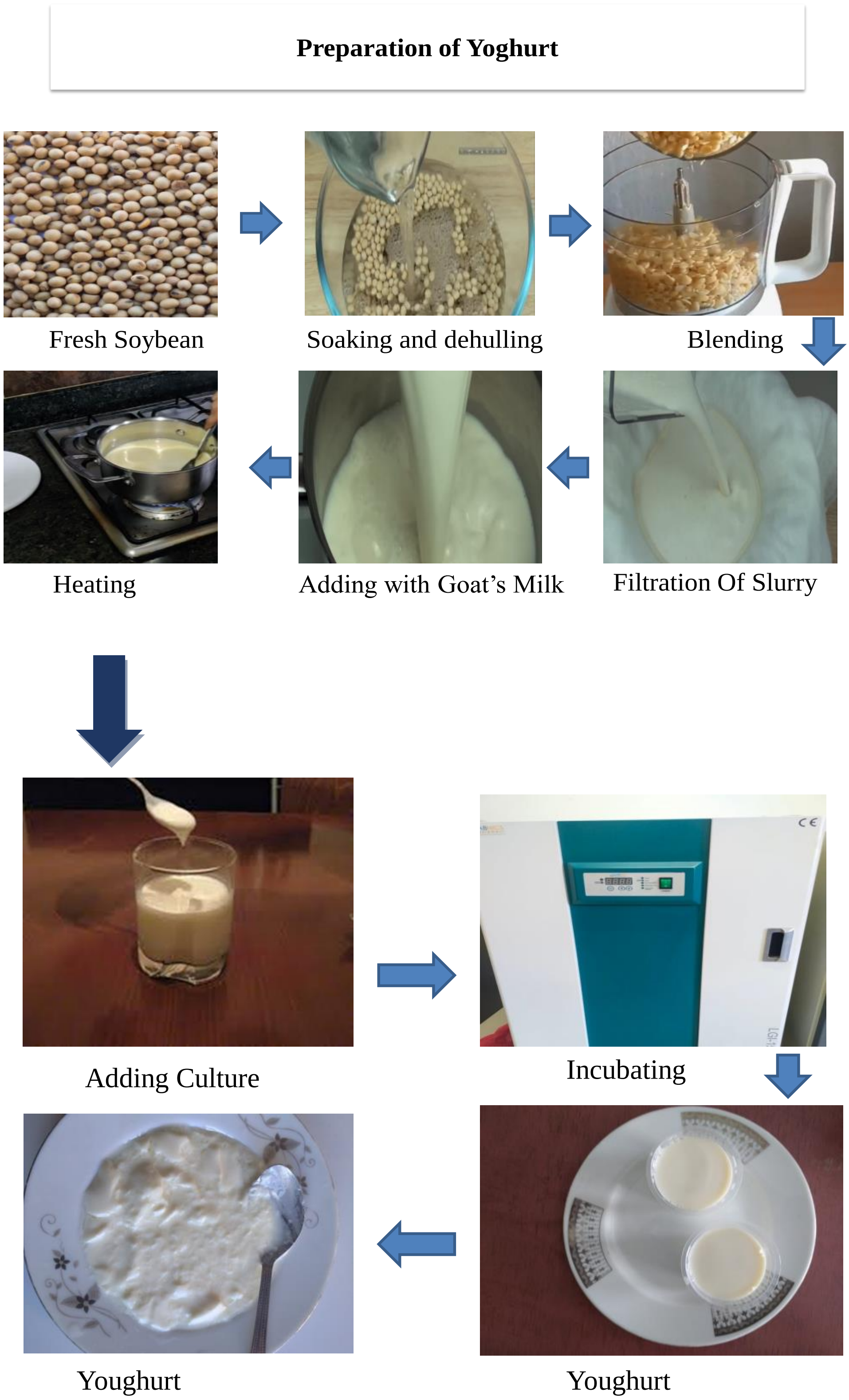


Figure: Preparation of Yoghurt

3.2.4 Chemical analyses of milk and yoghurt

3.2.4.1 Fat content

Fat content was determined by Gerber method according to Bradley,1992 as follows: 10 ml of sulphuric acid (specific gravity 1.815 gm/ml at 20^{o}C) were poured into a clean dry Gerber tube, then 10.94 ml of milk or yoghurt sample were added. Amyl alcohol (1 ml) was added to tube and then add distilled water (10 ml). The contents were thoroughly mixed until no white particles could be seen. The tubes (Gerber Tube) were centrifuged at 1100 revolutions per minute **(**rpm**)** for 4-5 minutes. The tubes were then transferred to water bath at 65^{o}C for 3 min. The fat column was immediately read after exclusion from water bath.

3.2.4.2 Protein content

The protein content was determined by Kjeldahl method. The Kjeldahl method was developed by Johan Kjeldahl in 1883 which recognized by Codex Alimentarius as the standard for measuring milk protein (FAO, 2017). The methods are as follows: 10(ten) millilitres of milk (10 gm yoghurt) were poured into a clean dry Kjeldahl flask and 2 gm Kjeldahl tablest ($CuSO_4$) were added as catalyst. 25 millilitres of concentrated sulphuric acid were added to the flask, and then heated until a clear solution was obtained. The flask was left for another 30 minutes, after which the flask was removed and allowed to cool. The digested sample was transferred in a volumetric flask and diluted to 100 ml with distilled water.

The Chemical reactions are as follows:

$N(food) = (NH_4)_2SO_4$ (1)

$(NH_4)_2SO_4 + 2\ NaOH = 2NH_3 + 2H_2O + Na_2SO_4$ (2)

$NH_3 + H_3BO_3$ (boric acid) $= NH_4^+ + H_2BO_3^-$ (3)

$H_2BO_3^- + H^+ = H_3BO_3$ (4)

5 millilitres were distilled with 10 ml of 40% NaOH. The distillate was received in a conical flask containing 25 ml of 2% boric acid plus 3(three) drops of indicator (bromocresol green + phenolphthalein red). The distillation was continued until the

volume in the flask was 75 ml, then the flask was removed from the distillator. The distillate was titrated with 0.1 N HC1 until the end point (red colour) was obtained.

We can calculate the protein content from the following equation:

$$N(\%) = \frac{T \times 0.1 \times 20 \times 0.014}{W} \times 100$$

Protein content = N (%) × 6.38

Where:

T = titration figure, W = weight of the original sample

3.2.4.3 Total solids content

According to the modified method of AOAC (1990) the total solids content was determined: 3(three) grams of samples (milk or yoghurt) were weighed into a dry clean flat-bottomed aluminium dish, heated on a steam bath for 10 to 15 minutes. The dish was further put in an oven at 70°C overnight, and then cooled in a desiccator and weighed quickly. Heating and weighing were repeated until the difference between the two consecutive weighing's was less than 0.1 mg. The total solids content was determined from the following equation:

Total solids (%) = $\frac{W1}{W0} \times 10$

Where:

W_1 = Weight of sample after drying, W_0= Weight of sample before drying

3.2.4.4 Ash content

Ash content was determined by methods of Ranganna (2002). Ash content is the inorganic residue remaining after destruction of organic matter. 10(Ten) gram sample was taken in a pre-dried weighed crucible. It was then burned to charcoal. The charcoal was then taken in a muffle furnace and heat at around 600°C for 4 hours till the charcoal is completely removed. The crucible is then taken out of the furnace. Cool it in a desiccator carefully and then weighed.

% Ash content =$\frac{W3 - W1}{W2 - W1} \times 100$

Where:

W1 = the weight of dried empty crucible

W2 = the weight of dried crucible with sample

W3 = the weight of the crucible with ash

3.2.4.5 Titratable acidity

Titratable acidity was determined by methods of Ranganna (2002). Fifty-gram (50g) sample was taken in a blender and homogenized with distilled water, The blended materials were then filtered and transferred to a 250 ml volumetric flask and the volume was made up to the mark with distilled water. Five ml solution was taken in a conical flask and titrated with 0.1N sodium hydro-oxide (NaOH) solution using phenolphthalein as an indicator. The end point shows colourless to pale pink and will stand 15 seconds. The titration was done for several times for accuracy.

Percentage of titratable acidity was calculated using the following formula:

$$\% \text{ Titratable acidity} = T \times N \times V_1 \times E \times V_2 \times W \times 100 \times 100$$

Where:

T = Time, N = Normality of NaOH, V_1 = Volume made up

E = Equivalent weight of acid, V_2 = Volume of sample taken for estimation and W = Weight of sample

3.2.5 Sensory evaluation

Yoghurt samples were subjected to sensory evaluation using 15 inexpert panellists at 0, 3 and 6-days intervals. The test was done in a duplicate (Appendix 1)

3.2.6 Statistical analyses

Data were determined and stored in Microsoft Excel 2013 spread sheet to evaluate statistical analysis. All samples were in three replicates. Descriptive statistics (mean and standard deviation) were done for proximate composition and sensory evaluation of yoghurt. Data were sorted, coded and recorded in IBM SPSS Statistics 25. After that statistical analysis were conducted. Proximate composition and sensory evaluation data were analysed by using One-way ANOVA procedures to assess significant level of variation at 95% confidence interval. Post hoc "Tukey" test was conducted to identify the variation within the sample groups. The statistical analysis was conducted for at 5% level of significant ($P < 0.05$).

3.4 Microbiological analysis

Soymilk and soy-yoghurt sample, were examined for viable count of bacteria, *Esherichia coli* and moulds using plate count Agar, Eosin Methylene Blue agar and Potato Dextrose Agar, respectively.

The pour plate method was used to enumerate the total number of viable microorganisms in the soymilk and the various yoghurt samples. Serial dilution was done using normal saline to 10^{-6} dilution and 1 mL of 10^{-6} dilution was added into each sterile petri dish. Molten plate count agar was added into the plates, agitated, allowed to solidify and incubated at 28 and 37°C for 48 h. The number of colonies counted on the plates taken into consideration the dilution factor.

The presence of *E. coli* was determined by inoculating soymilk and the soy-yoghurt samples on Eosin methylene Blue Agar and incubating at 37°C for 18 h (Anderson and Holbrook, 1980). The presence of yeasts and moulds were enumerated by inoculating serial dilution of soymilk and soy-yoghurt samples on potato Dextrose Agar. The plates were incubated at 25°C for 3-4 days (Harrigan and McCance, 1976).

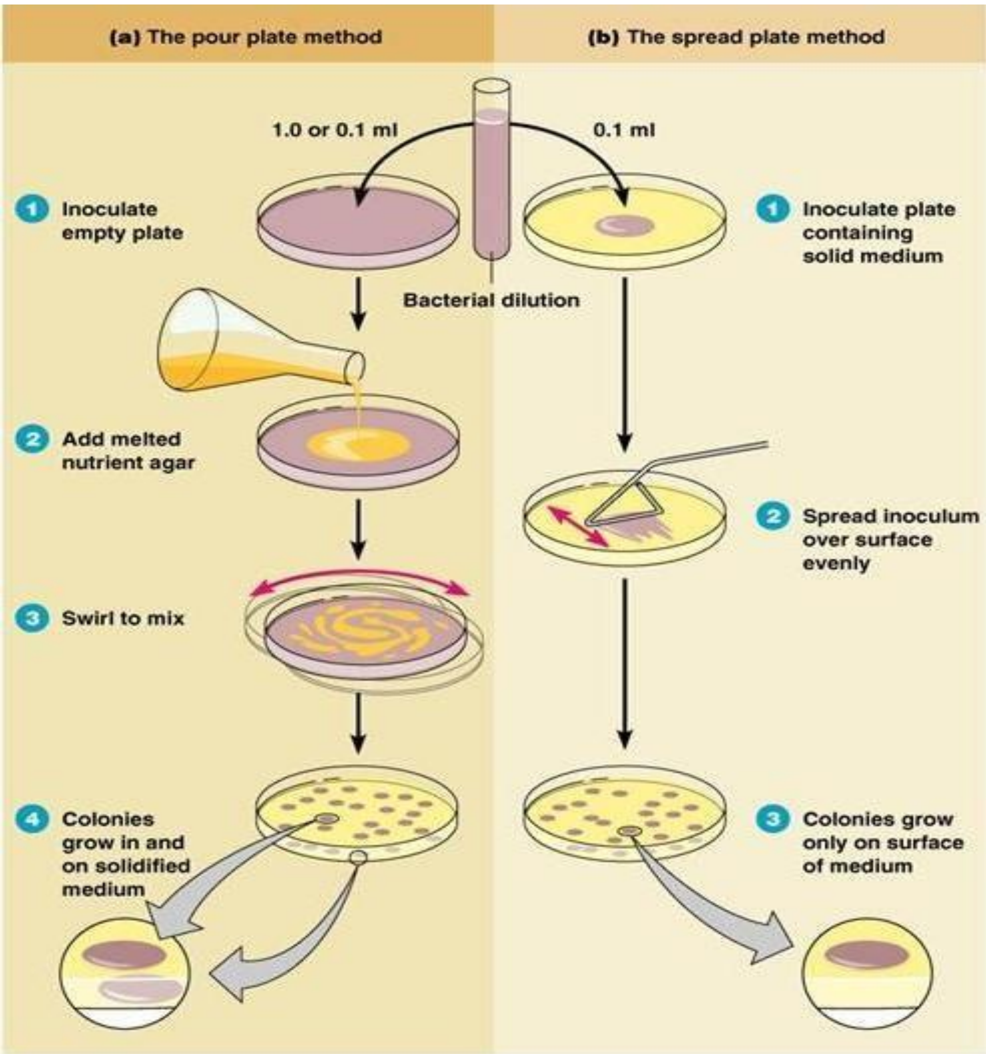


Figure: TPC determination procedure flow diagram

3.4.1 Mould counts

Peptone water (0.1%) containing 5ml O of yoghurt was kept at room temperature (26±2 C) for 48 h for enumeration. Diluents were made using 0.1% peptone water, and 1ml from each diluent was pourplated on Saboround dextrose agar plates, and the plates were incubated at room temperature for 48 h after which colonies were counted manually.

3.4.2 Standard plate counts

A SPC was used to estimate the level of microbes in the prepared & stored soy yoghurt. This data could be used as the indicators of food quality or predictors for the shelf life of the product. Using a sterile pipette, 1 ml of the diluted sample was then taken into each of the sterile empty petri-dishes having nutrient agar media (Plate count agar) at a temperature of 45°C.Plates were mixed by swirling on a flat surface.

After solidification of the media the plates were inverted and incubated at 37 °C for 24 hours in an incubator (Sharf et al, 1966).

3.4.3 Counting and recording

After incubation the incubated plates were selected for counting the bacterial colony based on the number and easy of counting of the colony. The plate containing segregated, overlapping and confusing colonies was avoided. The plates containing 30 to 250 bright, cleared and countable colonies were selected.

Number of colony forming unit (cfu)/g or ml. = $\frac{\text{Average cfu}}{\text{Plate}}$ x dilution factor.

The viable bacterial count was done through the steps of sample preparation, sample dilution, standard plate counts and counting and recording. The incubation was performed at 37°C for 24 hours (Sharf et al, 1966).

CHAPTER FOUR

RESULTS AND DISCUSSION

4.1 Effect of amount of substitution of soymilk composition of yoghurt

Table 1 shows the chemical composition of yoghurt that affected by soymilk concentration. The fat content of yoghurt was significantly (P<0.05) affected by the concentration of soymilk, where the highest fat content was found in the control sample (3.67±0.17%) followed by milk supplemented with 10%, 20% and 15% soymilk (3.19±0.51, 2.89±0.47% and 2.94±0.43 respectively). The protein content was meaningfully (P<0.05) affected by the concentration of soymilk with the highest protein content was in the control sample (7.51±0.82%), then the content progressively lessened to 6.45±1.13, 6.57±1.17 and 6.20±1.71% as milk was supplemented with 10%, 15% and 20% soymilk respectively.

The total solids content was significantly (P>0.05) fewer in the control sample (14.12±0.57). The total solids content of yoghurt inclined to decrease with the increase of soymilk concentration. The highest total solids was noted in the 10% level of soymilk (18.65±1.33) trailed by 15% and 20%, (18.24±1.59 and 17.89±1.76 respectively). However, the difference in total solids did not secure a statistical significance (Table 1).

The ash content of yoghurt was significantly (P<0.001) affected by the concentration of soymilk. The ash content in the yoghurt (control) was 0.68±0.07, then progressively decreased as the concentration amplified (0.62±0.09, 0.59±0.07 and 0.52±0.11%) in yoghurt supplemented with 10%, 15% and 20% soymilk respectively. The acidity was significantly (P<0.05) affected by soymilk concentration, with the highest acidity gained in the yoghurt (control) (1.12±0.02), then a steady decrease was detected as the concentration increased (0.90±0.21, 0.88±0.15 and 0.88±0.14%) for yoghurt supplemented with 10, 15 and 20% soymilk, respectively.

Table 1 Effect of concentration of soymilk on the chemical composition of yoghurt

Composition (%)	**Concentration of soymilk (%)**				**S.L.**
	Control	**10**	**15**	**20**	
Fat	3.67±0.17^{a}	3.19±0.51^{b}	2.89±0.47^{c}	2.94±0.43^{bc}	**
Protein	7.51±0.82^{a}	6.45±1.13^{b}	6.57±1.17^{b}	6.20±1.71^{b}	*
Total Solids	14.12±0.57 ^{b}	18.65±1.33^{a}	18.24±1.59^{a}	17.89±1.76^{a}	*
Ash	0.68±0.07^{a}	0.62±0.09^{b}	0.59±0.07^{c}	0.52±0.11^{b}	***
Acidity	1.12±0.02^{a}	0.90±0.21^{b}	0.88±0.15^{b}	0.88±0.14^{b}	*

Means within the same row bearing similar letters are not significantly different ($P>0.05$).

S.L. = Significance level

*** = $P<0.001$

** = $P<0.01$

* = $P<0.05$

NS = Not significant

The above results were in agreement with those reported by Adam (1996) and Blesa, 1980 who found that the fat content lessened as the soymilk concentration used for the manufacture of soy-yoghurt increased.

The reduction in protein content with the intensification of soymilk concentration might be due to lower protein content of soybean, and this result is in agreement with Blesa, 1980 who found a diminishing trend of protein content from 3.0% to 2.5% in cow's milk supplemented with soymilk. The fact that control sample did not contain any additives as in the other types, a result might explain the increase in solids content in yoghurt made with the accumulation of sugar, fruits and soymilk. This explicates the lower total solids content of the plain yoghurt, but as the soymilk was added to milk, there was an increase in total solids content. This result is in dissimilarity with the findings of Lee *et al.* (1990) and Adam (1996) who stated that, milk-based yoghurt contained higher total solid content than the soymilk alone.

The ash content reduced with increasing soymilk concentration, a result that agreed with Metal and Steinkraus (1976) who stated a decreasing ash content with increasing soymilk concentration. The results of acidity reported in this investigation are in agreement with those stated by Metal *et al*. (1974) who suggested that, the poor acid production in soymilk by *Lactobacillus bulgaricus* was due to certain inhibiting substances in soymilk that resulted in the failure of the organism to ferment sucrose and other carbohydrates in soymilk. The results are also in agreement with the findings of Gehrke and Weister (1948) who stated that the lactic cultures produced less acid in soymilk than in cow's milk. However, the results are in disagreement with Abou-Donia *et al.* (1980) and Metal and Steinkraus (1976) who stated rise in acidity with increasing level of soymilk further.

4.2 Effect of concentration of soymilk on the sensory characteristics of yoghurt:

In Table 2 shows that, soymilk concentration significantly ($P<0.01$) affected the colour of yoghurt, with the plain yoghurt recording the highest in colour (4.80±0.67) and then the score decreased by increasing soymilk concentration (3.69±1.19, 3.54± 1.14 and 3.53 ±1.24 in 10%, 15% and 20% soymilk, respectively, however the flavour score augmented by increasing soymilk concentration (2.27±0.86, 2.38±0.79 and 2.42±0.87 in 10% 15% and 20% respectively), except for plain yoghurt, which scored the highest (3.53±0.91) ($P<0.05$). No significant variation was reported between the mean scores of different soymilk concentrations in consistency, taste and overall acceptability ($P>0.05$). However, the highest scores were found in plain yoghurt(sample) (3.23±1.19, 3.50±1.72 and 3.70±1.55) for consistency, taste and overall acceptability, respectively. The lowest score in consistency was in yoghurt supplemented with 15% soymilk (2.66±1.04), while the lowest score in taste was in 20% soymilk yoghurt (3.31±1.17) and the overall acceptability score was lowest in 10% soymilk yoghurt (3.41±1.17).

The results of colour, taste and overall acceptability are in harmony with Nosfor and Chukwu (1992) who reported that, yoghurt from cow's milk showed lesser scores in taste, colour and overall acceptability than that made from buffalo's milk.

Table 2 Effect of concentration of soymilk on the sensory characteristics of yoghurt

Sensory Attributes	Soymilk Concentration (%)				S.L
	Control	10	15	20	
Colour	4.80±0.67[a]	3.69± 1.19[b]	3.54± 1.14[b]	3.53± 1.24[b]	**
Flavour	3.53±0.91[a]	2.27± 0.86[b]	2.38 ±0.79[b]	2.42± 0.87[b]	*
Consistency	3.23±1.19[a]	2.77± 1.03[a]	2.66± 1.04[a]	2.80± 0.94[a]	NS
Taste	3.51 ±1.72[a]	3.44± 1.22[a]	3.53 ±1.04[a]	3.31± 1.17[a]	NS
Overall Acceptability	3.70±1.55[a]	3.41± 1.17[a]	3.55± 1.00[a]	3.43± 1.04[a]	NS

Means within the same row bearing similar letters are not significantly different (P>0.05).

S.L. = Significance level

** = P<0.01

* = P<0.05

NS = Not significant

The results are also in agreement with those of Lee *et al*. (1990) who reported that milk-based yoghurt was preferred by the sensory panellists. The results of flavour and consistency are in accord with Abou-Donia *et al*. (1980) who stated that the control sample give the best organoleptic score, and also in agreement with El-Gazzar and Hafez, 1992 who found the total organoleptic characteristic of the normal fresh cow's milk yoghurt to be brilliant compared with those of yoghurt made from soymilk. Nevertheless, the results of flavour are in variance with Mohamed (1999) and Cheng *et al.* (1990) who reported that the flavour score decreased with increasing soymilk concentration.

4.3 Effect of type of fruit on the chemical composition of yoghurt:

In Table 3, the data shows that fat content was significantly (P<0.0.5) affected by type of fruits added the highest value was obtained in banana (3.03±0.26) followed by mango yoghurt (2.86±0.89). The protein content was highly significantly (P<0.001) affected by type of fruit, with the highest content being in banana (5.96±1.25) followed by mango (5.85±0.73). The total solids content was highest (P<0.001) in banana yoghurt (17.78 ± 0.86) followed mango (17.60 ± 2.06). The ash content was high in mango yoghurt (0.55±0.12) followed by banana (0.55±0.09). The acidity was significantly (P<0.001) higher in mango yoghurt (1.04±0.08) followed by banana (0.84±0.14).

The results of total solids are in concurrence with Duitschaever *et al.* (1973) who determined that high solids fruit preparations would increase the total solids of fruit yoghurt. Kroger and weaver (1973) found that in fruit yoghurt the total solids content was strongly dependent on the addition of fruits.

Table 3 Effect of type of fruit on the chemical composition of yoghurt

Composition (%)	**Type of fruit**		**S.L**
	Banana	**Mango**	
Fat	3.03 ± 0.26^{ab}	2.86 ± 0.89^{b}	*
Protein	5.96 ± 1.25^{b}	5.85 ± 0.73^{b}	***
Total solids	17.78 ± 0.86^{b}	17.60 ± 2.06^{b}	***
Ash	0.55 ± 0.09^{b}	0.55 ± 0.12^{b}	***
Acidity	0.84 ± 0.14^{b}	1.04 ± 0.08^{a}	***

Means within the same row bearing similar letters are not significantly different (P>0.05).

S.L. = Significance level

*** = P<0.001

* = P<0.05

The results of fat also agreed with those of Gad El-Rab *et al*. (1995) who determined that, addition of Mango juice to buffalo's milk reduced the fat content of the product.

The results of total solids agree with those of Duitschaever *et al.* (1973) who concluded that high solids fruit preparations would raise the total solids of fruit yoghurt. Kroger and weaver (1973) determined that in fruit yoghurt the total solids content was strongly dependent on fruit addition, and Park (1999) reported that the blueberry flavoured goat's milk yoghurt showed greater total solids and lesser fat than plain yoghurt.

4.4 Effect of type of fruit on the sensory characteristics of yoghurt:

In Table 4 shows that the colour was significantly ($P<0.001$) affected by form of fruit yoghurt, with the highest score obtained in mango yoghurt (3.52±1.23) followed by banana yoghurt (3.20±1.26). The highest score of flavour ($P<0.05$) was gained in banana (2.46±0.82) than mango (2.33±0.87). The consistency was best ($P<0.01$) in banana yoghurt (3.87±0.99), while mango yoghurt was the foulest in consistency (2.67±0.97). Although, taste was not significantly ($P>0.05$) affected by the accumulation of fruit in yoghurt manufacture, banana yoghurt scored best (3.38±1.19) followed by mango yoghurts (3.41±1.18). The overall acceptability was not significantly ($P>0.05$) affected by types of fruits used in the production of yoghurt, although the highest score was attained in mango yoghurt (3.48±1.13) followed by banana (3.37±1.16).

Table 4 Effect of type of fruit on the sensory characteristics of yoghurt

Sensory attributes	**Type of fruit**		**S.L.**
	Banana	**Mango**	
Colour	3.20 ±1.26^{b}	3.52± 1.23^{b}	***
Favour	2.46 ±0.82^{a}	2.33 ±0.87^{b}	*
Consistency	2.86 ±0.99^{a}	2.66 ±0.98^{b}	**
Taste	3.38 ±1.19^{a}	3.41 ±1.18^{a}	NS
Overall acceptability	3.37 ±1.16^{a}	3.48 ±1.13^{a}	NS

Means within the same row bearing similar letters are not significantly different ($P>0.05$).

S.L. = Significance level

*** = $P<0.001$

** = $P<0.01$

* = $P<0.05$

NS = Not significant

My results in flavour and consistency concur with Abdallah (1997) who found that banana scored higher flavour and consistency. The higher score of colour, taste and overall acceptability might be due to the permanency of colour and taste during manufacture. Gad El-Rab *et al*. (1995) and Guirguis *et al*. (1984) determined that the supplementation of banana to the milk lead to production of yoghurt with lowermost firmness and consistency

4.5 Effect of storage period on the chemical composition of yoghurt:

In table: 5 shows that, though fat content was not significantly affected ($P>0.05$) by storage period, it amplified at the (3^{rd}) third day of storage period (3.19±0.58%) and was low at the commencement of storage period (3.14±0.45). The protein content ($P<0.001$) and acidity ($P<0.05$) amplified from 6.21±0.97 and 0.93±0.18 respectively at the beginning of storage period to (6.93±1.25 and 0.96±0.17, respectively), at the end of storage period. However, the ash ($P<0.001$) contents and total solids ($P<0.01$) increased from 0.59±0.08 and 17.05±2.21 at the commencement of storage period to 0.65±0.10 and 17.73±2.43, respectively at the (3^{rd}) third day, followed by a decrease to 0.59±0.11 and 16.95±2.05 at the end of (0n 6^{th} day) storage period.

The results of protein agreed with the findings of El-Shibiny*et al*. (1979a, b), Mohon and Saddum (1990) who stated that, during the storage of yoghurt, either at cold of room temperature, soluble protein, total protein and amino acids values progressively augmented.

Table 5 Effect of storage period on the chemical composition of yoghurt

Composition (%)	Storage period (days)			S.L
	0	3	6	
Fat	3.14 ±0.45[a]	3.19± 0.58[a]	3.17± 0.49[a]	NS
Protein	6.21 ±0.97[b]	6.90± 1.18[a]	6.93 ±1.25[a]	***
Total solids	17.05 ±2.21[b]	17.73±2.43[a]	16.95± 2.05[b]	**
Ash	0.59± 0.08[b]	0.65 ±0.10[a]	0.59± 0.11[b]	***
Titratable acidity	0.93±.0.18[a]	0.95± 0.16[a]	0.96 ±0.17[a]	NS

Means within the same row bearing similar letters are not significantly different (P>0.05).

S.L. = Significance level

*** = P<0.001

** = P<0.01

NS = Not significant

The decrease in total solids en route for the end of storage period is in line with El-Shibiny *et al*. (1979a, b) who stated that total solids content reduces proportionally during the storage period. The decreased in ash content at the end of storage period is in concurrence with the conclusions of Adam (1996) who reported that, the ash content diminished with continuing storage period. The increase in acidity with advancing storage period agrees with Hamdy *et al*. (1974) and Abrahamsen (1978) who reported that, the total acidity of the resultant fermented milk increased during storage. The decrease in fat content during the storage period is in agreement with Shanley (1973) who reported that, with progressing storage period, the values lessen, a result which might be endorsed to the microbial action on the components of yoghurt (fat, protein and lactose).

4.6 Effect of storage period on the sensory characteristics of yoghurt

As per Table 6 colour, taste, consistency and overall acceptability (P<0.001) were finest on the (3^{rd}) third day of storage period (3.94±1.16, 3.01±1.02, 3.64±1.06 and 3.72±0.98 respectively), then they deteriorated towards the end (3.17±1.22, 2.84±0.94, 3.06±1.26 and 2.99±1.12 respectively). However, the flavour improved (P<0.001) from 2.17±0.88 at the beginning of storage period to 2.63±076 at the end of storage period.

The results of colour are in agreement with Adam (1996) who reported that the highest score of colour was obtained at day zero. The increase in flavour with increasing storage agreed with Mehana and Hefnawy (1990) who reported that acetaldehyde content gradually augmented over storage time and continued during the first six days of storage. My results agreed with El-Shibiny *et al*. (1979a) who mentioned that, acetaldehyde content increased with advancing cold storage. The results of taste, consistency and overall acceptability are in concurrence with those reported by Adam (1996).

Table 6 Effect of storage period on the Sensory characteristics of yoghurt

Sensory attributes	Storage period (days)			S.L.
	0	**3**	**6**	
Colour	3.85± 1.07^{a}	3.94 ±1.16^{a}	3.17± 1.22^{b}	***
Flavour	2.18 ±0.88^{b}	2.45 ±0.95^{a}	2.64± 0.76^{a}	***
Consistency	2.46 ±1.01^{b}	3.01 ±1.03^{a}	2.84± 0.94^{a}	***
Taste	3.61 ±1.17^{a}	3.63 ±1.06^{a}	3.06± 1.26^{b}	***
Overall acceptability	3.69 ±1.07^{a}	3.72± 0.97^{a}	2.99 ±1.12^{b}	***

Means within the same row bearing similar letters are not significantly different (P>0.05).

S.L. = Significance level

*** = P<0.001

4.7 Microbial quality:

Microbial quality of the yoghurts samples is shown in Table 4. Moulds were not detected in any of the samples within the three days of storage. Coliforms (CFU/ml) were detected in yoghurt samples C2 at 2.0×10 and C3 at 1.0×10 but not in the samples Aand C1. There were viable counts (CFU/ml) in all the samples and this increased in 5 5 5 5 the following order: A(1.43×10)> C1 (1.82×10) > C2 (2.62×10) > C3 (2.91×10)

Table 7 Microbiological quality of cow's milk and soymilk yoghurts after 3 days of refrigerated (4°C) storage**:**

Samples	Total viable Count (TVC) (CFU/ml)	Coli forms (CFU/ml)	Mould (CFU/ml)
Control	1.43×10^5	0.0×10	0.0×10
10%	1.82×10^5	0.0×10	0.0×10
15%	2.62×10^5	2.0×10	1.0×10
20%	2.91×10^5	1.0×10	0.0×10

Control = cow's milk yoghurt with no added calcium phosphate and lactose, 10% = soymilk yoghurt with no added lactose and calcium citrate, 15% = soymilk yoghurt with added lactose and 0.22 g of calcium citrate, 20% = soymilk yoghurt with added lactose and 0.65 g of calcium citrate, ND = not detected. Values along the column with different superscript are significantly different.

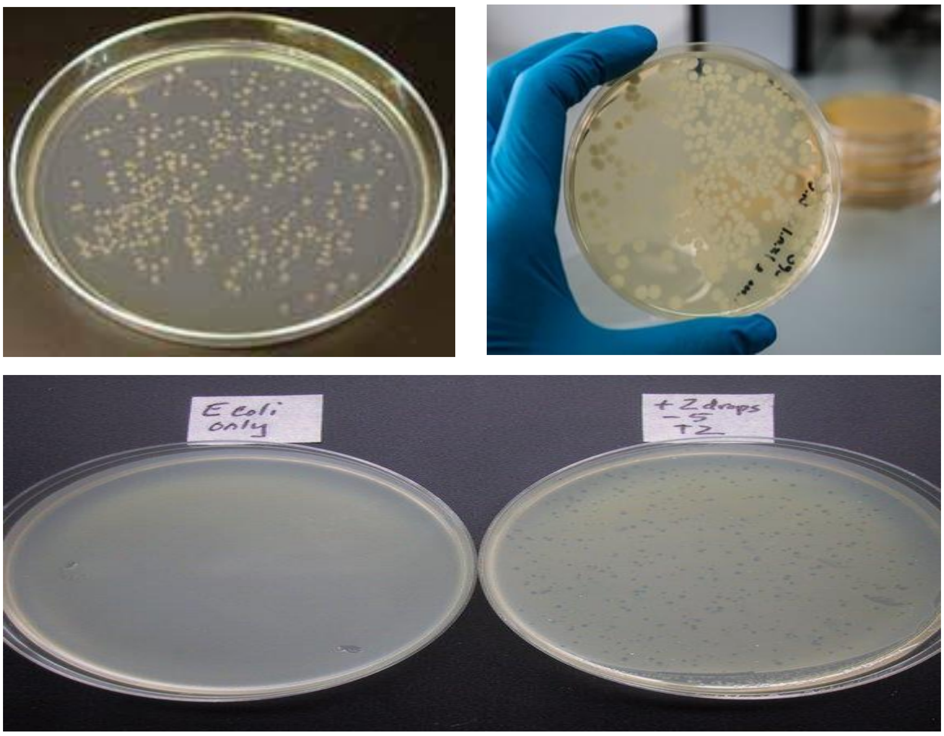


Figure: Identification of *E.coli*, Mould

CHAPTER FIVE

CONCLUSIONS AND RECOMMENDATIONS

5.1 Conclusions

Fortification of soymilk with calcium phosphate and other ingredients improved mineral contents of soymilk yoghurt. The soy yoghurts compared favourably with cow's milk yoghurt in nutrient and sensory characteristics. There were no moulds, low coliforms but high total viable counts in the soymilk yoghurts, suggesting high presence of probiotic bacteria and of health promoting quality of the yoghurts.

The soymilk yoghurts were higher in fat content than the cow's milk yoghurt. High fat content of the soymilk yoghurts is feasible from the usual high fat content in soybeans and recommended accessibility of fat-soluble vitamins in the yoghurts. Also, soy fat is plant fat, and composed mainly of unsaturated fats which are of high health profit to human. Cow milk fat is animal fat, which on the other hand is composed mainly of saturated fats which are likely to predispose consumers to heart-related diseases. High ash contents implicit high minerals in the samples. Higher protein and minerals in the cow's yoghurt suggested to higher quality than the soymilk yoghurts. Adding up of lactose to soymilk for production of soymilk yoghurt, improved nutrient of the substrate for high viable, probiotics counts.

Form this study the following conclusions can be drawn:

1) The highest fat, protein and ash contents and titratable acidity were found in the plain yoghurt (control sample), while the highest total solids content was gained in yoghurt made from 10% soymilk.
2) The plain yoghurt (control sample) presented the best scores of colours, flavour, consistency and overall acceptability, while the best score in taste was attained in yoghurt made with 15% soymilk.
3) The total solids content was high in banana yoghurt, while other constituents were high in plain yoghurt (control sample).
4) Storage of yoghurt for 3 days provided the highest fat, total solids and ash contents, while storage for 6 days resulted in high protein content and acidity.

5) The highest score in colour, consistency, taste and overall acceptability were found in yoghurt stored for 3 days, while the flavour was best when yoghurt was stored for up to 6 days.

5.2 RECOMMENDATIONS

The study recommends the following:

1) Local fruits of Chittagong as papaya and other tropical fruits can be used for the manufacture of fruit yoghurt.
2) Protein content at 6th days of storage is higher, further research should be focused on this issue as its eatable for infants or not.
3) Research should be focused on vitamin content of yoghurt from goat's milk added with soymilk.
4) Attempts should be made to prepare cowpea milk with the supplementation of soymilk or goat's milk for infants.
5) The microbiology of yoghurt made with soymilk or cowpea milk should be determined.
6) In such yoghurt, other stabilizers such as gum should be tried.

REFERENCES

Abbrahamsen, R.K. (1978). The content of lactic acid and acetaldehyde in yoghurt stored at different temperatures. International Dairy Congress, pp. 829-830.

Anderson, J.M. and K. Hollorook, 1980. The rapid detection of *Escherichia coli* in food by using direct plating method. J. Food Technol. Aust., 32: 78-83.

Abdalla, H.A. (1997). Effect of additives on the composition and sensory characteristics of yoghurt.M.Sc. Thesis, University of Khartoum, pp.63.

Abo- Dawood, E.A.; AbdRabo, H.F.; Ahmed, S.N. and Hassan, M.A.F. (1993). Manufacture of yoghurt from goat's milk. Egypt.J. Dairy Sci., 21: 21-33.

Abou-Donia, S.A.; El-Sada, M.A. and Mashaly, R. (1980).Enrichment of zabadi with soy extract. J. Dairy Res., 47(1): 151-153.

Abou El-Ella, M.W.; Farahat, Guirguis, H.A.; El-Fak, M.A. and El-Neshawy, A.A. (1980).Some properties of fermented milk as affected by soymilk starter cultures. Egypt. J. Food Sci., 8(1-2): 41- 47.

Accolas, B.R., Didienne, R. and Regnier, J. (1977). Acid producing properties of thermopgilic lactic bacteria in relation to yoghurt manufacture. Lait, 57: 1-23.

Alm, L. (1982).Effect of fermentation on curd size and digestibility of milk protein in vitro of Swedish fermented milk products. J. Dairy Sci., 65:509.

Angeles,A. and Marth, H.E. (1971).Growth of lactic acid bacteria in soymilk.Growth and acid production. J. Milk Food Technol., 34:30-36.

Anifantakis, E.M. (1986). Comparison of physico-chemical properties of ewe's and cow's milk. Bull. Int. Dairy Fed. No. 202:42-53.

AOAC (1990).Official Methods of Analysis, 15th ed., Association of Official Analytical Chemists, Washington, D.C., U.S.A. pp.375-378.

Aworth, O.C.; Adelej, B.A. and Nwanekezi, E.C. (1987). Effect of partial substitution of cow's milk with soymilk on yield and quality attributes of West Africa soft cheese. Inter. J. Food Sci. Technol., 22(2): 135-138.

Ayebo, A.D. and Shahani, K.M. (1980). Role of cultured dairy products in the diet.Cult.Dairy Prod.J., 15:21.

Blesa, O.; Ellerrieder, G.; Geronozzo, H. and Macrorittio, A. (1980). Mixtures of cow's milk and soymilk.Studies on acceptability and elimination of antinutrients.A notesde. pp. 251-256.

Bradly, Jr.; Arnold, Jr.E.;Barbano, D.M.; Semerad, R.G.; Smith, D.E. and Vines, B.K.(1992). Chemical and physical methods. In: "StandarsMethods for the Microbiological Examination of Dairy Products",16th edition. Marshall, T.R. (ed.). American Public Health Association, Washington, DC.

Chawla, A.K. and Balachandran, R. (1986). Effect of addition of potato starch on certain rheological characteristics of yoghurt. Indian Dairyman, 38:386.

Cheng, T.Y.; Setser, C.; Erickson, E.L. and Fug, C.Y.D. (1990). Soymilk yoghurt: sensory evaluation and chemical measurement. J. Food Sci., 55(4): 1178-1179.

Corporate Authors (1983).From Fat to Doorstep.A guide to Milk and Dairy Products. National Dairy Council, London, pp. 52-54.

Deeth, C.H. (1984). Yoghurt and cultured products. Aust. J. Dairy Technol., 39(3):111- 113.

Deeth, H.C. and Tamime, A.Y. (1981). Yoghurt: nutritive and therapeuticaspects. J. Food Prot., 44(1): 78-86.

Driessen, F.M. and Stadhouders, J. (1982).Effect of air on growth of Bacillus cereus during manufacture of stirred yoghurt. In XXIInternational Dairy Congress, Vol. 1, Book 1. Cited in DSA (), 45: Abstr. No. 3881.

Duirtschaever, C.C.; Arnott, R.D. and Bullock, H.D. (1973). Quality evaluation of yoghurt produced commercially in Ontario. J. Milk Food Technol., 35(3): 173-175.

El-Deeb, S.A. and Hassan, H.N. (1987).Effect of partial substitution of milk solids - non-fat with defatted soy flour on the qualities of zabzdi. Alex. Sci. Exchange, 8(1): 87-105.

El-Deeb, S.A. and Salam, A.E. (1984).The use of flour vegetable proteins in ice cream manufacturing. Alex. Sci. Exchange, 5(1): 87-100.

El-Gazzar, E. and Hafez, E.H. (1992).Physico-chemical properties of yoghurt- like product from soymilk fortified with skimmilk powder. Egypt. J. Food Sci., 20(1):25-36.Cited in DSA (1993), 55(12): Abstr. No. 8017.

El-Softy, M.S. and Mehanna, N. (1977).Studies on the use of soymilk in Ras and Cheddar cheesemaking. Egypt. J. Dairy Sci., 5:55.

El-Shibiny, S.; Farage, S.I.; EI-Dien, H.F. and Mahfouz, M.B. (1978). Improving the consistency of yoghurt manufactured from dried skimmilk. Annals of Agric. Sci., Moshtohor, 25:169.

El-Shibiny, E.; EI-Dein, H. and Hofi, A.A.(1979a). Effect of storage on the chemical composition of zabadi. J. Dairy Sci., 7:1.

El-Shibiny, S.; EI-Dein, H. and Hofi, A.A. (1979b).Effect of storage on the proteins of zabadi. Egypt. J. Dairy Sci., 7:9.

El-Sobery, M.A and Shalaby, S.O. (1991).Effect of some hydrocolloids on the flavour components and rheological properties of zabzdy.EI-Ahar. J. Agric Res., 14:165-180.

Fevrier, C.; Mourot, J.; Jaguelin, Y.; Mounier, A. and Lebreton, Y. (1993). Comparative digestive utilization of UHT of goat’s and cow’s milk: nutritional effects of gelation-use of swine model. Lait, 73:581-592.

Gad El-Rab, E.l.; El-Naggar, E. and Noman, A.A. (1995). Some physic-chemical and sensory evaluation of zabady made from buffaloe’s milk fortified with soymilk and guava juice. Al-Azhar. J. Agric. Res., 21:145-155.

Ghaleb, H.M.; Elhami, M. and Rashed, M.A. (1983). Soya as a complement replacer in processed cheese production. J. Agric. Res., Tanta Univ., 9(3):694-707.

Gehrke, C.W. and Weister, H.H. (1984). A comparative study of the biochemical activity of Streptococcus lactis, S. citrovorus and S. paracitrovoruswhen grow in cow’s milk and soybean milk. J.Dairy Sci., 31(4):213-222.

Guirguis, N.; Broom, M.C. and Hikey, M.W. (1984).The effect of partial replacement of skim milk powder with whey protein concentrate on the viscosity and syneresis of yoghurt.Aust. J. Dairy Technol., 33.

Haenlein, W.F.G. (1995). Nutritional value of dairy products of ewes and goat’s milk.Proceedings of 2nd IDF Seminar on Production and Utilization of Ewes and Goat’s milk.LiminHersoniss, Crete, Greece, October 19-21, pp. 10-16.

Hamdan, Y.I.; Kunsman, Jr.E.J.and Deane, D.D. (1971). Acetaldehyde production by combined yoghurt culture. J. Dairy Sci., 54(7): 1080-1082.

Hamdy, A.M.; El-K0ussy, Jr. E.J. and Abdel-Latiff, R. (1972), A study on the fermented milk ‘zabady’. Agric. Res. Rev., 50(3): 159-168.

Hamad, Y.A.; Hamzawi, L.F.; Zedan, A.N. and Khader, A.E. (1985). The use of defatted soy flour in ice cream manufacture. Minufiya J. Agric. Res., 10:833.

Hang, Y.D. and Jackson, H. (1967). Preparation of soybean cheese using lactic organisms. I. General characteristics of the finished cheese. Food Technol., 21:1033-1034.

Hofi, A.A.; Rabie, A.H.; Farahat, S.E.; Abou El-Ella, W.M. and El- Shibiny, S. (1976). The yield, quality and chemical composition of Domiati cheese from buffaloe's and soymilk mixture. Egypt. J. Dairy Sci., 4:141.

Humphrey, C.T. and Maurean, P. (1969). Yoghurt a review of its Manufacture D.S.A, 31(1): 607-622.

Hurts, A. (1972). Interactions of food starter cultures and food-borne pathogens: the antagonism between Streptococcus lactic and spore-forming microbes. J. Milk Food Technol., 35:418.

Jaques, D. and Emile. W. (1968) Structure studies of Gum Arabic. The exudates polysacharid from Acacia sengal. Carbohydrate Research, (150): 221-231.

Jenness, R. (1980). Composition and characteristics of goat milk.A review.J. Dairy Sci., 63: 1605-1630.

Jordana, J.; Amills, M.; Diaz, E.; Angulo, C.; Serradilla, J.M. and Sanchez,(1995). Gene frequencies of caprine α-SI casein polymorphism in Spanish goat breeds.Small Rum.Res. pp. 178-190.

Kanda, H.; Hesseltine, C.D. and Wang, F.E. (1981).A method for making soybean milk yoghurt. Japanese Examined patent 5, 628:130. Cited in DSA (1982), 44.

Kosikowski, F.V. (1982). Cheese and Fermented Food. Kosikowski and Associates, 2nd edition, New York, pp. 521-529.

Kotharis, S.L. (1976). Studies on fermented soymilk products. III. Activity of cheese and yoghurt culture in soymilk and fortified soymilk. Indian J. Microbiol., 15:18-26.

Kroger, M. and Weaver, C.J. (1973). Confusion about yoghurt composition and otherwise. J. Milk Food Technol., 36(7): 388-391.

Lacrosse, R. (1972). Development of acidity in yoghurt stored at various temperatures. Revue Agric., Brux, 25:383. Cited in DSA (5), 34.

Lang, F. and Lang, A. (1973). Symposium on New Technology of Fermented Milk Products and Milk Specialties. The Milk Industry, 4: 28.

Leder, K.H. and Thomasow, J. (1973). Use of gelatin in yoghurt manufacture. Deutsvhe olkereizeitung, 94: 688-694. Cited in DSA, (19), 37.

Lee, J.S.; Kim, Y.B. and Ko, Y.T. (1985). Flavour and volatile compounds of soy yoghurt. Korean J. Food Sci. Technol., 17(1): 51-53.

Lee, S.Y.; Morr, V.C. and Seo, A. (1990). Comparison of milk-based and soymilk-based yoghurt. J. Food Sci., 55(2): 532-536.

Metal, B.K, Steinkraus, K.H. and Nylor, H.B. (1974).Growth of Lactic acid bacteria in soymilk. G. Food Science, 39(5): 1018-1022.

Metal.B.K, Steinkraus, K.H (1976).Flavour acceptability of in fermented and Latic Fermented soymilk. G. Milk Food Technol., 39(5): 3112-344.

Magdob, M.N.; Shehata, A.E.; El-Samragy, Y.A.; Mohamed, N.H. and Hofim A.A. (1985). Soymilk in Ras cheese making. Annals Agric. Sci., 30(1):335.

Marges, H. El-Sayed and Magdy, M. El-Sayed (1988). Using soybean milk in manufacture of zabady. Egypt. J. Food Sci., 16(1):165.

Mehanna, S.A. and Hefnawy, A. (1990). To follow the chemical changes during processing and storage of zabady. Egypt. J. Dairy Sci., 18: 425-434.

Mohamed, F.S. (1999). Effect of partial substitution and supplementation of cowpea milk on the chemical composition and sensory characteristics of yoghurt. M.Sc. Thesis, University of Khartoum.pp-311-321.

Mohran, R.M. and Said, R.M. (1990). Behavior of microbial contaminants in zabady during fermentation and storage. Egypt. J. Dairy Sci., 18: 16-24.

Monib, A.; Gamal El-Din, A. and Selem, E. (1981). The quality of fermented milk (zabady) as influenced by heat treatment of milk. Al-Azhar Agric. Res. Bull., 100.

Oberman, H.C. (1985). Fermented milks. In: “Microbiology of Fermented Foods”, Vol. l Edited by Wood, B.J.B. Elsevier Applied Science Publishers, London. pp.184-191

Paik, I.S.; Lim, S.J. and Ko, Y.T. (1985). Keeping quality of yoghurt beverage prepared from soy protein concentrate. Korean J. Food Sci. Technol., 17(1):47-50.

Pal, K.U. and Agnihort, K.M. (1995).Quality of dairy products from goat's milk. Indian Farming, December, 1995, pp. 25-27.

Park, W.Y. (1999). Comparison of mineral and cholesterol composition of different commercial goat milk products manufactured in U.S.A. Small Rum. Res., 37: 115-124.

Parkash, S. and Jenness, R. (1968). The composition and characteristics of goat's milk: A review. Dairy Sci. Abstr., 30: 67-87.

Parnel-Clunies, M.E.; Kakuda, Y.; Mullen, K.; Arnott, R.D. and Deman, J. (1986) . Physical properties of yoghurt: A. comparison of vat versus continuous heating systems of milk. J. Dairy Sci., 69(10): 2593-2603.

Peppler.Q.H. and Robart, E.K. (1977). Microbial Technology, Robart, E.Kreiger. Publishhing Company, Huntington New York, pp.231-233.

Razafindrakoto, O.; Ravelomanana, N.; Rasolofo, A.; Rakotoarimanana, R.D.; Gourgue, P.; Coquin, P.; Briend, A.; Desjeux, J.F. (1993). Lait., 73: 601-11.

Sandine, E.W.; Daly, C.; Elliker, R.P. (1970). Microbially induced flavours and fermented foods. Flavour in fermented dairy products. J.Agric. Food Chemist., 18:557-562.

Sandine, E.W.; Daly, C.; Elliker, R.P. and Vedamuthum K.E. (1972a). Causes and control of culture related flavour defects in culture dairy products. J. Dairy Sci., 55(7): 1031-1036.

SAS (1988). SAS/STAT User's Guide, version 6.03 edition, Cary, NC: SAS Institute Inc., 1988, 1028 pp.

Shahani, M.K. and Chandan, K.C. (1979). Nutritional and healthful aspects of culture-containing dairy food. J. Dairy Sci., 62(10): 1685-1694.

Shalaby, S.; El-Shobery, M.A.; Gamal El-Din, A. and El- Nzgar, E. (1989). Chemical and rheological properties of zabady as influenced by milk heat treatment and storage. Com. Sci. Dev. Res., 28:283-292.

Shanley, M.K. (1973). Analysis of free sugars in yoghurt. Aust. J. Dairy Technol., 28(2): 58-60.

Shukla, C.F. Jain, C.S. and Sandhu, S.K. (1986). Effect of stabilizers and additives on the diacetyl and volatile fatty acids content of yoghurt. Indian J. Dairy Sci., 39(4): 486-488.

Shukla, F.C. Jain, S.C. and Sekhon, K.S. (1988). Effect of additives on the quality of yoghurt. Indian J. Dairy Sci., 1: 467.

Stenkraus, K.H.; Hwa, Y.B.; Van Baren, J.P.; Prouvidenti, M.I. and Hand, D.B. (1962). Tempeh. An Indonesian fermented soybean food. Food Res., 25:771-788.

Behavior of Bacillus ceresu in yoghurt. Egypt. J. Dairy Sci., 16: 9. Tamime,A.Y.and Deeth, H.C. (1980). Yoghurt:Technology and biochemistry. J. Food Prot., 43(12): 939-977.

Tamime, Y.A. and robinson, R.K. (1988). Fermented milks and their future trends. Part II. Technological aspect. Dairy Res., 25: 281-287.

Tatochenko, V.K. (1972).Protein Advisory Group of the United Nations System, 2:34. In: "Cheese and Fermented Milk Products, 2nd edition, Kosikowski, F.V. Kosikowski and Associates, N.Y., 9:251-265.

Thomasow, J. and Hoffman, W. (1978). Possibilities of influencing the consistency of milk products using gelatin and starch. Deutsche Molkerei Zeiung, 99:6. Cited in DSA (1991), 40.

Vescove, M. (1970).Effect of milk composition and treatment on fermentation of carbonyi compounds in yoghurt. Sci. Tech. Latt. Casean, 21.

Yamanaka, Y.; Okumura, S. and Hasegawa, Y. (1970). Method of preparing a sour milk beverage. U.S. Patent, 3:535, 117, October 20.

Robinson R. K.Dairy Microbiology" volume 2,1983. The Microbiology of Milk Products, Applied Science publication. Patent, 4:624, 117, October 18.

Appendix 1: Hedonic Rating Test (Soy milk Yoghurt)

Name of Tester………………………. Date…………………

Please taste these samples and check how much you like or dislike each one on four sensory attributes such as Colour, Flavour, Texture, Taste and Overall Acceptability Use the appropriate scale to show your attitude by checking at the point that best describes you're feeling about the sample please give a reason for this attitude remember you are the only one who can tell what you like. An honest expression of your personal feeling will help me.

HEDONIC	**CLOUR**				**FLAVOUR**				**TEXTURE**					**TASTE**				**OVERALL ACCEPTABILITY**			
	Sample				**Sample**				**Sample**					**Sample**				**Sample**			
	1	2	3	4	1	2	3	4						1	2	3	4	1	2	3	4
Like extremely																					
Like very much																					
Like moderately																					
Like Slightly																					
Neither like nor dislike																					
Dislike slightly																					
Dislike moderately																					
Dislike very much																					
Dislike extremely																					

Extra comments on each sample if any:

N.B. Overall scale used: 9= like extremely; 8=like very much, 7= like moderately; 6= like slightly; 5= neither like nor dislike; 4= dislike slightly; 3= dislike moderately;2= dislike very much; 1= dislike extremely

……………………………..

Signature of Judge

Figure: Soaking of Soy Bean

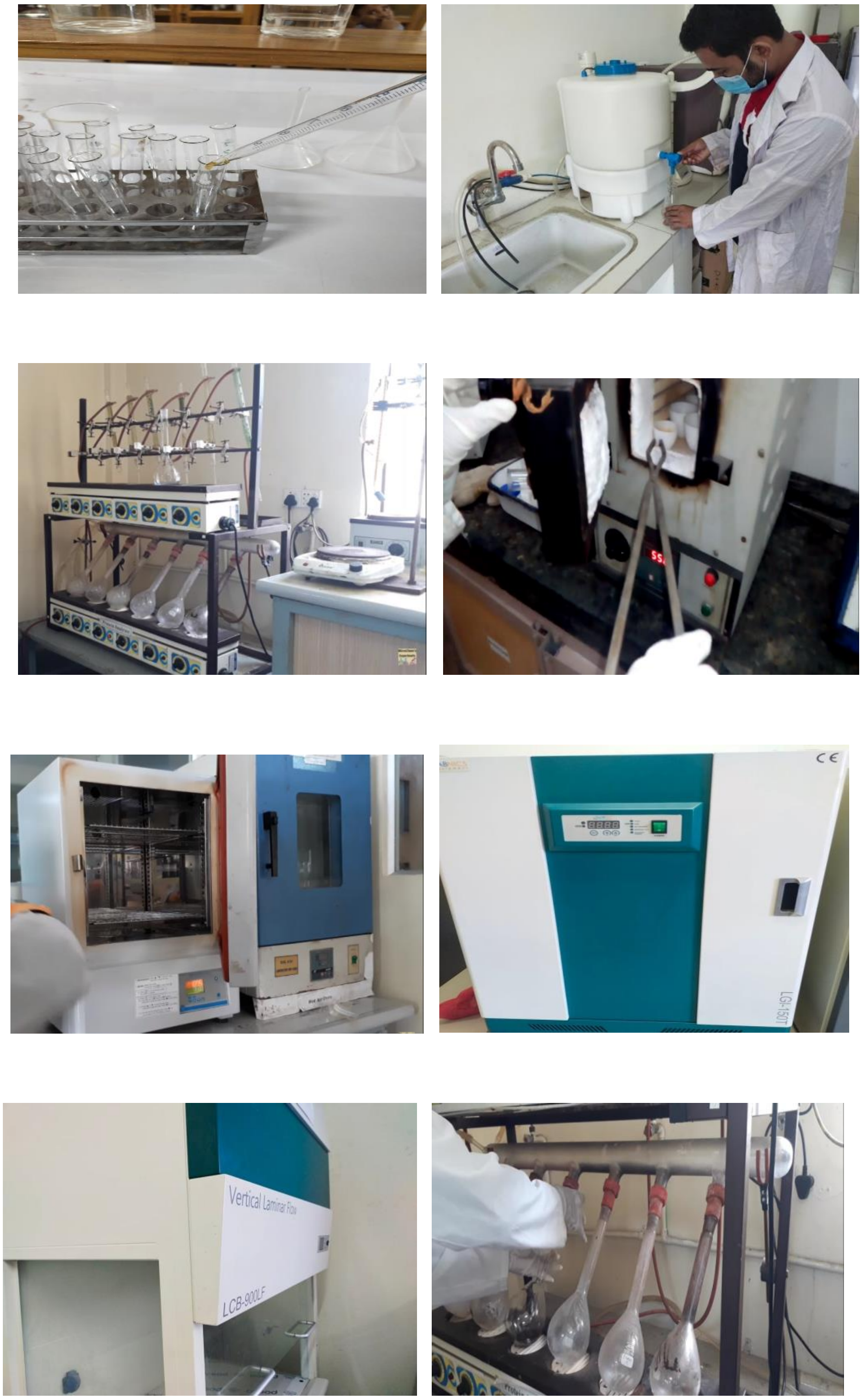
Figure: Blending and Filtration of Soymilk

Figure: Making of Soymilk

Figure: Addition of Starter Culture to Milk Sample

Figure: Stir and cooling

Figure: Soy Youghrt



Testing of various parameters

Brief Biography

Nayan Chowdhury passed the Secondary School Certificate Examination in 2008 andthen Higher Secondary Certificate Examination in 2010. He obtained his B.Sc. (Hon's) in Food Science and Technology from the Faculty of Food Science andTechnology of Chattogram Veterinary and Animal Sciences University, Chattogram, Bangladesh. Now, he is a candidate for the degree of Master of Science in Food Chemistry and Quality Assurance under the Department of Food Chemistry and Chemical Technology, Faculty of Food Science and Technology, Chattogram Veterinary and Animal Sciences University (CVASU). My research interests are processing, preservation and development of modified food products, functional food product development and nutritional value analysis, quality control and quality assurance regarding food, chemical and microbial analysis of food, new techniques to measure food quality, taste and flavour, control of unit operation in food processing.