Dairy products: physio-chemicals and microbiology

Environment, Air

\n[toc title="Table of Contents"]\n

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Agriculture is the single largest sector in the Pakistan, contributing 21. 8 to the gross domestic product and employing approximately 44. 7 of the workforce. Livestock is playing a vital role in the economy of Pakistan and account for 51. 8 % of the agriculture value added and 11. 3% of the national Gross Domestic Product. The milk production in country increased by 35. 6% from 1996 to 2007 (Anonymous, 2008).

Pakistan dairy sector is producing 41. 3 million tons milk and is the fifith largest milk producing country in the world. Its massive herd of 60. 8 million cows and buffaloes produced 40. 76 million tons of milk in the year 2007-2008. while 56. 70 million goats produced 0. 70 million ton (Anonymous, 2008). The role of livestock sector in the rural economy of Pakistan is important as 30-35 million rural population of the country derive their livelihood from livestock production as a primary or secondary activity (Anonymous, 2008),

Milk is defined as the whole, fresh, clean, lacteal secretion obtained by the complete milking of one or more healthy milk animals excluding that obtained within fifteen days before or five days after the calving or such period as may be necessary to render the milk practically colostrums free and containing the minimum prescribed percentage of milk fat and sold not fat (Goff and Griffth, 2006).

Milk is a dynamically balanced mixture and is also a perishable food. It is one of few foods consumed in the natural form throught the world. Milk contain 87% water 3. 9% fat, 3. 3% protein, 5% lactose and 0. 7% ash. Milk supply body building protein, bone forming minerals, health giving vitamin and energy giving lactose and milk fat. Besides providing certain essential fatty acids it contain all essential amino acid. All the properties of milk make it an important food for growing children, adults, adolescents, invalid, convalescents and patients (Khan et al., 2005).

There is a great potential for dairy industry but the sector operates mostly in the informal economy and needs a constituents effort to formalize and be able to contribute better to the national economy. There are nearly 5. 5 million small scale rural units owing less than 6 dairy herds. These small dairy holders produce 65% of all buffalos and cows milk. Out of total milk produced, 97% is in the informal sector (i. e. loose milk consumed in the village and or sold in the cities through ‘ Gawalas’ in unhygienic condition and without any quality standard). The small scale milk collector collect 200-400 kg milk per day from different villages. Medium scale milk collectors collect 400-800 kg milk per day in a manner similar to the small milk

collectors, but on a large scale, Large scale milk collectos collect 5-to 10 tons milk per day and supply milk the dairy factories (Garcia et al, 2003). There are hardly 15 milk processing plant (mainly UHT fluid milk, milk powder and yoghurt in Pakistan). Only about 3 % milk is being processed and 97% is consumed as a raw milk (Malik, 2008).

Milk and milk products are one of the most important food products with livestock origin which enjoy special significance in terms of its various nutritional properties such as protein, lactose, fat, minerals and vitamins. Many studies have been made on its constituents and physiochemical characteristics (Walstra et al, 1999).

Adulteration of milk and dairy products is one of the most serious issues in the dairy industry and causes economic losses and major health problem to consumers. Due to the limited number of large dairy farms, milk handling process in the traditional system are unhygienic and there is insufficient enforcement of standards, resulting in poor quality of milk products. In order to keep the milk safe, middleman add ice to the milk, in addition microbiological contamination occur due to addition of ice in the milk. The middleman increases the milk quality by adding water, vegitable oil, whey powder and other ingredients to increase the soilds of milk. Antibiotics and Hydrogen peroxide are often used as a preservatives (Garcia et al, 2003).

The adulterants in milk include water, starch, whey poxder, vegetable oil and hazourds substance such as antibiotics, caustic soda, urea, formaline, detergents and other chemicals preservatives. Adulteration in milk is a very

serious issues in Pakistan. Keeping in view these facts, the present will be planned.

Objectives:

- To study the Physio-chemicals and microbiological quality of dairy products.
- To determine the adulterants and residues in the dairy products.
- To determine the relationship of physio-chemical parameters with adulterants.
- To make recommendation to the Govt of Punjab in the control of adulterants in milk and other food products.

Review of Literature:

A study conducted on physiochemical quality of UHT milk produced from whole milk powder and stored at 4°C and 25°C for 48 hours. They observed that non protein nitrogen content of UHT milk increased while pH decreased with storage and the rate of change being greater at higher storage temperature. Sediment increased with longer storage period, but independent of storage temperature. With longer storage at both 3+-1 C and 25-+ 1°C, greater sediment and lower pH were observed in UHT milk processed from older milk powder. The development of off flavors increased in UHT milk with a prolong storage period (Ernani et al, 1997).

Kuo et al. 2001 studied the effect of heat treatments on the meltability of cheese. They studied cheddar cheese of different composition and low-moisture. Cheese samples were heated to 60°C and held for 0, 10 and 20

min before allowing the melted cheese to flow. Mean meltabilities, over all ages of both Cheddar and Mozrella cheeses decreased significantly as holding time increased. Meltability of young cheese was scarcely affected by the holding time, in contrast to that of the old cheese where increasing the holding time greately reduced meltability.

Khan (2004) studied the physio-chemicals changes in UHT bottled milk and found that effect of treatments and storage on sedimentation, fat, pH, acidity and SNF was highly significant. Maaximum sedimentation was observed after 12 weeks of storage, pH gradually decreased and minimum value were found after 12 weeks. Maximum acidity was found after 12 weeks and minimum was noted in the first week.

Kumar and Mishara (2004), studied the effect of stabilizer addition on physiochemical, sensory, textural properties and stater culture counts of mango soy milk fortified yoghurt (MSFY). Three stabilizer namely gelatin, pectin and sodium alginate were used. The addition rate of stabilizer was 0. 2%, 0. 4% and 0. 6% w/w. Significant effect of type and addition rate on acidity, msture content and total solids ofMSFY were observed. Syneresis and acetaldehyde content of MSFY was reduced significantly. Lightness and yellowness of MSFY increased with gelatin and decreased with pectin and sodium alginate. Gelatin gave better effect on appearance and color, body and texture, flavor and overall acceptability in comparision with other stabilizer at 0. 4 % addition rate. Hardness, cohesiveness and adhesiveness of MSFY increased up to 0. 4 % stabilizer addition, while springiness and gumminess did not follow any trend. There was a significant effect of

stabilizer addition on Streptococcus thermophillus and lactobacillus delbrueckii subsp. bulgaricus counts.

Griffiths et al 1988, manufactured low heat skim milk powder from raw farm bulk tank and creamery silo milk which had been stored at 2°C for 24 and 72 hours. During the storage period psychrotroph count increased by about 1log cycle after 24 hour aand 2 log cycle after 72 hours. There was no increase in thermoduric or spore counts of the milk under these storage condition. The powder manufactured from these milk was good bacteriological quality and conformed to ADMI recommendations regarding moisture content, titratable acidity and solubility. They concluded that storage of raw milk at 2 C had no deterintal effect on the heat stability of the powder manufactured from it when reconstituted to both 9 and 22% total solid concentrations.

Molska et al 2003 studied the microbiological quality of kefir (61 samples) and yoghurt (92 samples) purchased in retail network in Warsaw. The total number of bacteria in at least 90% of yoghurt and 73% of kefir was in the range of 10(7)-10(9) cfu/g. The domestic group of bacteria in kefir were mesophilic lactic acid streptococci and in yoghurt S. thermophillus. The number of L. delbrueckii in 40 % of sample was less than 10(7) cfu/g. More than 86 % of kefir and 97 % of yoghurt analysed were free from coliform bacteria., B. cereus, mould and yeast. About 48 % of kefir samples did not fulfilled the FAO/WHO requirements concerning the number of yeast.

Kessel et al 2004, determine the test for standard plate count (SPC) and fecal coliforms in the bulk tank milk in the inited state. As part of the 2002 survey, 861 bulk tank milk sample were collected from farms in 21 states,

coliform were detected in 95 % samples. There were no apparent relationship between SPC and incidence of salmonella or L. monocytogenes. Although the prevalence of L. monocytogenes and salmonella was low, these pathogens represent a potential risk to consumers of raw milk and raw milk products.

Nero et al 2004 condcted a study to avaluate the microbiological quality and the presence of Listeria monocytogenes and Salmonella spp. In the raw milk produced in 210 small and medium farms located in four important milk producing Brazilian states. In 66% of the selected farms the milkng was manual. In 33 % of them, the milking was semi-automatic and only 1 % were equipped wit hfully automatic milking systems. All raw milk samples were negative for L. monocytogenes and salmonella spp. Mesophilic aerobes counts were higher than 10^5 CFU /ml in 75. 7% of the samples. In 80. 4%, coliforms were over 10^2CFU /ml. Escherichia coli were detected in 36. 8% of the samples.

Aygun et al 2005 purchased 50 randomly selected samples of Carra cheese, raw milk cheese, from different retail markets in the Antakya region and were investigated for microbiological quality and some chemical analyses. In their samples, the number of microorganisms were found as follows : Staphylococcus aureus 2. 51* 10^3 cfu/g, coliform 1. 02*10^4 cfu/g, E. coli 4. 27*10^3 cfu/g, Salmonella were not detected in any of the samples. Mean moisture, salt and fat content of Carra cheese were found as 41. 26%, 7. 82% and 26. 77% respectively. The pH value of the samples varied b/w 4. 53 and 6. 32 with the mean of 5. 24. The microbiological finding showed the

presence of high counts of microorganisms investigated and the poor hygienic quality of Carra cheese.

Little et al 2008 determined the microbiological quality of two retail fresh ripened and semi hard cheeses made from raw, thermized or pasteurized milk. Raw or thermized milk cheeses were of unsatisfactory quality due to level of Staphylococcus aureus st 10^4 cfu/g, E. coli at 10^5 cfu/g, whereas pasteurized milk cheeses were of unsatisfactory quality due to S. aureus at 10^3 cfu/g and E. coli at 10^3 cfu/g. Salmonella was not detected in any samples. They emphasize the need for applying and maintaining good hygeinc practices throught the food chain to prevent contamination and bacterial growth. Labelling of cheeses with clear information on whether the cheese was prepared from raw milk also requires improvement.

Sheppard et al 1985 demonstrated the application of various analytical methods to the detection, identification and quantitation of vegetable oil adulteration o ice cream. Total fat content, sterol, long and chain fatty acid, vit E, Reichert â€" Meissle values and Polenske values were measured in ice cream. All method except total fat determination were capable of detecting vegetable oil adulteration. Sterol determination was the most effective and versatile measurement because it provided information not only on the detection and extent of adulteration but also on the possible identity of the adulterant.

Fox et al 1988, described a test for routine screening of Mozzarrella Cheese and butter for vegetable fat adulteration. Fat is extracted and sponified. The potassium salts of the fatty acids are measured through direct gas

chromatographic analysis. A ratio, calculated from the concentration of butyric acid and oleic acid is used to avaluate the puroty of the samples. The test offers good precision and can detect less than 10% partially hydrogenated vegetable fat.

Kumar et al 2002, reported that adulteration in milk and milk products has reached an alarming stage. Milk fat is being mixed or replaced with cheaper vegetable oil. Therefore, often more than one test has to be employed to confirm the purity of milk fat. The various method for the detection of adulteration in milk at is based on the physical properties, chemical properties and presence or absence of specific constituents of either milk fat or adulterant fats.

Jha and Matsuoka 2004, conducted a study on the adulteration of natural milk by synthetic milk, prepared by mixing appropriate amount of vegetable oil, urea, detergent powder /shampoo, caustic soda, sugar /salt and skim milk powder to water. Detection of adulterants is difficult by a single method and sometimes more than two methods are required to confirm the presence. The potential of near-infrared spectroscopy were investigated (NIRS) in the wavelength range of 700-1124. 8 nm.

Material And Methods:

Collection of Samples:

The dairy products samples will be collected from the market and then analysis will be performed at Dairy Laboratory, National Institute of Food Science & Technology, University of Agriculture, Faisalabad.

Butter:

Butter samples of three different brand namely Gourmet, haleeb and Nurpur Dairies will be collected. Three samples from each brand will be collected.

Youghurt:

Yoghurt samples of three different brands namely Gourmet, haleeb and Nurpur Dairies will be collected. Three samples from each brand will be collected.

Cheese:

Cheese samples of three different brands namely Adams, Military dairy Factory and Nurpur Dairies will be collected. Three samples from each brand will be collected.

Milk Powder:

Milk Powder samples of three different brands namely Gourmet, haleeb and Nurpur Dairies will be collected. Three samples from each brand will be collected.

UHT milk:

UHT milk samples of three different brands namely Gourmet, haleeb and Nurpur Dairies will be collected. Three samples from each brand will be collected.

Sampling Procedure:

Dairy product samples will be collected in clean sterilized container and put in ice chest, whereas milk powder will be collected in zip polyethylene bag. These samples will be transported for analysis to the Dairy Laboratory, National Institute of Food Science & Technology, University of Agriculture, Faisalabad.

Sterilization:

All glassware like pipette, test tubes, petri dishes, beaker and flasks will be thoroughly cleaned and sterilized in an oven at 180 C for 2 hours. All media and solution will be prepared in distilled water and autoclaved at 121 C at 15 lb pressure for 15 min using the procedure of AOAC (2000).

Physiochemical Test:

The samples will be subjected to different physic-chemical test which are detailed as under.

Melting Resistance and Melting Quality:

Melting Resistance and Melting Quality will be determined by the method as prescribed by Bhadari(2001).

Fat:

Fat will be determined by using Gerber method as described by the Kirk and sawyer (1991).

pH

The pH of all the treatments will be determined according to AOAC (2000) method no. 981. 12.

Moisture and ash

All the treatments will be analyzed for moisture and ash according to their respective methods mentioned in AOAC (2000).

Total solids

Total solids called percent residues will be determined by drying the sample in hot air oven according to method described in AOAC (2000).

Protein:

Protein content will be determined by using Kjeldhal method as described by AOAC (2000).

Microbiological Test:

Dairy products samples will be tested for total plate counts, Coliform counts, Staphyloccus aureus and Yeast and Mould count by the method prescribed by AOAC (2000).

Chemicals Adulterants Detection Test:

Dairy products samples will be tested for the adulterants namely Formaldehyde, Boric acid, Hydrogen peroxide, Starch, Neutralizers (Sodium carbonate, bicarbonates, Sodium hydroxide by the method prescribed by AOAC (2000).

Statistical analysis

Results will be analyzed statistically to determine the level of significance (Steel et al., 1997).

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