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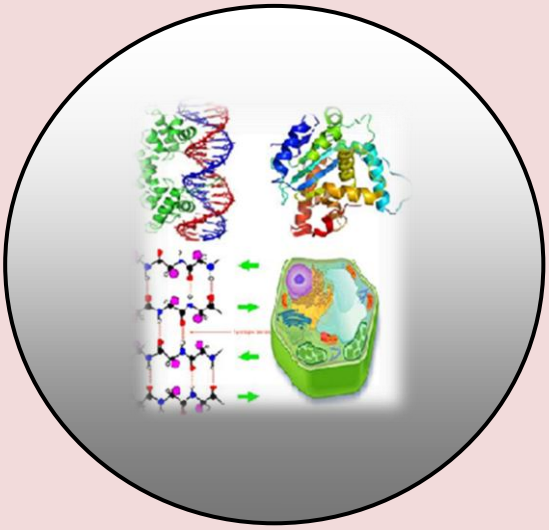

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Nutritional Contents of Different Milk and their Biological Activity

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ABSTRACT

Milk is the first intake taken by any mammalian infant. It provides the first energy required for all the vital biological functions of any infant. It also gives strength to fight out any infections which try to prevail in the newly born. Milk show different biological activities like anticancer, antiviral, antibacterial, immunostimulant anti-tumor and anti-tubercluosis. Keeping in view all these health promoting and immunostimulating properties of milk, the nutrient profile and biological activities of seven milks were studied. In this process we deals with the methods of estimation of macro nutrients i.e. the protein, fat, lactose and oligosaccharide contents of milk of cow, buffalo, sheep, ,goat, donkey, mare and camel. The average protein content of various milks was estimated to be 3.9, 5.9, 5.5, 3.9, 1.7, 2.7 and 3.7% by Micro Kjeldal's Process respectively. The average fat content of various milks were estimated to be 5.55, 10.44, 5.36, 3.53, 1.23, 1.65 and 4.95% by Rose Gottlieb Method respectively. The average lactose content of various milk was estimated to be 4.91, 4.02, 4.90, 4.35, 6.09, 6.1 and 5.1% by Lane Eynon's Method respectively. The average oligosaccharide content of various milks isolated to be0.84, 0.88 0.79, 0.79, 0.91, 0.80 and 0.83 % by modified method of Kobata and Ginsberg respectively.

Keywords: Milk, nutrients, protein, oligosaccharides and Kobata and Ginsburg.

INTRODUCTION

A mammalian neonate is provided food by its mother in the form of milk (bio fluid) which provides it energy, immunity and develops its vital organs like brain, bones, pulmonary system and digestive system. Milk contains protein fats and carbohydratesas the main components and besides this also contains minerals, vitamins, peptides, nucleotides, cytokines etc. which play different roles in the development of infants and adults alike.

The milk of different mammals carries a variety of constituents which depends on the flora and fauna around them as well as the fodder they consume. Besides the above contents it also contains oligosaccharides. Oligosaccharides are carbohydrate chains made up of monosaccharides which are mainly; glucose, galactose, glcNAc, galNAc, fucose and neuraminic acid. They are linked together by glycosidic linkages at different positions of monosaccharides present therein. They are linked byα and β glycosidic linkages. Due topresence of different monosaccharides at their sequential positions and α and β glycosidic linkages show specific biological activity .These oligosaccharides contain 2-14 monosaccharides at different positions. Moreover Fucose and Neuraminic acid is always present at non- reducing end. These oligosaccharidesmay be in the straight chain or branched chain. The role of these oligosaccharides present in different milk was not precisely known and it was thought that these activities were due to milk. Later with the advent of glycobiology the specific biological activity of each oligosaccharidewas studied. There are various structural features which are responsible for specific biological activity.

They are given as under-

Oligosaccharides bear structural homology to cell surface glycoconjugates which are used as receptors by pathogens, thus protecting nursing infants. Human milk oligosaccharide containingα and βlinked fucose inhibits the stable toxin-producing Escherichia coli in vitro (Newburg D.S., et al 2004, Guillermo M. Ruiz-Palacios, et al, 2003 Cervantes L.E., et al 1995) and its toxin induced secretory diarrhea in vitro and in vivo. Glycoconjugate found in human milk also inhibit binding by Campylobacter jejuni in vitro and in vivo and also inhibit binding by calciviruses in vitro. Thus specific fucosyl oligosaccharides of human milk have been observed to inhibit specific pathogens. Some important enteric pathogens, for example- rotavirus, are inhibited by human milk oligosaccharide or other glycoconjugates that are not fucosylated. Thus the association described here addresses only one possible set of enteric pathogens that may be inhibited by a family of milk oligosaccharide; other oligosaccharide that inhibit other pathogens are probable. Finally it can be concluded that the family of α l,2-linked fucosylated oligosaccharide, probably in conjugation with other families of oligosaccharide, constitute a powerful innate immune system of milk(Mehra R., P.Kelly, et. al). Infection by rotavirus is responsible for much of the diarrhea in infants around the world. The ability of rotavirus to infect MA- 104 cells in culture is inhibited by human milk, and this inhibition is due to a mucin-associated 46 kDa milk glycoprotein named lactadherin. Furthermore, after sialic acid is removed from lactadherin, its ability to inhibit rotavirus is essentially lost, which suggests that the glycan portion of the molecule is responsible for inhibition and that specific terminal sialic acid is required for inhibition. Lactadherin from human milk also inhibits rotavirus (EDIM strain) gastroenteritis in mice (Sudramo and Ranuth, 2003). Due to presence of sialic acid in milk, they serves as anti-inflammatory components and reduce platelet-neutrophill complex formation leading to a decrease in neutrophill B2 integrin expression .While neutral human milk oligosaccharide fraction had no effect. Sialylated human milk oligosaccharide also inhibit binding of pathogenic strains of *Escherichia coli* and ulcer-causing human pathogen *H. pylori* on the other hand neutral human milk oligosaccharide may protect the intestinal tract of neonates from Vibrio cholera. Prebiotic is non-digestible food ingredients that beneficially affect the host by selectively affecting the growth and activity of bacteria in colon that can improve the host health.

Milk oligosaccharides are non-digested due to the presence of α -glycosidic linkage. So this α-glycosidic linkage plays an important role for its prebiotic activity (Amit Srivastava et al., 2012, 2014).N-and O-linked oligosaccharide causes the release of histamine and other mediators of the allergenic, response which then lead to the development of allergeic symptoms (William et al., 1999). Oligosaccharide mimics containing galactose and fucose specifically label tumour cell surfaces and- inhibit cell adhesion to fibronectin (Osthoff et al., 2007). Supplementation of milk formula with galacto-oligosaccharides improves intestinal micro flora and fermentation in term infants (Urashima et al., 2013). Galactose and sialic acid present in milk oligosaccharide are required for optimal development of the infant's brain (Kins E.Y. 2005).

A detailed study of different milk specified the biological activity of the mammalian milk which is given as under-

Buffalo milk (Saxena et al., 1999) oligosaccharides have also been evaluated for their ability to stimulate non-specific immunological resistance of the host against parasitic infections. Mare's milk (Amit Srivastava et al., 2012) has shown anti-oxidant, lipid lowering and post heparin lipolytic activity as well as they promote cellular immune response as observed in vitro both in terms of cellular proliferation and reactive oxidative burst and also interpreted as an activation of innate immune defense mechanism. The Dog milk (Amit Srivastava et al., 2014) has a dominant N-acetylneuram in lactose sulphate oligosaccharide which plays an important role in the nutrition of the rat pups. The Elephant milk (William et al., 1999) oligosaccharide fraction contained a high ratio of sialyl oligosaccharides; this may be significant with respect to the formation of brain components, such as gangliosides of the suckling calves. Cow milk (Osthoff et al., 2007) oligosaccharides reduce the adhesion of enterotoxic *E. Coli* strains of the calf. Bovine milk (Urashima et al., 2013) oligosaccharide is an inhibitor of the binding of this toxin to the intestinal mucosa in the suckling young of these species. It is microbiotic modulators involved in preventing the pathogen binding to the intestinal epithelium and serving as nutrients for a selected class of beneficial bacteria. Sheep milk is a rich source of fucosylated oligosaccharides which has definite biological effects like α-1, 2-linked fucosylated oligosaccharides, probably in conjugation with other families of oligosaccharide, constitute a powerful innate immune system of human milk. Sheep milk aggravates hiccup and dyspnoea. It also eliminates pitta, kapha and fat. Sheep milk is an important source of bioactive inhibitory and hypertensive defense and control of microbial infection. Bioactive component present in sheep milk have their effect in cardiovascular, nervous and immune system. It also contains omega- fatty acids which are important for body and the brain, this also addresses dry skin joint pain and cardiovascular issues. Donkey milk (Deepak et al., 1998) oligosaccharides have ability to stimulate non-specific and specific immunological resistance. Goat milk oligosaccharides have anti-inflammatory effects in rats with trinitrobenzenesulfonic (T) acid induced colitis and may be useful in the management of inflammatory bowel diseases enhances the platelets (Hakkarainen et al., 2005) count which is drastically reduced during dengue fever. Its oligosaccharides play important roles in intestinal protection and repair after damage caused by DSS (Dextron sodium sulphate) induced colitis and their implication in human intestinal inflammation (Federico et al., 2006). Human milk oligosaccharides are metabolized by specific strains of bifidobacteria and thereby contribute to the establishment of a unique beneficial gut microbiota in infants during breast-feeding, so can be interpreted as prebiotics (Gunther Boehm and Guido Moro 2008).

Camel milk (Mani Arjita et al., 1994) oligosaccharides, which contain sialyl oligosaccharides and this sialic acid may exhibit a number of health benefits for human infants, including the promotion of infant brain development.

As already discussed that milk is made up of proteins fats and carbohydrates which are in the form of lactose and oligosaccharides. In the present study we have selected the milk of Cow, Buffalo, Sheep, Camel, Donkey, Goat and Mare for finding out their protein, fat, lactose and oligosaccharide contents. We have used micro kjedahl method for protein estimation, Rose Gottlieb method for fat estimation, ferric cyanide method for lactose estimation and modified method of Kobata and Ginsburg for oligosaccharide estimation.

MATERIALS AND METHODS

The basic aim of this study was to know the nutritional constituents and biological properties of various kinds of milk. For this purpose, seven milks of following animals were selected-

1. Cow Milk (Gunjan et al., 2016)
2. Buffalo Milk (Gangwar et al., 2017)
3. Sheep Milk (Ranjan and Deepak, 2015)
4. Goat Milk (Kumar et al., 2016)
5. Donkey Milk (Rathore et al., 2018)
6. Mare Milk (Das et al., 2018)
7. Camel Milk (Verma et al., 2017)

For ascertaining the nutritional constituents, the protein, fat, lactose and oligosaccharides of these milks were estimated. For the estimation of protein, fat, lactose and oligosaccharides the following methodologies were used:-

1. Micro Kjeldal's Method for protein estimation.
2. Rose Gottlieb method for fat estimation.
3. Lane Eynon's Method for fat estimation.
4. Modified method of Kobata and Ginsberg for estimation of oligosaccharide.

Determination of milk protein by Micro-Kjeldahl's method (Gasper, 1984)

Principle

The amino nitrogen in various nitrogenous compounds is converted to ammonium sulphate on digestion with concentrated sulphuric acid in presence of K_2SO_4 and $CuSO_4$. K_2SO_4 is included in digestion mixture to raise the boiling temperature whereas $CuSO_4$ acts as a catalyst. Alternatively, selenium dioxide can also be used as a catalyst. On distillation of the digested sample with NaOH, NH_3 is liberated and trapped in boric acid containing a mixture of bromocresol green and methyl red as an indicator. Ammonia reacts with boric acid to form ammonium borate which is then estimated volumetrically by titrating against standardized HCl and the amount of nitrogen is determined. Since proteins contain about 16% nitrogen, the protein content of the sample is calculated by multiplying its nitrogen content by 6.25%.

Sample Preparation– 100 ml. milk sample was taken. 15 gm K_2SO_4 and 1 Ml $CuSO_4$. $5H_2O$ solution was added to it. K_2SO_4 acts as boiling point elevator to release nitrogen from protein and retains nitrogen as ammonium salt. $CuSO_4$. $5H_2O$ acts as a catalyst. The milk was warmed at 38 ^{O} C and was placed in digestion tube. 25 ml H_2SO_4 was added to it and the solution was digested on thermostat till the solution became clear. After cooling it was transferred to the volumetric flask. The digestion flask was rinsed several times with small amounts of water and the washings were poured into the volumetric flask.

Procedure

1. 1 gm of sample was taken in a long necked digestion flask. 10 ml of Conc H_2SO_4 and 200 mg of catalytic mixture was added and the sample was digested on thermostat till the solution became clear. After cooling it was transferred to 50 ml volumetric flask. The digestion flask was rinsed several times with small amount of water and the washings were poured into the volumetric flask. Finally the volume was made up to 50 ml with distilled water.
2. 10 ml of boric acid solution was taken in 100 ml conical flask. The receiving flask was placed in such a way that the condenser of Micro-Kjeldahl's distillation apparatus dips into the boric acid solution.
3. 5 ml of digested sample was transferred to the steam chamber of Micro Kjeldahl's apparatus. 6 ml of 40% NaOH was added to the aliquot of the digested sample. Immediately the stopcock was closed and the steam was passed through the steam chamber to distill ammonia till about 30-40 ml of distillate was collected in the receiving boric acid containing flask.
4. The receiving flask was removed and the condenser outlet tip was rinsed into the receiving flask with water.
5. The contents of receiving flask were titrated against standardized 0.01 N HCI till the bluish green colour changes to pink.
6. A blank preparation was run which was identically prepared except that it did not contain the sample.

Calculations: According to the findings of the titration, the calculations were done as follows.

1 ml of 0.01 N HCI = 0.00014 g nitrogen.
Since average nitrogen content of most proteins is 16%
I g of nitrogen = 100/16 g of protein.
Volume of 0.01 N HCI used for blank = *v* ml.
Volume of 0.01 N HCI used for sample = *y* ml.
Titre volume of sample = *y* - *u* ml
Vol. of sample taken for distillation = 5 ml.
Total volume made of the digested sample = 50 ml.
Nitrogen present in 5 ml of digested sample = 50 ml.
Nitrogen present in 5 ml. of digested sample = (*y* - *u*) 0.00014 g

$$\text{Nitrogen present in 50 ml digested sample} = \frac{(y\text{-}v)\ x\ 0.00014\ x\ 50\ g}{5}$$

$$\text{Nitrogen present in 1 g sample} = \frac{(y\text{-}v)\ x\ 0.00014\ x\ 50\ g}{5}$$

$$\text{Amount of nitrogen present in 100 g sample} = \frac{(y\ -v)\ x\ 0.00014\ x\ 50\ x\ 100\ g}{5}$$

$$\%\ \text{Protein content in sample} = \frac{6.25\ x\ (y\ -v)\ x\ 0.00014\ x\ 50\ x\ 100\ g}{5}$$

Rose Gottlieb Method for Estimation of Fat Content (Pearson, 1984)

The milk sample was treated with ethanol and ammonia. The separated fat was extracted with combination of mixed ethers. Ammonia helps soften the curd of milk and alcohol breaks off milk emulsion and separates fat from proteins. It also enhances contact between solvent and fat. The petroleum ether used, reduces solubility of alcohol and solvent ether in water. The extracted dried fat was weighed. The extraction was carried out in a Mojoinner tube. Ammonia also neutralizes the free acid of the sample which would be extracted by ether. The petroleum ether decreases the solubility of milk, sugar and other non-fat solids soluble in ether.

5 gms of the prepared sample was weighed and put into an extraction tube. The sides of the tube were washed with 2 ml hot water and mixed by gentle swirling. 2 ml concentrated ammonia was added and mixed thoroughly. The tube was heated on a water bath for 20 minutes at 60^{o}C with occasional shaking. 10 ml alcohol was added and mixed. Mixture was transferred to a separating funnel. In a beaker 25 ml ether and 5 ml petroleum ether were rinsed and added to the funnel.

After each reagent addition shaking was done for 5 minutes, till a clear upper layer was obtained. The ether layer was transferred into a tared flask. The extraction tubes were washed with 1:1 mix of titre solvents and added to the flask. The liquid in the separating funnel were re-extracted twice and collected into a tared flask. The solvent was distilled on a hot plate or a steam bath at 60^{0}C. The residue of fat was dried in an oven at 100^{0}C. The flask was cooled and weighed. The fat was removed in the flask with 15-20 ml petroleum ether, then it was dried and weighed as before.

Loss in wt. of flask = wt. of fat

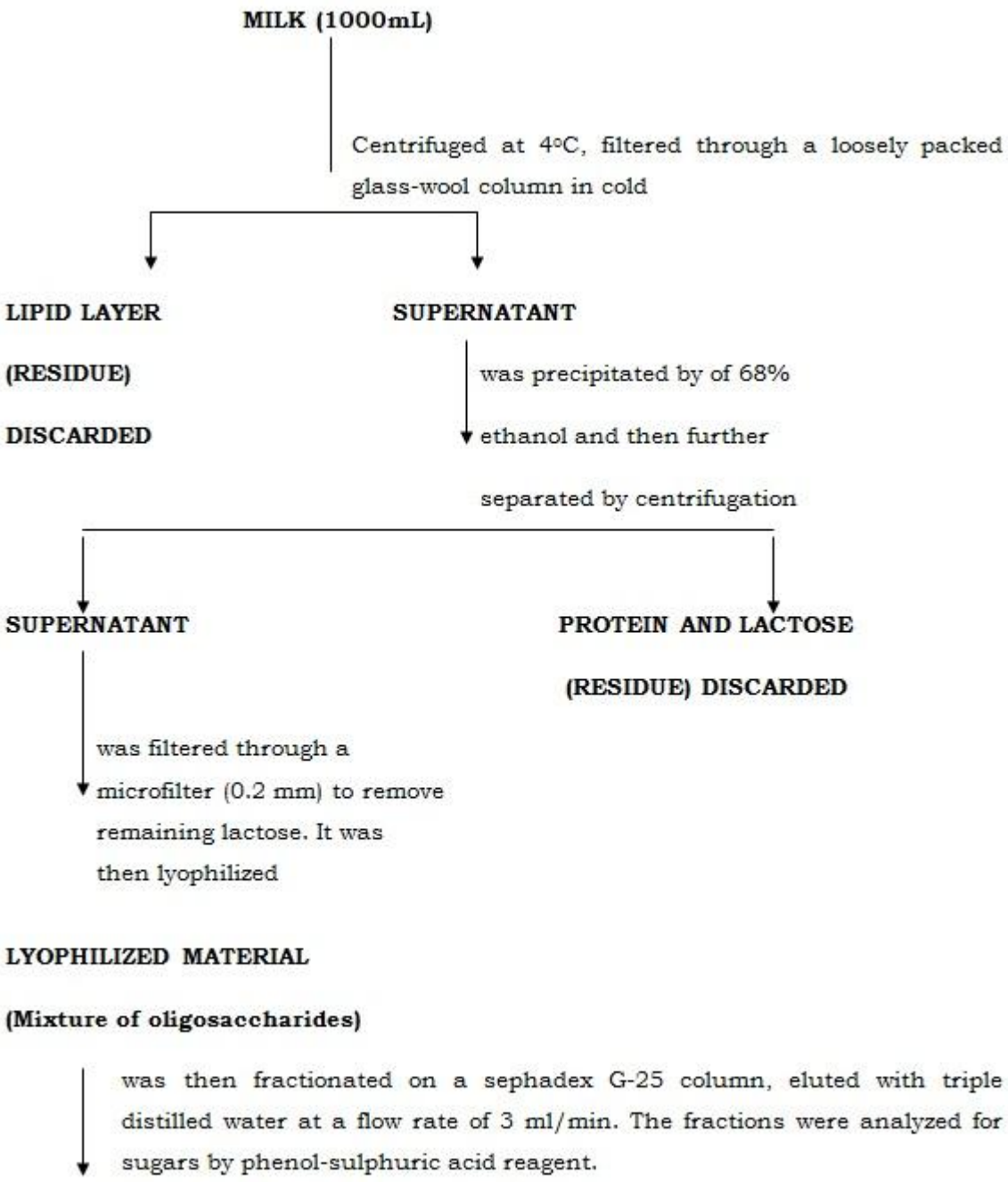
$$\text{Percent fat} = \frac{100[(\text{wt. of flask} + \text{dry fat}) - (\text{wt. of empty flask})]}{\text{wt. of sample}}$$

Lane Eynon's Method for Estimation of Lactose Content (Plummer, 1971)

10 g of milk was accurately weighed and transferred into a 250 ml volumetric flask with 50 mL water. 5 ml. each of $K_3Fe(CN)_6$ and Zinc Acetate were added as clearing agents. The volume was making up to 250 ml with distilled water and filtered. Fehling's Solution was titrated against this solution by Lane Eynon's method

1 mL of Fehling's solution = 0.00645 g. of anhydrous lactose.

ISOLATION OF COW'S MILK OLIGOSACCHARIDES BY MODIFIED METHOD OF KOBATA AND GINSBURG



CARBOHYDRATE CONTAINING FRACTIONS IN GMS

Isolation of milk oligosaccharides by modified method of Kobata and Ginsberg (Kobata and Ginsburg (1969)

1000 mL of milk was collected and stored at -20^{0}C. It was centrifuged for 15 minutes at 5000 rpm at 4^{0}C.

The solidified lipid layer was removed by filteration through glass wool column in cold. Ethanol was added to the clear filtrate to a final concentration of 68 % and the resulting solution was left overnight at 0^0C. The white precipitate formed, mainly of lactose and protein was removed by centrifugation and washed twice with 68% ethanol at 0^0C. The supernatant and washings were combined and filtered through a microfilter to remove remaining lactose and lyophilized affording crude oligosaccharide mixture. The lyophilized material (mixture of oligosaccharides) was further purified by fractioning it on sephadex G-25 column using glass double distilled water as eluant at a flow rate of 3 ml/min. Each fraction was analysed for sugars by phenol sulphuric acid reagent for presence of sugars.

Estimation of Protein Content of Cow's Milk by Micro Kjheldal's Method

The estimation of protein in Cow's milk was done by Micro Kjheldal's Method. The procedure was same as described earlier. The formula used for estimation of protein was as under:

$$\% \text{ of protein is equal to } \frac{6.25 \times (y-v) \times 0.00014 \times 50 \times 100}{5} \text{gms.}$$

For estimation of protein content of Cow's milk by micro kjhedal's method was done on ten samples. The protein content present in 10 samples were 3.5, 3.8, 3.9, 4.3, 3.7, 3.9, 4.2, 4.0, 4.1 and 3.6 percent respectively. The mean value ofprotein content by micro Kjheldal's method was obtained as 3.9%

Estimation of Fat Content of Cow's Milkby Rose Gottlieb's Method

The estimation of fat in Cow's milk was done by Rose Gottlieb Method with the procedure described earlier. The formula used for estimation of fat was

$$\text{Percent fat} = \frac{100[(\text{wt. of flask} + \text{dry fat}) - (\text{wt. of empty flask})]}{\text{wt. of sample}}$$

For estimation of fat content of Cow's milk by Rose Gottlieb method was done on ten samples. The fat content present in 10 samples were 5.46, 5.58, 5.62, 5.66, 5.39, 5.51, 5.55, 5.70, 5.35 and 5.72 % respectively. The mean value of fat content in Cow's milk by micro Kjheldal's method was obtained as 5.55%.

Estimation of Lactose content in Cow's Milk by Lane Eynon's Method

The estimation of lactose content in Cow's milk was done by Lane Eynon's Method with the procedure described earlier. The formula used for estimation of lactose content was

1 ml. of Fehling's solution = 0.00645 gms. of anhydrous lactose.

For estimation of lactose content of Cow's milk by Eynon's method ten samples was performed. The lactose content present in 10 samples was 4.9, 4.7, 4.6, 5.1, 5.1, 4.7, 4.8, 5.5, 4.9, and 4.8 respectively. The mean value of lactose content in Cow's milk by Lane Eynon'smethod was 4.9%

Estimation of Oligosaccharide Contents of Cow's Milk by modified method of Kobata and Ginsburg

For estimation of milk oligosaccharide modified method of Kobata and Ginsburg was used**.** The milk oligosaacharide present in 10 samples were 0.86, 0.88, 0.81, 0.85, 0.87, 0.84, 0.80, 0.81, 0.86 and 0.82 gms respectively. The average value of oligosaccharide content in 1 litre of milk was 0.88gms

Estimation of Protein Content of Buffalo's Milk by Micro Kjheldal's Method

The estimation of protein in Buffalo's milk was done by Micro Kjheldal's Method. The procedure was same as described earlier. The formula used for estimation of protein was as under:

For estimation of protein content of Buffalos milk by micro kjhedal's method ten samples were used. The protein content present in 10 samples was 5.8, 5.7, 6.0, 6.2, 5.4, 5.9, 6.4, 5.9, 5.5 and 6.1 respectively. The mean value of protein content in Buffalo's milk by micro Kjheldal's method was 5.9

Estimation of Fat Content of Buffalo's Milkby Rose Gottlieb's Method

The estimation of fat in Buffalo's milk was done by Rose Gottlieb Method with the procedure described earlier. The formula used for estimation of fat was

For estimation of fat content of Buffalo's milk by Rose Gottlieb method ten samples were used. The fat content present in 10 samples was 10.56, 10.33, 10.61, 10.52, 10.40, 10.44, 10.38, 10.42, 10.37 and 10.46 respectively. The average value of fat content in Buffalo's milk by Rose Gottlieb method was 10.44%.

Estimation of Lactose Content of Buffalo's milk by Lane Eynon's Method

The estimation of lactose content in Buffalo's milk was done by Lane Eynon's Method with the procedure described earlier. For estimation of lactose content of Buffalo's milk by Lane Eynon's Method ten samples were used. The fat content present in 10 samples was 4.2, 4.1, 3.8, 3.7, 4.2, 4.3, 3.6, 4.5, 3.8 and 4.0 percent respectively. The average value of lactose content in Buffalo's milk by Lane Eynon's method was 4.02%

Estimation of Oligosaccharide Contents of Buffalo's Milk by modified method of Kobata and Ginsburg

For estimation of milk oligosaccharide modified method of Kobata and Ginsburg was used**.** The milk oligosaacharide present in 10 samples was 0.90, 0.85, 0.88, 0.86, 0.92, 0.87, 0.91, 0.89, 0.88 and 0.85 % respectively. The average value of oligosaccharide content in 1 litre of milk was 0.88%

Estimation of Protein Content of Sheep's Milk by Micro Kjheldal's Method

The estimation of protein in Sheep's milk was done by Micro Kjheldal's Method. The procedure was same as described earlier.

For estimation of protein content of Buffalos milk by micro kjhedal's method ten samples were used. The protein content present in 10 samples was 5.8, 5.7, 6.0,6.2, 5.4, 5.9, 6.4, 5.9, 5.5 and 6.1 percent respectively. The mean value of protein content in Buffalo's milk by micro Kjheldal's method was 5.5%.

Estimation of Fat Content of the Sheep's Milk by Rose Gottlieb Method

The estimation of fat in Sheep's milk was done by Rose Gottlieb Method. For estimation of fat content of Sheep's milk by Rose Gottlieb Method ten samples were used. The fat content present in 10 samples was 5.26, 5.38, 5.52, 5.56, 5.39, 5.41, 5.24, 5.32, 5.30 and 5.22 percent respectively. The mean value of fat content in Sheep's milk by Rose Gottlieb method was 5.36%.

Estimation of Lactose content in Sheep's Milk by Lane Eynon's Method

The estimation of lactose content in Sheep's milk was done by Lane Eynon's Method with the procedure described earlier. For estimation of lactose content of Sheep's milk by Lane Eynon's Method ten samples were used. The lactose content present in 10 samples was 4.9, 4.7, 4.6, 5.1, 5.1, 4.7, 4.8, 5.5, 4.9, and 4.8 percent respectively. The average value of lactose content in Sheep's milk by Lane Eynon's method was 4.90%

Estimation of Protein Content of Goat's Milk by Micro Kjheldal's Method

The estimation of protein in Goat's milk was done by Micro Kjheldal's Method. The procedure was same as well as stated before. For estimation of protein content of Goat's milk by micro kjhedal's method ten samples (0.01N HCl) were used. The protein content present in 10 samples was 3.5, 3.8, 3.9, 4.3, 3.7, 3.9, 4.2, 4.0, 4.1 and 3.6 respectively. The mean value of % protein content in Goat's milk by micro Kjheldal's method was 3.9%.

Estimation of Fat Content of Goat's Milkby Rose Gottlieb's Method

The estimation of fat in Goat's milk was done by Rose Gottlieb Method with the procedure described earlier. For estimation of fat content of Goat's milk by Rose Gottlieb Method ten samples were used. The fat content present in 10 samples was 3.70, 3.58, 3.62, 3.66, 3.39, 3.35, 3.55, 3.60, 3.51 and 3.42 percent respectively. The mean value of % fat content in Goat's milk by Rose Gottlieb method was 3.53%

Estimation of Lactose content in Goat's Milkby Lane Eynon's Method

The estimation of lactose content in Goat's Milk was done by Lane Eynon's Method with the procedure described earlier. For estimation of lactose content of Goat milk by Lane Eynon's Method ten samples of 100 ml of milk were used. The lactose content present in 10 samples was 4.2, 4.1, 4.4, 4.3, 5.0, 4.0, 4.5, 4.9, 3.9 and 4.2 percent respectively. The average value of lactose content in Goat's milk by Lane Eynon's method was 4.35% in 100 ml of milk.

Estimation of Oligosaccharide Contents of Goat's Milk by modified method of Kobata and Ginsburg

For estimation of oligosaccharide in Goat's milk modified method of Kobata and Ginsberg was used. In this process 10 samples of 1 litre was taken, in each sample (1litre) quantity of milk oligosaccharide was 0.80, 0.78,0.77, 0.79, 0.81, 0.83, 0.76, 0.79, 0.75 and 0.82 percent respectively. The average value of milk oligosaccharide was found to be 0.79% from 1 litre of Goat's milk.

Estimation of Protein Content of Donkey's Milk by Micro Kjheldal's Method

The estimation of protein in Donkey's milk was done by Micro Kjheldal's Method. The procedure is same as well as stated before. For estimation of protein content of Donkey's milk by micro kjhedal's method ten samples (0.01N HCl) were used. The protein content present in 10 samples was 1.6, 1.5, 2.0, 1.9, 1.4, 1.7, 2.1, 1.7,1.9 and 1.8 percent respectively. The mean value of % protein content in Donkey's milk by micro Kjheldal's method was 1.7%

Estimation of Fat Content of Donkey's Milk by Rose Gottlieb's Method

The estimation of fat in Donkey's milk was done by Rose Gottlieb Method with the procedure described earlier.

For estimation of fat content of Donkey's milk by Rose Gottlieb Method ten samples were used. The fat content present in 10 samples was 1.26, 1.2, 1.12, 1.08, 1.23, 1.30, 1.45, 1.10, 1.16 and 1.24 percent respectively. The mean value of % fat content in Donkey's milk by Rose Gottlieb method was 1.23%

Estimation of Lactose content in Donkey's Milk by Lane Eynon's Method

The estimation of lactose content in Donkey's milk was done by Lane Eynon's Method with the procedure described earlier. The procedure was same as well as stated before.

For estimation of lactose content of Donkey's milk by Lane Eynon's Method ten samples of 100 ml of milk were used. The lactose content present in 10 samples was 7.2, 6.4, 6.7, 6.9, 7.5, 7.3, 6.7, 6.5, 6.8 and 7.0 percent respectively. The average value of lactose content in Donkey's milk by Lane Eynon's method was 6.90 in 100 ml of milk.

Estimation of Oligosaccharide Contents of Donkey's Milk by modified method of Kobata and Ginsburg

For estimation of oligosaccharide in Donkey's milk modified method of Kobata and Ginsberg was used. In this process 10 samples of 1 litre was taken from each sample quantity of milk oligosaccharide was 0.95, 0.94, 0.92, 0.88, 0.87,0.91,0.90,0.89,0.86, and 0.94 percent respectively. The average value of milk oligosaccharide was found to be 0.91% from 1 litre of Donkey's milk.

Estimation of Protein Content of Mare's Milk by Micro Kjheldal's Method

The estimation of protein in Mare's milk was done by Micro Kjheldal's Method. The procedure is same as well as stated before. For estimation of protein content of Mare's milk by micro kjhedal's method ten samples (0.01N HCl) were used. The protein content present in 10 samples was 2.7, 2.3, 2.1, 3.2, 3.0, 2.7, 2.4, 2.6, 3.3 and 2.8 respectively. The average value of % protein content in Mare's milk by micro Kjheldal's method was 2.7%

Estimation of Fat Content of Mare's Milk by Rose Gottlieb's Method

The estimation of fat in Mare's milk was done by Rose Gottlieb Method with the procedure described earlier. For estimation of fat content of Mare's milk by Rose Gottlieb Method ten samples were used. The fat content present in 10 samples was 1.46, 1.58, 1.82, 1.66, 1.89, 1.76, 1.55, 1.70, 1.45 and 1.72 percent respectively. The mean value of % fat content in Mare milk by Rose Gottlieb method was 1.65%

Estimation of Lactose content in Mare's Milk by Lane Eynon's Method

The estimation of lactose content in Mare's Milk was done by Lane Eynon's Method with the procedure described earlier. The procedure is same as well as stated before. For estimation of lactose content of Mare milk by Lane Eynon's Method ten samples of 100 ml of milk were used. The lactose content present in 10 samples was 5.6, 6.1, 6.3, 6.4, 6.0, 6.2, 5.2, 6.9, 5.5 and 6.8 percent respectively. The average value of lactose content in Mare milk by Lane Eynon's method was 6.1% in 100 ml of milk

Estimation of Oligosaccharide Contents of Mare's Milk by modified method of Kobata and Ginsburg

For estimation of oligosaccharide in Mare's milk modified method of Kobata and Ginsberg was used. In this process 10 samples of 1 litre was taken, in each sample (1litre) quantity of milk oligosaccharide was 0.82, 0.79, 0.80, 0.81, 0.83, 0.84, 0.80, 0.79, 0.78 and 0.77 percent respectively. The average value of milk oligosaccharide was found to be 0.80% from 1 litre of Mare's milk.

Estimation of Protein Content of the Camel's Milk by Micro Kjheldal's Method

The estimation of protein in Camel's milk was done by Micro Kjheldal's Method. The procedure is same as well as stated before For estimation of protein content of Camel's milk by micro kjhedal's method ten samples were used. The protein content present in 10 samples was 3.6, 3.4, 3.9, 4.1, 3.7, 3.5, 4.3, 3.8, 3.2, and 3.8 percent respectively. The mean value of protein content in Camel's milk by micro Kjheldal's method was 3.7%

Estimation of Fat Content of the Camel's Milk by Rose Gottlieb's Method

The estimation of fat in Camel's milk was done by Rose Gottlieb Method with the procedure described earlier. For estimation of fat content of Camel's milk by Rose Gottlieb Method ten samples were used. The fat content present in 10 samples was 4.76, 4.80, 5.12, 5.06, 4.96, 4.91, 5.18, 4.78, 4.85 and 5.16 percent respectively. The mean value of fat content in Camel's milk by Rose Gottlieb method was 4.95%

Estimation of Lactose content in Camel Milk by Lane Eynon's Method

The estimation of lactose content in Camel milk was done by Lane Eynon's Method with the procedure described earlier. For estimation of lactose content of Camel's milk by Lane Eynon's Method ten samples were used. The lactose content present in 10 samples was 5.0,4.9, 5.4, 4.8, 4.2, 4.8, 4.9, 4.7, 4.5 and 4.7 percent respectively. The average value of lactose content in Camel's milk by Lane Eynon's method was 5.10%

Estimation of Oligosaccharide Contents of Camel's Milk by modified method of Kobata and Ginsburg

For estimation of oligosaccharide in Camel's milk modified method of Kobata and Ginsburg was used. In this process 10 samples of 1 litre was taken from each sample quantity of milk oligosaccharide was 0.82, 0.86, 0.81, 0.79, 0.75, 0.81, 0.86, 0.90, 0.83, and 0.85 respectively. The average value of milk oligosaccharide Was 0.83 g from 1 litre of Camel milk.

RESULTS AND DISCUSSION

The results of the present study have reaffirmed the fact that milk is the most beneficial and nutritionally complete food for all age groups. Milk not only has excellent nutritional properties but it also has immunological properties. In this study, milks of seven animals i.e. Cow, buffalo, sheep, goat, donkey, camel and mare were taken and studied for their nutritional and immunological properties. The macronutrients i.e. the fat, protein and carbohydrate contents of the milks mainly contributed to their nutritional properties whereas oligosaccharides mainly contribute to their immunological and other biological characteristics. The protein contents of all the milk were assessed by the Micro Kjheldal's Method. All the milks were analysed for their fat contents by Rose Gottlieb Method. The lactose contents of various milks were assessed by Lane Eynon's Method and the Oligosaccharide contents were assessed by modified method of Kobata & Ginsberg Method. The results obtained from above studies have been given as under-

Assessment of Cow's Milk

we have assessed the protein fat, lactose, and oligosaccharide contents of Cow's Milk, were assessed which is most commonly consumed milk by people of all age groups specially weaning infants. The protein percentage was assessed by Micro Kjheldal's Method in which were 10 samples were analyses and the highest value for protein content was reported as 4.3% while the minimum value assessed was 3.5%. The calculated mean value for protein percentage in Cow's Milk was 3.9%. Simultaneously, the fat content in cow's milk was assessed by Rose Gottlieb Method. The highest value for fat content in Cow's Milk was calculated as 7.2% and minimum percentage was 5.35%. In total all the 10 samples were collected from various sources, the average value for fat content came as 5.55% in Cow's Milk. Further the lactose content of the Cow's Milk was assessed by Lane Eynon's Method in 10 collected samples 5.5 was found as the highest value and 4.6 as lowest value. The average lactose content in Cow's Milk was found to be 4.9%. In the last, the most important oligosaccharide content was analyzed by modified method of Kobata and Ginsberg Method in 10 samples of Cow's Milk. The maximum value for oligosaccharide contents was estimated as 0.88% which came to lowest value of 0.80% having the mean value of 0.83%.

Assessment of Buffalo's Milk

After cow's milk, we have assessed the protein fat, lactose, and oligosaccharide contents of buffalo's milk, which is the most common milk used by people of North India.

The protein percentage was assessed by Micro Kjheldal's Method in which 10 samples were analysed highest value for protein content was found as 6.4% while the minimum value assessed was 5.4%. The calculated mean value for protein percentage in buffalo's milk was 5.90%. Simultaneously, the fat content in buffalo's milk was assessed by Rose Gottlieb Method. The highest value for fat content in buffalo's milk was calculated as 10.61% and minimum percentage was 10.37% and the mean value was 10.44.. Further the lactose content of the buffalo's milk was assessed by Lane Eynon's Method in 10 collected samples. 4.5% was found as the highest value and 3.86 as lowest value. The average lactose content in buffalo's milk was found to be 4.02 %. Finally, the most important oligosaccharide content was analyzed by modified method of Kobata and Ginsberg Method in 10 samples of buffalo's milk. The maximum value for oligosaccharide contents was estimated as 0.92% which came to lowest value of 0.85% and the mean of it was 0.88%.

Assessment of Sheep's Milk

The protein fat, lactose, and oligosaccharide contents of Sheep's Milk were assessed by various methods. The protein percentage was assessed by Micro Kjheldal's Method in which 10 samples were analysed and the highest value for protein content was reported as 6.0% while the minimum value assessed was 5.1%. The calculated mean value for protein percentage in Sheep's Milk was 5.5%. Simultaneously, the fat content in Sheep's Milk was assessed by Rose Gottlieb Method. The highest value for fat content in Sheep's Milk was calculated as 5.56% and minimum percentage was 5.22%. In total all the 10 samples were collected from various sources, the average value for fat content came as 5.36% in Sheep's Milk. Further the lactose content of the Sheep's Milk was assessed by Lane Eynon's Method in 10 collected samples. 5.5 was found as the highest value and 4.6 as lowest value. The average lactose content in Sheep's Milk was found to be 4.90%. finally, the most important oligosaccharide content was analyzed by Kobata and Ginsberg Method in 10 samples of Sheep's Milk. The maximum value for oligosaccharide contents was estimated as 0.84% which came to lowest value of 0.72% with the mean value of 0.79%.

Assessment of Camel's Milk

Further in the study Camel's milk was assessed for its protein fat, lactose, total soluble sugars and oligosaccharide contents by various methods. The protein percentage was assessed by Micro Kjheldal's Method in 10 samples and the highest value for protein content came as 4.3% while the minimum value assessed was 3.2%. The calculated mean value for protein percentage in Camel's Milk was 3.7%. Simultaneously, the fat content in Camel's Milk was assessed by Rose Gottlieb Method. The highest value for fat content in Camel's Milk was calculated as 5.18% and minimum percentage was 4.76%. In total all the 10 samples were collected from various sources, the average value for fat content came as 4.95% in Camel's Milk. Further the lactose content of the Camel's Milk was assessed by Lane Eynon's Method in 10 collected samples. 5.4 was found as the highest value and 4.2 as lowest value. The average lactose content in Camel's Milk was found to be 5.1%. Finally, the most important oligosaccharide content was analyzed by Kobata and Ginsberg Method in 10 samples of Camel's Milk. The maximum value for oligosaccharide contents was estimated as 0.90% which came to lowest value of 0.75% showed a mean value of 0.83%.

Assessment of Goat's Milk

Goat's Milk was assessed for its protein fat, lactose, and oligosaccharide contents.

The protein percentage was assessed by Micro Kjheldal's Method in which 10 samples were analysed and the highest value for protein content was reported as 4.3% while the minimum value assessed was 3.5%. The calculated mean value for protein percentage in Goat's Milk was 3.9%. Simultaneously, the fat content in Goat's Milk was assessed by Rose Gottlieb Method. The highest value for fat content in Goat's Milk was calculated as 3.7% and minimum percentage was 3.35%. In total all the 10 samples were collected from various sources, the average value for fat content came as 3.53% in Goat's Milk. Further the lactose content of the Goat's Milk was assessed by Lane Eynon's Method in 10 collected samples. 5.0% was found as the highest value and 3.9% as lowest value. The average lactose content in Goat's Milk was found to be 4.2%. Finally the most important oligosaccharide content was analyzed by modified method of Kobata and Ginsberg in 10 samples of Goat's Milk. The maximum value for oligosaccharide contents was estimated as 0.83% which came to lowest value of 0.75% with average value of 0.79%.

Assessment of Donkey's Milk

Donkey's Milk was assessed for its protein fat, lactose, total soluble sugars and oligosaccharide contents. The protein percentage was assessed by Micro Kjheldal's Method in which 10 samples were analysed and the highest value for protein content came as 2.1% while the minimum value assessed was 1.4%. The calculated mean value for protein percentage in Donkey's Milk was 1.7%. Simultaneously, the fat content in Donkey's Milk was assessed by Rose Gottlieb Method. The highest value for fat content in Donkey's Milk was calculated as 1.45% and minimum percentage was 1.08%. In total all the 10 samples were collected from various sources, the average value for fat content came as 1.23% in Donkey's Milk. Further the lactose content of the Donkey's Milk was assessed by Lane Eynon's Method in 10 collected samples. 7.5% was found as the highest value and 6.4 as lowest value. The average lactose content in Donkey's Milk was found to be 6.9%. In the last, the most important oligosaccharide content was analyzed by modified method of Kobata and Ginsberg in 10 samples of Donkey's Milk. The maximum value for oligosaccharide contents was estimated as 0.95% which came to lowest value of 0.86% having an average of 0.91%.

Assessment of Mare's Milk

Mare's Milk was assessed for its protein fat, lactose, total soluble sugars and oligosaccharide contents. The protein percentage was assessed by Micro Kjheldal's Method in which 10 samples were analysed and the highest value for protein content came as 3.3% while the minimum value assessed was 2.1%. The calculated mean value for protein percentage in Mare's Milk was 2.7%. Simultaneously, the fat content in Mare's Milk was assessed by Rose Gottlieb Method. The highest value for fat content in Mare's Milk was calculated as 1.89% and minimum percentage was 1.45%. In total all the 10 samples were collected from various sources, the average value for fat content came as 1.65% in Mare's Milk. Further the lactose content of the Mare's Milk was assessed by Lane Eynon's Method in 10 collected samples. 6.9% was found as the highest value and 5.2 as lowest value. The average lactose content in Mare's Milk was found to be 6.1%. In the last, the most important oligosaccharide content was analyzed by Kobata and Ginsberg Method in 10 samples of Mare's Milk. The maximum value for oligosaccharide contents was estimated as 0.84% which came to lowest value of 0.77% with the mean value of 0.80%.

COMPARATIVE TABLE OF MACRO NUTRIENTS PRESENT IN VARIOUS MILKS

SL. NO.	SPECIES / NUTRIENTS %	COW	BUFFALO	SHEEP	GOAT	DONKEY	MARE	CAMEL
1.	**PROTEIN**	3.9	5.9	5.5	3.9	1.7	2.7	3.7
2.	**FAT**	5.55	10.44	5.36	3.53	1.23	1.65	4.95
3.	**LACTOSE**	4.91	4.02	4.90	4.35	6.09	6.1	5.1
4.	**OLIGOSACC-HARIDES**	0.84	0.88	0.79	0.79	0.91	0.80	0.83

The above Table shows the comparative amount of various nutrients in Milks of different animals. The protein content of buffalo's milk is 5.9% which is the highest followed by sheep's milk which has 5.5% protein. The cow, camel, goat, mare and donkey were found to contain 3.9, 3.7, 3.9, 2.7 and 1.7 % protein respectively. The high percentage of protein in buffalo's milk makes it an ideal drink for the vulnerable sections of the Society, especially for pregnant women, lactating women, growing children and adolescents. However, because of its high fat content which is 10.4% buffalo's milk should not be recommended for adult and old aged. Buffalo's and sheep's milk can be of great therapeutic importance in patients suffering from severe catabolic disorders like cancer, tuberculosis, typhoid, anemia, post-surgical conditions, burns and trauma. These milks can supply the much needed high protein and calories for tissue repair and energy. Cow milk has 3.9% protein which can be easily digested and absorbed by the growing infant. Cow milk also has high lactose content, this combination makes it most suitable for infantile digestion and absorption. Since buffalo's milk has a high fat content 10.4% it cannot be given to people suffering from metabolic disorders such as diabetes, hypertension, cardiovascular diseases, obesity and certain hepatic and kidney diseases. In these conditions, milk of donkey and mare can provide the patient with nonfat calories and proteins.

The fat content of buffalo's milk was the highest 10.44% followed by cow milk 5.55%, sheep 5.36%, camel 4.95%, goat 3.53%, mare 1.65% and donkey 1.23%. buffalo's milk because of its high fat content would be suitable for underweight persons and people suffering from catabolic diseases. However, it cannot be given to people who are either obese of suffer from cardiac diseases. Donkey's milk and mare's milk can be given in weight reducing diets also.

The lactose content of donkey's milk was the highest which is 6.9% followed by mare 6.1%, camel 5.1%, cow 4.91%, sheep 4.90%, goat 4.35% and buffalo 4.02%. Lactose a disaccharide composed of glucose and galactose is the principle sugar of mammalian milk and the main carbohydrate energy source for infants and children. Thus lactose plays a central metabolic role in human nutrition. Lactose is hydrolyzed in the intestine by the enzyme lactase-phlorizin hydrolase to glucose and galactose. However, in some conditions small intestine does not make enough enzyme lactase. In the absence of this enzyme lactose does not split into glucose and galactose which is essential for its absorption by the cell lining of small intestine.

This condition known as lactose intolerance has symptoms of gastrointestinal origin mainly abdominal pain, cramping, diarrhea, flatulens, stomach bloating, abdominal distention and nausea Symptoms occur because unabsorbed lactose passes through the small intestine into the colon. It can also have long term effects like calcium and vitamin "D" deficiency leading to osteoporosis. Another disease galactosemia which is characterized by high blood levels of galactose is caused by one or more of the enzyme necessary for metabolizing galactose. A metabolic build up is generated which is toxic to the lever and kidneys and also damage the lens of the eyes causing cataract. Galactose is an important constituent of the complex polysaccharide which is the part of the cell glycoconjugates, key elements of immunologic determinants, harmones, cell membranes, structures and it is also incorporated in galacto lipids which are important structure elements of the central nervous system. Neonates suffering from galactosemia have symptoms like failure to thrive, diarhoea, jaundice, hypatomegally cataracts, galactoseuria, gonadal disfunction, developmental delay and neurological symptoms etc. In cases of secondary lactose intolerance which occurs because of a disease which causes harm to the intestinal lining milks of reduced lactose content by cow, buffalo and sheep milk can be given. In cases of galactosemia a strict galactose free diet is the only permanent treatment. Commercially prepared milk in which the lactose content has been reduced, are prepared at processing plants by adding the liquid enzyme lactase to pasteurized milk and storing it for 24 hours. Milk that has 99.9% of this lactose hydrolyzed is leveled lactose free.

Oligosaccharides, naturally occurring in human milk, as receptors for microbes

Receptors	**Microorganisms**
Mannose-containing glycoproteins	Escherichia coli (type 1 fimbriae)
Fucosylated oligosaccharides	E. coli (heat-stable enterotoxin)
Fucosylated tetra and pentasaccharides	E. coli
Sialyl (a 2-3) lactose and glycoproteins	E. coli (S-fimbriae)
Sialyl (a 2-3) galactosides in mucins	E. coli (S-fimbriae)
Neutral oligosaccharides (LNT, neo-LNT)	Streptococcus pneumoniae
Gal (b1-4)GlcNAc or Gal (b1-3)GlcNAc	Pseudomonas aeruginosa
Fuca 1 -2Gal epitopes	Candida albicans
Sialyl-lactose	Helicobactor pylori
Sialyl-lactose	Streptococcus sanguis
Sialyl-lactose and sialylated glycoproteins	H. pylori
Sialylated glycoproteins (a2-3-linked)	Mycoplasma pneumoniae
Sialylated poly-N-acetyllactosamine	M. pneumoniae
Sialylated (a2-3)poly-N-acetylactosaminoglycans	Streptococcus suis
Sialyl(a 2-6) lactose	Influenza virus A
Sialyl(a2-3)lactose	Influenza virus B
9-O-Ac of NeuAc(a2-3)R	Influenza virus B

The oligosacchride contents of various milks was as follows ; donkey (0.91%), buffalo (0.88%), cow (0.84%), camel (0.83%), mare (0.80%), sheep (0.79%) and goat (0.79%).

Oligosaccharides provide the milk unique immunological properties they inhibit adherence of many pathological microorganisms to human epithelial cells, thus protecting the infants as well as adults from various life threatening infections. Apart from this they also inhibit binding a toxin released by this microorganism to the mucosal cells. Milk because of its excellent nutritional profile can save the consumer from many deficiency diseases. In the growing years deficiency of the protein and energy can cause growth retardation, slow mental development and diseases like kwashiorkor and marasmus. Growing children can be victim of vitamin A deficiency showing symptoms like night blindness. Deficiency of vitamin D and Calcium can cause rikets. Consumption of milk can be helpful in all these situation.

Dietary Role of Milk from various Species

Milk is a complex biological fluid which has been viewed primarily as a food that provides energy and essential nutrients for optimal health, growth and development of the young mammal. In our study we have seen that milk of various species has got nutrient profile which is most suitable for various life cycle stages and also for various clinical conditions.

Dietary Role of Buffalo's Milk

When buffalo milk was analyzed for its nutrient framework, it had the highest content of protein which was 5.9%. It also had 10.44% fat and 4.02% lactose. This nutrient profile makes it most suitable for the vulnerable sections of the society, especially for pregnant women, lactating mothers, growing infants and adolescents. Skimmed buffalo's milk can also be given to geriatric people for they need the high protein and calcium content. It can also be of great therapeutic importance in severe catabolic disorder such as cancer, T.B., Typhoid, Anemia, post-surgical conditions and burns. Buffalo's milk can supply the much needed high protein, high caloric diet for tissue repair and energy the lactose in buffaloes milk breaks into glucose and galactose when acted by enzymes. This provides ready energy. Also lactose when ingested changes into lactic acid making the gut environment acidic. This favour calcium and phosphorous absorption, essential for the development of teeth and bones. Buffalo's milk, however, cannot be given to obese people, cardiac patients or people suffering from Diabetes and High Blood Pressure.

Dietary Role of Cow's Milk

Cow's Milk analysis showed 3.9% protein, 5.55% fat, 4.91% lactose, and 0.84% oligosaccharide. Cow's milk because of its nutritional profile has always acquired a place near mother's milk in the nutrition chart. All the human milk is best suited for digestion and need of the infant, cow's milk is considered next best to it. Infants can digest and absorb cow's milk in an effective way. For an effective digestion and absorption infant milk formula should have low fat, medium protein and high lactose content and cow's milk has a nutrient profile same as that the high lactose content in cow's milk facilitates calcium and magnesium absorption and favour amino acid absorption and nitrogen retention.

Galactose is present only in milk and is essential for the formation of myelin, a protective sheath that surrounds the nerve fibre and protects their ability to transmit nerve messages. Unpasteurised cow's milk has protein splitting enzyme in it, which reduces the protein into less complex peptone stage, on which digestive enzymes act more effectively. The fatty acid make up in lipids of cow's milk is suited for all age groups. It has more medium chain triglyceride and all three essential fatty acids (Linoleic acid, linolenic acid and archidonic acid). It also has cholesterol which is important for the formation of myelin sheath of Central Nervous System.

In addition to the nutrients, the cow's milk also has some immunologic biologically compounds which had anti-infective properties. Lysozyme attacks the cell wall of bacterial Lactoperoxidases and act by killing the streptococcus organism. Macrophase though found in small amounts engulf and digest bacteria, they also synthesize complements, a protein involved in establishing immunity towards infectious agents. The lymphocytes produced lymphocytokins which stimulates proliferation and differentiation in lymphoid tissue and its capacity to react to antigencs. Lactoferrin an iron binding protein inhibit the growth of *E. coli* bacteria by making iron unavailable for their growth. It also prevents free redical generation. Cow's milk because of its low fat, high protein content can be given to obese, cardiac, hypertention and diabetic patients also. It can prove to be very good in hepatic disorder as it can provide low fat high protein diet.

Dietary Role of Camel Milk

Camel Milk had 3.7% protein, 4.95% fat, 5.1% lactose, and 0.83% oligosaccharide. Due to his high protein and high lactose content Camel Milk can be very beneficial for all age groups and also in various clinical conditions, such as people suffering from malnutrition, children with kwashiorkor and marasmus, pregnancy lactation and even in old age. It can have a good impact of on several areas of normal health and pathology. It can improve dental health and bone formation due to high calcium content. People suffering from gastric ulcers, diarrhea, hypertension, hyperlipidemia, coronary heart disease and cancer require high calorie moderate fat diet and camel milk can be of importance in these conditions. Even in post-surgical conditions camel milk can be used.

Dietary Role of Sheep Milk

Sheep milk analysis showed 5.5% protein, 5.36% fat, 4.90% lactose, and 0.79% oligosaccharide. The high calorie and high protein content makes it suitable to be given in catabolic stages such as diabetes, tuberculosis, prolonged fever, cancer, burns, septicemia, severe infections and in post-surgical conditions. In life cycle stages where high protein diet is required, this milk can be given and in conditions where patient requires a low fat high calorie diet, this milk can be given in its skimmed form.

Dietary Role of Goat's Milk

Goat's milk has 3.9% protein, 3.53% fat, 4.35% lactose, and 0.79% oligosaccharide. The protein fat ratio is less than 1% and this nutrient make up makes it very important. The high lactose content can supply the young infant with required. Energy lactose converted into lactic acid improves the gut health and can facilitate absorption of other nutrients. The low fat content makes its easily digestible and the soluble sugars in it supply ready energy. Fat globules of goat milk resemble those of cow milk in lipid composition and properties of the globule membrane but goat milk lacks agglutinin which causes fat globules of cow milk to cluster when cooled. Five principle proteins of goat milk lactalbumin, β-lactoglobulin, casein, β-casien, and α_{s2}-casien, closely resemble their homo-logs in cow milk. Goat milk lacks a homolog of bovine β_{s1}-casien, the most abundant protein in cow milk. Caseinate micelles of goat milk contain more calcium and inorganic phosphorous, are less solvated and less heat stable, and lose β-casien more readily than bovine micelles. Activities of ribonuclease, lipase, and xanthine oxidase are less in goat than in cow milk. Goat milk contains more potassium and chloride N-acetyl neuraminic acid, folate, vitamin B_6 and Vitamin B_{12} than cow milk.

Dietary Role of Donkey's milk

Donkey's milk analysis showed 1.7% protein, 1.23% fat, 6.9% lactose, and 0.91% oligosaccharide. Nutritionally Donkey's milk is very important because of its low protein, low fat and high lactose content. It can be given to infants easily because they can digest and absorb it and the high lactose content gives them free energy and also keeps the gut health in good conditions. Cow's milk protein intolerance is the most frequent food intolerance in infancy occurring in between 0.3 and 7.5% of the infant population. In such cases when breast feeding is not possible, a cow's milk free diet is given as an alternative. Recent clinical studies confirm, Donkey's milk feeding as a safe and valid treatment of most complicated cases of multiple food intolerance. Donkey's milk has medium chain tri-glyceride which are easily digested and absorbed specially in infancy. Its more palatable than the other milk formulas and it is similar in composition to human milk. Its hormonal peptide stimulate the functional recovery and development of the intestine. Besides peptides providing growth factors and protective factors, substances with bio-active properties are also found among the lipids in Donkey's milk. Dietary and therapeutic properties of Donkey's milk have been known since ancient times. It has immunostimulant properties. The immunostimulant compounds in donkey's milk are of physiological significance. Various bioactive substances such as enzyme and enzyme inhibitors, binding proteins (casein, lactalbumin, serumalbumin, lactoferin and vitamins) are found in donkey's milk. Apart from these immunoglobulin bifidus factor, growth factors, casein hydrolysate, platlet modifying factors and angiotentision converting enzyme inhibitors are found. It is very beneficial in stages when patient is recovering from long illness. It is also used in making beauty products since it is very good for skin health. The high lactose content in donkey's milk stimulate calcium and magnesium absorption. Apart from being good for bone and teeth formation calcium is important in different phases of skeletal growth. Calcium also has a protective effect against colorectal carcinogenesis.

Dietary Role of Mare's Milk

Mare's milk analysis showed 2.7% protein, 1.65% fat, 6.1% lactose, and 0.80% oligosaccharide. Because of the high lactose and total soluble sugars Mare's milk can supply free energy in the form of glucose in abundance. The instant energy supplying properties of Mare's milk have long been recognized. The low fat high energy nutrient profile is a unique combination which can be used in conditions where high protein and high energy diet is required without increasing the fat content of the diet.

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