**CHAPTER I**

**INTRODUCTION**

Milk is defined to be the lacteal secretion, practically free from colostrums, obtained by the complete milking of one or more healthy cows, five days after and 15 days before parturition, which contains not less than 8.5 percent solids-not-fat and 3.5 percent milk fat **(**USPHS**,** 1965; Itzerott, 1960). According to Byron *et al.* (1974), the average composition of milk are (i) Water (87.20%), (ii) Protein (3.50%), (iii) Fat (3.70%), (iv) Milk sugar or lactose (4.90%), (v) ash (0.70%) and (vi) Dry matter (12.80%). The constituents may vary with breed, type of feed, stage of lactation, season and age of the cow etc. and also between individuals of the same breed.

As a developing country Bangladesh is a low quantity milk producing nation having production of 2.11 million tons of fluid milk annually as per FAO statistics with per capita production of 13 kg/capita/year. (http://www.fao.org). According to the most recent data of DLS milk production of Bangladesh is 2.27 million tons (DLS, 2004-2005). The total number of cattle population is 22.87 million and the total numbers of the registered dairy farms are 5364 in all over Bangladesh (http://www.dls.gov.bd/about\_us.htm).

Milk is the most perfect single balanced food of high biological value in nature as it contains almost all ingredients of food in right proportion and in any digestible form. Wholesome milk and milk products have an important place in supplying palatable, refreshing, nutritious, economical and convenient food for human beings.

In order to evaluate nutrition, conversion of nutrients and metabolism it is important to study milk fat to milk protein ratio. The optimum F/P ratio is 1.2 – 1.4. Lower values are likely to lead to subclinical rumen acidosis which can endanger reproduction performance of cows and enhance a possible development of mineral metabolism disorders. The F/P ratio higher than 1.4 signals energy deficit and subclinical ketosis if ketone bodies are present (Haas *et al; 2004).* Richardt, (2004) confirms that the F/P ratio higher than 1.5 can indicate subclinical ketosis whereas the F/P ratio lower than 1.1 can mean suspected rumen acidosis.

Chemical and microbiological analysis is important tool to monitor the quality of dairy products. Milk is an important source of all basic nutrients for mammals. Milk from various mammals are used for producing different dairy products including milk cream, butter, yogurt, ghee, sour milk, etc. Consumers always demands nutritionally enriched milk and dairy products. The current processes for milk collection from a large number of subsistence farmers are time-consuming, costly and prone to adulteration. Adulteration of milk can causes the deterioration of dairy products and to ensure milk quality requires the necessity and greater emphasis on regulatory aspects with advanced methods of analysis and monitoring milk production and processing, and the new product ideas such as genetically modified foods and the nutraceuticals have set new goals for quality assurance and food safety. Fresh milk considered as a complete diet because it contains the essential nutrients as lactose, fat, protein, mineral and vitamins in balanced ratio rather than the other foods (Khalid, A., 2006).

Recently, consumer’s health concerns are developed to the milk properties i.e., SNF, TS, acidity and bacterial count along with protein and fat content. The presence of above mentioned milk properties are in standard ratio are important concerned as well. According to World Health Organization (WHO) standards and other Scientifics works , the quality milk should contents 2.6% fat, 3.5% protein, 0.17% TA, 7.71% SNF and SG 1.030, total bacterial count 1.3x106 *cfu* per ml. The pH 6.6 ensures the milk freshness at boiling point 100$℃$-117$℃$ (Sanjeev K Anand, 2004).

Public health authority is employed the standards of milk and dairy products based on Bangladesh Standards (BDS). So it is important to evaluate nutritional and microbiological quality of raw cow milk. Therefore, the present study was carried out in order to demonstrate the nutritional and microbial qualities of raw milk collected from surrounding farms of CVASU campus, Chittagong, Bangladesh.

**CHAPTER II**

**RIVEW OF LITARATURE**

**2.1. Definition of milk**

Milk may be defined as the whole, fresh, clean, lacteal secretion obtained by the complete milking of one or more healthy milch animals, excluding that obtained within 15 days before or 5 days after calving or such periods. It may be necessary to render the milk practically colostrum-free, and containing the minimum prescribed percentages of milk fat and milk-solids-not-fat (De, 2000).

**2.2. Constituents of Milk**

Chandan (1997) and Singh *et al.* (1997) showed that milk is a complex colloidal dispersion of fat globules and protein (casein, whey) in an aqueous solution of lactose, minerals, and other minor constituents. Milk is made up of 12.6% milk solids (3.7% fat, 8.9% milk solids-not-fat).

 According to Eckles *et al*. (1951) milk should contain on an average 87.25 % water, 3.80 % protein, 4.80 % lactose and 0.65 % minerals, Besides, milk contains considerable amounts of fat soluble vitamins (Vit-B complex and Vit-C).

In general, the gross composition of cow's milk in the U.S. is 87.7% water, 4.9% lactose (carbohydrate), 3.4% fat, 3.3% protein, and 0.7% minerals (referred to as ash). Milk composition varies depending on the species (cow, goat, and sheep), breed (Holstein, Jersey), the animal's feed, and the stage of lactation. (<http://www.milkfacts.info>**)**

**2.3. Nutritive Value of Milk**

Milk is the almost perfect food of nature providing energy, protein and vitamin-minerals composition for a sustainable health. Milk is a nutrient-dense food providing a high concentration of nutrients in relation to its energy content. The energy provided by milk depends mostly on its fat and carbohydrate contents. Whole milk (3.2% milk fat) provides 150 kcal/cup (8 oz.); 2% reduced fat milk provides 121 kcal/cup; 1% low fat milk provides 104 kcal/cup; and nonfat (fat free, skim) milk provides 90 kcal/cup. The addition of nonfat milk solids, sugars, and other energy-yielding components also influence milk's calorie content. .

Walstra, P. and R. Jennees (1984) reported cow's milk is an excellent source of high-quality protein, providing varying amounts of the essential amino acids that humans cannot synthesize. Only the sulfur amino acids (methionine and cystine) in milk proteins are slightly limiting as compared with the adult's estimated requirement of essential amino acids. The protein of milk is not a single compound but includes three major proteins namely, casein (80% of total protein) and lactalbumin (18%) and lactoglobulin (2%). The essential amino acids like tryptophan and lysine are present in large quantity in milk which are deficient in vegetable protein. Besides glutamic acid present in cow’s milk are three times higher than in human milk, which results a reduction of cholesterol level in blood. Oratic acid of milk protein improves liver detoxification. Another content taurine is responsible for the development of immature brain tissue of mammalian young.

Jensen (1995) and Fox (1992)stated that Cow's milk protein is rich in lysine and complements many plant proteins, which normally are limited in this amino acid. Moreover because of its high quality, cow's milk protein is used as a standard reference protein to evaluate the nutritive value of food proteins.

Dionysius *et al.* (1997) observed that individual milk proteins have a wide range of beneficial health and functional effects. For example, antibacterial properties of peptides derived from bovine lactoferrin have been demonstrated. Also, limited evidence from in vitro and experimental animal studies indicates that milk proteins may protect against cancer. Whey proteins in particular appear to be anti carcinogenic, possibly as a result of their ability to enhance immunity.

Takada *et al.* (1997) detected that whey proteins increased bone strength in experimental animals.

European Dairy Association (1997) described that whey protein concentrates and isolates are used as ingredients in a number of formulated food products.

Fox (1992) showed that cow's milk is a heterogeneous mixture of proteins. About 80% of the total protein in milk is casein and 20% is whey protein. Milk also contains small amounts of various enzymes (e.g., lipoprotein lipase, alkaline phosphates, lactoperoxidase) and traces of non protein nitrogenous compounds (e.g., ammonia, urea, creatinine, creatine, and uric acid).Casein constitutes about 80% of the total nitrogen present in the milk. Alpha lactalbumin, constitutes about 3.5 % of the total nitrogen content. Milk protein is particularly rich in lysine and valine, which is poor in the cereal protein. It posses high digestibility, biological value and growth promoting value. They are about equal to human milk protein in infant nutrition.

Ziegler (1983) reported that the principal carbohydrate in milk is lactose, a natural disaccharide consisting of one galactose and one glucose unit. Lactose accounts for about 54% of the total solids-not-fat content of whole milk and about 30% of its calories (about 9% of the calories of 2% reduced fat milk). The lactose content of milk varies by species. Cow's milk contains about 4.8% lactose (12 to 12.5% lactose/cup), whereas human milk has 7% lactose (15 to 18 g lactose/cup). The higher concentration of lactose in human milk explains why lactose is used to enrich breast milk substitutes or infant formula.

Millar (1999) found that minor quantities of glucose, galactose, and oligosaccharides present in milk. Glucose and galactose are the products of lactose hydrolysis by the enzyme lactase. He assumed that galactose may have a unique role in the rapidly developing infant brain.

Wong (1988) identified that milk fat as a source of energy, essential fatty acids, fat-soluble vitamins, and several other potential health-promoting components.
It is commonly the most valuable constituent of milk. Milk fat is a natural fat with unique physical, chemical, and biological properties. This fat contributes to the appearance, texture, flavor, and satiability of dairy foods.

UPHA (1997) discussed that milk has special significance in nutrition, due to the presence of wide range of fatty acids and high content of short chain volatile fatty acids. Among animal fats, milk fat is unique because it contains a relatively high proportion of short-chain and medium-chain saturated fatty acids, many of which are not found in other fats.

German *et al*. (1998) identified that milk fat contains about 7% short-chain fatty acids (C4 to C8), 15 to 20% medium-chain fatty acids (C10 to C14), and 73-78% long-chain fatty acids (C16 and higher). It is easily digestible and serves as the concentrated source of energy and each gram of fat furnishes 9 calories energy, which is 2.25 times more than protein and carbohydrate. It is a carrier of fat-soluble vitamins and helps in lactose assimilation.

Parodi (1979) stated that milk fat as a natural fat with unique physical, chemical, and biological properties. This fat contributes to the appearance, texture, flavor, and satiability of dairy foods.

Minerals constitute less then 1% in milk. Milk is the important source of calcium, phosphorus and very small quantity of iron, copper, lithium, barium, strontium and silica. In normal milk chloride and lactose ratio remains fairly constant. (http://www.ars.usda.gov/main/main.htm.)

Fox (1997) and Jensen (1995) stated that milk and other dairy foods contain all of the water-soluble vitamins in varying amounts required by humans. Milk is fairly a good source of vitamins such as thiamine and riboflavin. Except vitamin C it provides particularly all the ingredients necessary to promote and maintain life. Enzymes found in the milk include lipase, alkaline phosphatase, acid phosphatase, xanthinie oxidase, peroxidase, protease, amylase, catalase and lactase.

**2.4. Physical Parameters of Milk**

Islam *et al.* (2002) stated that milk is yellowish white in color as physical parameter. He reported that milk samples collected from BAU university dairy farm showed 80% yellowish white and 20% of the samples had whitish color.

Eckles *et al* (1951) reported that color of the milk depends upon the breed, amount of fat and solids present and on the nature of feed consumed by cow.

Islam *et al* (2002) conducted a study and suggested that proper hygienic measure during milking and not using odd flavored feed prior milking produces milk with normal flavor.

Water form the largest fraction of milk and ranges from 80 to 90% depending upon the species and breed. Water serves as a carrier for all the constituents of milk. (http://www.milkfacts.info)

Debnath *et al.* (2009) found in their study that the specific gravity of milk from different sources from Chittagong metropolitan area varied from 1.025 to 1.028 and vendor supplied rural milk had the lowest value of it.

Azad *et al*. (2007) demonstrated in a comparative study that the specific gravity of milk do not significantly differs in different month of the year. The maximum, minimum and average specific gravity of milk obtained from Bhaghabarighat area was 1.0288(February), 1.0262 (October) and 1.0260 respectively.

Rahman (1995) reported in his study that the specific gravity of milk were 1.025±.001, 1.023±.001, 1.023±.001 from Manikjonj Chilling plant, Takerhat Pasteurization plant and Baghabarighat Dairy Plant respectively.

Islam (1993) found the average specific gravity of milk was 1.0276±0.001.

Islam *et al*. (1984) reported that the specific gravity of milk obtained from BAU Dairy Farm and Local market were 1.031 and 1.026 respectively. He stated that Lower specific gravity indicates that milk was adulterated with water. Milk Fat has some influence on the specific gravity of milk. As the higher fat content of milk, the lower will be the specific gravity.

Eckles *et al.* (1951) demonstrated the normal range of specific gravity of whole milk is 1.027 to 1.035 with an average of 1.0320.

**2.5. Chemical parameters**

Haug *et al., (*2007), Chemically, milk is a complex mixture of fat, protein, carbohydrates, minerals, vitamins and other miscellaneous constituents dispersed in water, make it a complete diet.

Debnath *et al.* (2009) demonstrated in his experimental study that the butter fat of milk from different sources from Chittagong metropolitan area varied from 3.52 to 4.01 and vendor supplied rural milk had the highest value of it.

Rahman (1995) observed that the average fat% of milk samples collected from Baghabarighat Dairy plant was 4.28±0.028.

Talukdar (1989) observed indigenous dairy cow’s milk of Trishal Thana of Mymensingh District contained 4.72% fat.

Judkins and Keener (1960) reported that the average fat% of milk sample was 2.5 to 8.0%.

PFA Rules (1976) published that to the market milk should contain at least 4.0% fat in Chandigarh and in Haryana and punjab, 3.5% fat and 8.0% SNF.

IDRI annual report (1948) showed that commercially fat is the important constituents of milk. It is also the most variable fraction in milk. The average percentage of milk of Holstein Friesian is 3.5%, Sindhi 4.9%, Shahiwal 4.5%.

Debnath *et al.* (2009) studied SNF% 8.33, 7.98, 7.85, 8.2 from farm produced milk, vendor supplied farm milk, and vendor supplied rural milk and brand market milk respectively in Chittagong metropolitan area.

Rahman (1995) observed that the average SNF content of milk collected from Pasteurization Plant and Baghabarighat Dairy Plant were 6.67%, 7.2%, 7.04% and 7.96% respectively.

The milk solids-not-fat contains protein (3.4%), lactose (4.8%), and minerals (0.7%). (http://www.milkfacts.info)

Islam *et al.* (1984) also reported that lower SNF% in local market milk than that of the milk from BAU Dairy Farm, Mymensingh.

USPHS (1965) and Itzerot (1960) described milk contains minimum 8.5% solids-not-fat.

Panero (1975) proposed that, if the milk is not adulterated the SNF should be more than equal to lactose+protein+0.7.

**2.6. Microbial characteristics**

Lunder and Brenne (1996), Milk itself contains low number of micro-organisms when it leaves the normal udder but it may get contaminated from manure, water, soil, milker’s hands, utensils and flies.

Desmasures, Bazin and Guen. (1997), Coliforms were present in most samples, but 84% of samples had counts \_100 cfu ml\_1.

Dey and Karim, The initial average TVC in raw milk was 5.49±0.69 log c.f.u. /ml. which increased to 6.25±0.10 log c.f.u. /ml. The initial average coliform bacteria were estimated 3.55±0.12 log c.f.u. /ml.

Lee *et al.* (1983) conducted an experiment in Seoul of Korea and found that the bacterial count in raw milk ranged from 4 × 106 to 2.7 × 107 per ml.

Iknomov *et al.* (1956) who reported that the total bacterial counts ranged from 1,70,000 to 9,000,000 per ml of milk depending on milking techniques and cleanliness.

Mutukumira *et al.* (1996) found the coliform bacteria 3.2 × 102 to 2.3 × 105 whereas Saitanu *et al.* (1996) examined and found that the total coliform count of <1000 CFU/ml.

**2.7. Fat protein ratio**

Richardt (2004) considers the F/P ratio to be a very important indicator of animal health. Its high values (above 1.5) in dairy cows signify a 1.5 times higher probability of incidence of mastitis, 7.5 times higher tendency towards lameness and 3.5 times higher incidence of ketosis.

According to Trajlinek (2000), the presence of ketosis in a herd brings about enormous economic loss. Apart from a negative impact on reproduction it also negatively affects milk production and enhances development of other diseases such as displacement of abomasum and liver steatosis.

According to Gajdůšek (2003), a non physiological increase in milk fat content was found in individual milk samples in milk recording. This occurs due to a negative energy balance in cows, especially at the beginning of lactation when cows degrade their fat deposits which might otherwise increase milk fat content.

Richardt (2004), points out that F/P ratio is useful only when monitored in individual milk samples, not in pool samples. Official milk recording data provide a rough picture of the herd situation (milk yield, milk components) and indicate nutritional status of animals regarding energy, protein, fibre and starch supply. In high producing herds we need considerably more information on milk production of the herd, and individual cows in particular.

Haas *et al;* (2004),the optimum F/P ratio is 1.2 – 1.4. Lower values are likely to lead to subclinical rumen acidosis which can endanger reproduction performance of cows and enhance a possible development of mineral metabolism disorders. The F/P ratio higher than 1.4 signals energy deficit and subclinical ketosis if ketone bodies are present.

Vladimír *et al.* (2005), the appropriate F/P ratio for Holstein cows is 1.05 -1.18. High values in the first phase suggest a great energy deficiency.

**CHAPTER III**

**MATERIALS & METHODS**

The study was conducted at the Dairy science Laboratory under the Department of Dairy and poultry Science, Chittagong Veterinary and Animal Sciences University, during a period from 5th September to 10th October 2013. A total number of 40 raw milk samples were collected at morning (20 samples) and evening (20 samples) from surrounding farms of CVASU campus. The nutritional and microbiological qualities of each sample were analyzed. The nutritional parameters included Chemical composition (specific gravity, fat percentage, SNF percentage, protein percentage, lactose percentage, Freezing point and Mineral percentage), correlation between various nutritional values and the microbiological analysis comprised enumeration of total viable count (TVC) and total colifrom count (TCC) for the determination of sanitary quality.

**3. 1. Selection and Collection of milk sample:**

Surrounding farms (Jalalabad, Foy’s lake area) of the CVASU campus were selected for collection of milk sample. About 250 ml of individual raw milk samples were collected at morning and evening from each farm. After collection, the samples were transported to the laboratory maintaining sterile condition. Forty individual samples of raw milk (20 of morning and 20 of evening) were collected after milking from the farm.

**3.2. Procedure of Sampling:**

The samples were directly collected from the bulk sources of fluid raw milk through proper mixing with the help of plunger and dipper. Soon after collection the sample were kept into the cool box for ceasing the growth and activity of acid producing organisms.

**3.3. Methods followed for testing of collected fluid raw milk:**

The collected milk samples were kept in the refrigerator at 40 C until the tests were conducted. Before using each and every sample was pre warmed for few minutes.

Chemical composition (specific gravity, fat percentage, SNF percentage, protein percentage, lactose percentage, Freezing point and Mineral percentage) was determined by Lactoster machine (Germany).

**Total Viable Count (TVC):** TVC were done as per recommendation of APHA (1967). In brief, Bacto agar was used for enumeration of SPC. Ten fold dilution of each raw milk sample was prepared using peptone water. For the determination of SPC, 0.1 ml of each dilution was transferred using sterile pipette and spreaded on agar. Inoculated plates were incubated at 37°C for 48 hours to facilitate viable bacterial growth. After incubation, the colonies were counted. The number of colonies in a particular dilution was multiplied by the dilution factor to obtain the TVC and total count was expressed as colony forming units per milliliter (c.f.u. /ml.).

**Coliform count:** TVC were done as per recommendation of APHA (1967). In brief, total coliform was determined by the same method used in the enumeration of SPC. The medium used for coliform was Violet Red Bile agar (VRB). Inoculated plates were incubated at 37°C for 24 hours. After incubation, typical pinkish and centrally red colonies were counted and total coliform was calculated.

**3.4. Data recording and analysis:**

The obtained data were imported and stored in Microsoft Excel-2007. SPSS 16 statistical software was used for the calculation of mean, standard error, correlation coefficient®, t-test and significant value (p).

**CHAPTER IV**

**RESULTS & DISCUSSION**

**4.1. Nutrition**al **and microbial Quality**

**4.1.1. Nutrition**al **quality**

Table 1 and figure 1 show that the average fat percentage of farm milk was (3.94±0.22%). This result agrees with Debnath*et al.* (2009) who demonstrated that the butter fat of milk from different sources from Chittagong metropolitan area varied from 3.52 to 4.01. Judkins andKeener (1960) reported that the average fat% of milk sample was 2.5 to 8.0%.

This study indicted that the average SNF content of farm milk was (7.91±0.17%). Debnath *et al.* (2009) studied SNF% 8.33%, 7.98%, 7.85%, 8.2% from farm produced milk, vendor supplied farm milk, and vendor supplied rural milk and brand market milk respectively in Chittagong metropolitan area. Our result is slightly lower than it. It may be due to small sample size.

This study indicted that the average protein content of farm milk were (3.11±0.08%). Eckles *et al*. (1951) stated that milk should contain 3.80% protein. Our result is little lower may be due to breed variation. The average lactose content of farm milk was (4.32±0.10%). Eckles *et al*. (1951) stated that milk should contain 4.80% lactose. Our result was a little lower may be due to breed variation.

This study indicted that the average specific gravity of farm milk was 1.026±0.00. Debnath *et al.* (2009) found in their study that the specific gravity of milk from different sources in Chittagong metropolitan area varied from 1.025 to 1.028. This result also agrees with research findings of Islam *et al*. (1993) and Eckles *et al.* (1951).The average freezing point of farm milk was -0.46±0.007.

Fig 1: Graphical representation of nutritional composition of raw milk

This study indicted that the average mineral of farm milk was (0.68±0.01%). According to Eckles *et al*. (1951) milk should contain average 87.25 % water, 3.80 % protein, 4.80 % lactose and 0.65 % minerals. Our result agreed with this.

**Table 1: Average nutritional composition of different farm raw milk (Mean**$\pm $**SE)**

|  |  |
| --- | --- |
| Parameters | Mean$\pm $SE |
| Fat | 3.94$\pm $0.22 |
| SNF | 7.91$\pm $0.17 |
| Protein | 3.11$\pm $0.08 |
| Lactose | 4.32$\pm $0. 10 |
| Sp. Gravity | 1.026$\pm $0.0008 |
| Freezing point | -0.46$\pm $0.007 |
| Mineral | 0.68$\pm $0.01 |

*N=40 (20 at morning and 20 at evening)*

Table 2 and figure 2 shows that the average fat percentage of evening milk was significantly (P < 0.05) higher than the morning milk. It was due to the less volume of milk in the evening. The average SNF percentage of evening milk was not significantly (P > 0.05) higher than the morning milk.

According to the table 2 and figure 2 the average protein percentage of evening milk was not significantly (P$ > $0.05) higher than the morning milk. The average lactose percentage of evening milk was not significantly (P$ > $0.05) higher than the morning milk.

Fig 2: Graphical representation of nutritional composition of morning and evening raw milk

According to the table 2 and figure 2 average sp. Gravity of evening milk was not significantly (P $>$ 0.05) higher than the morning milk. The average freezing point of evening milk was not significantly (P$ > $0.05) higher than the morning milk. The average mineral percentage of evening milk was not significantly (P$ > $0.05) higher than the morning milk.

**Table 2: Nutritional composition of morning and evening raw milk of different farm**

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | Fat(mean$\pm $SE) | SNF(mean$\pm $SE) | Protein (mean$\pm $SE) | Lactose (mean$\pm $SE) | Sp. Gravity (mean$\pm $SE) | F. point (mean$\pm $SE) | Mineral (mean$\pm $SE) |  |
| Morning milking | 3.12$\pm $0.05 | 7.63$\pm $0.27 | 2.97$\pm $0.11 | 4.13$\pm $0.15 | 1.026$\pm $0.001 | -0.45$\pm $0.009 | 0.69$\pm $0.01 |  |
| Evening milking | 4.75$\pm $0.11 | 8.19$\pm $0.17 | 3.25$\pm $0.08 | 4.50$\pm $o.10 | 1.027$\pm $0.0009 | -0.47$\pm $0.007 | 0.67$\pm $0.02 |  |
| Significant value | 0.000 | 0.159 | 0.069 | 0.87 | 0.507 | 0.112 | 0.20 |  |

*N=40 (20 at morning and 20 at evening)*

**4.1.2. Microbial quality:**

Table 3 shows that the average TVC count of morning milk which was not significantly (p$>$0.05) higher than the evening milk. The results of this study correlate with findings of Iknomov *et al.* (1956) who reported that the total bacterial counts ranged from 1, 70,000 to 9,000,000 per ml of milk depending on milking techniques and cleanliness. The number of bacteria in aseptically drawn milk was 100-92,000 per ml, but infection occurred subsequently from the skin of animals, milkers hands, cow shed and milking utensils. Lee *et* *al.* (1983) conducted an experiment in Seoul of Korea and found that the bacterial count in raw milk ranged from 4 × 106 to 2.7 × 107 per ml.

This result indicates that the average coliform count of morning milk was lower than the evening milk. This was not statistically significant (p$>$0.05). The variation in coliform of the milk may be due to the hygienic maintenance during milking.The results of this investigation are in agreement with the finding of Mutukumira *et al.* (1996) who found the coliform bacteria 3.2 × 102 to 2.3 × 105. Saitanu *et al.* (1996) examined and found that the total coliform count of <1000 CFU/ml.

**Table 3: Microbial quality of different farm raw milk**

|  |  |  |
| --- | --- | --- |
|  | TVC(mean$\pm $SE) | Coliform Count(mean$\pm $SE) |
| Morning milking | 30500$\pm $639 | 8500$\pm $210 |
| Evening milking | 28625$\pm $566 | 9375$\pm $184 |
| Significant value | 0.150 | 0.320 |

*N=40(20 at morning and 20 at evening)*

**4.2. Correlation between nutritional content**

Table 4 shows that the fat content of the milk was positively correlated with SNF content i.e. if the fat increased the SNF also increased. This relationship was not statistically significant (P $>$ 0.05).

The fat content of the milk was positively correlated with protein content i.e. if the fat increased the protein also increased. This relationship was not statistically significant (P$ > $0.05).

The fat content of the milk was positively correlated with lactose content i.e. if the fat increased the lactose content also increased. This relationship was not statistically significant (P $> $0.05).

The lactose content of milk was positively correlated with protein content i.e. if the lactose increased than the protein also increased. This relationship was statistically significant (P$ <$0.05).

**Table 4: Correlation between various nutritional parameters of raw milk**

|  |  |  |
| --- | --- | --- |
| Parameter | Correlation coefficient | Significant value |
| Fat vs SNF | 0.375 | 0.152 |
| Fat vs Protein | 0.431 | 0.096 |
| Fat vs Lactose | 0.416 | 0. 109 |
| Lactose vs Protein | 0.99 | 0.000 |

*N=40 (20 at morning and 20 at evening)*

Table 5 shows that the fat content of morning milk was positively correlated with the evening milk i.e. if the fat increased in the morning milk; it is also increased in the evening milk. This relationship was not statistically significant (P$ >$ 0.05). The SNF content of morning milk was negatively correlated with the evening milk content i.e. the SNF increased in the morning than decreased in the evening. This relationship was not statistically significant (P$ > $0.05). The protein content of morning milk was positively correlated with the evening milk content i.e. the protein increased in morning and evening milk parallely. This relationship was not statistically significant (P $> $0.05).

According to the table 5 the lactose content of morning milk was negatively correlated with the evening milk i.e. the lactose increased in the morning but decreased in the evening. This relationship was not statistically significant (P$ >$ 0.05). The sp. gravity of morning milk was positively correlated with the evening milk content i.e. the sp. gravity increased in morning and evening milk parallely. This relationship was not statistically significant (P $> $0.05). The freezing point of morning milk was negatively correlated with the evening milk i.e. freezing point increased in the morning decreased in the evening. This relationship was not statistically significant (P$ >$ 0.05). The mineral content of morning milk was positively correlated (r = 0.817) with the evening milk i.e. the mineral increased in morning and evening milk parallely. This relationship was statistically significant (P < 0.05).

**Table 5: correlation between various nutritional parameters of morning and evening raw milk**

|  |  |  |
| --- | --- | --- |
| Parameter | Correlation Coefficient | Significant value |
| Fat | 0.241 | 0.565 |
| SNF | - 0.313 | 0.450 |
| Protein | 0.043 | 0.920 |
| Lactose | - 0.041 | 0.924 |
| Density | 0.043 | 0.919 |
| Freezing point | - 0.041 | 0.923 |
| Mineral | 0.817 | 0.013 |

*N=40 (20 at morning and 20 at evening)*

**4.3. Fat-protein ratio**

Table 6 show that fat protein ratio of morning and evening milk was 1.27. Richardt (2004) considers the F/P ratio to be a very important indicator of animal health. Its high values (above 1.5) in dairy cows signify a 1.5 times higher probability of incidence of mastitis, 7.5 times higher tendency towards lameness and 3.5 times higher incidence of ketosis. Vladimír *et al.* (2005**)** the appropriate F/P ratio for Holstein cows is 1.05 -1.18. High values in the first phase suggest a great energy deficiency. Haas *et al; (2004).*The optimum F/P ratio is 1.2 – 1.4. Lower values are likely to lead to subclinical rumen acidosis which can endanger reproduction performance of cows and enhance a possible development of mineral metabolism disorders. The F/P ratio higher than 1.4 signals energy deficit and subclinical ketosis if ketone bodies are present. Our average value was agreed with this range.

**Table 6: Fat-protein ratio of milk**

|  |  |  |  |
| --- | --- | --- | --- |
|  | Fat | Protein | Fat-protein ratio |
| Morning milk | 3.12 | 1.05 | 0.409 |
| Evening milk | 4.75 | 1.52 | 0.580 |
| Morning and evening milk | 3.94 | 3.11 | 1.27 |

**CHAPTER-V**

**CONCLUSION**

The chemical composition of raw cow milk indicates that it is a rich source of nutrients and thus offers excellent opportunities for the development of local dairy industry and to meet the public need for nutrition. The microbiological quality was only marginally acceptable with respect to the total bacterial count. Fat, protein, specific gravity, minerals between morning and evening milk were positively correlated. On the other hand SNF, lactose and freezing point were negatively correlated. Fat protein ratio was in acceptable range.Evening milk was superior to morning milk due to high chemical composition.

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