

## Studies on the nutritional composition of goat (Beetal) colostrum and its mature milk

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**Abstract:** Colostrum provides a complete diet for the neonate. In ruminants, colostrum is also the sole source of initial acquired immunity for the offspring therefore it plays an important role in mammalian host defense. Beetal colostrum and its mature milk were examined for the different chemical constituents such as crude protein, fat, ash, moisture and lactose. Mature milk was taken as control. During this study it was concluded that protein, ash, and total solids contents were much higher in the first day's colostrum and these parameters were decreased thereafter in the second and third day's colostrum respectively. However the fat, lactose and moisture contents were lower in the first day's colostrum, but latter on these constituents increased in second and third day's colostrum. The concentrations of the major colostrum constituents changed significantly after birth, the level of different constituents on the third day resemble to those of the mature milk.

**Keywords:** Goat (Beetal), colostrum, milk, nutritional analyses.

**Received:** April 5, 2012 **Accepted:** July 12, 2012

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### INTRODUCTION

Colostrum is the first milking of mammal after giving birth to young one and continues about till three days in goat. Colostrum has sufficient nutritional and immunological values and it is the most satisfactory way of providing nutritional requirements and passive immunity against diseases to the newborn in the early days of life. It is a complex biological fluid, which helps in the development of immunity in the newborn. It contains significant quantities of complement components that act as natural anti-microbial agents to actively stimulate the maturation of an infant's immune system. It is produced and stored in the mammary glands during the late pregnancy<sup>1</sup>.

Colostrum has high concentrations of nutrients and antibodies, but it is small in quantity. Colostrum is high in protein, high in antibodies, and low in fat (as newborns may find fat difficult to digest) and carbohydrates as compared to mature milk. Newborns have very small digestive systems, and colostrum delivers its nutrients in a very concentrated low-volume form. It has a mild laxative effect, encouraging the passing of the baby's first stool, which is called meconium. This clears the excess bilirubin, a waste product of dead red blood cells which is produced in large quantities at birth due to blood volume reduction, from the infant's body and helps to prevent jaundice. Feeding of colostrums within the few hours of birth plays a vital role in health, survival and subsequent performance i.e. immunity against diseases<sup>2</sup>.

Milk composition in mammals is greatly influenced by the breed, parity, age, nutrition, non-lactating periods and health status of the animal but the contents of the postpartum milk deviate from normal milk of organism in contents like

immunoglobulin, growth factors, proteins, non-proteinous nitrogen, ash, minerals and vitamins<sup>3,4</sup>.

Colostrum contains large numbers of antibodies called "secretory immunoglobulin". Immunoglobulin function is not limited to provide passive immunity in the blood but it has also been proven to work with a localized action against *E.coli*. The main three immunoglobulin IgA, IgG and IgM play vital role in passive immunity against many diseases of young neonates<sup>5</sup>.

IgA protect the intestinal lining from *E.coli* along with the protection of mucous membranes in the throat, lungs, and intestines of the infant. IgG occurs as IgG1 and IgG2 and is very important in antibacterial immunity. IgM is first immunoglobulin first formed in response to antigen and has high efficiency in functions that enhances immunity such as complement fixation, agglutination and opsonic activity<sup>6</sup>.

Growth factors IgFI and IgF II of colostrum stimulate growth, differentiation and metabolism in a variety of cell types acting via IgF I receptors<sup>7</sup> while the epithelial growth factor stimulates normal skin growth and essential for mucosal surfaces of bodies. Goat milk differs from cow milk or human milk in having better digestibility, alkalinity, buffering capacity and certain therapeutic values in medicine and human nutrition<sup>8</sup>.

In the present studies the comparative analysis of colostrum and mature milk of goat is carried out to focus the importance of colostrum to increase the survival rate of dairy goat.

### MATERIALS AND METHODS

#### *Colostrum and milk samples*

Fresh colostrum and milk samples were collected from Dairy farm Deera Chahal situated at

Bedian Road Lahore. Samples were collected in presterilized bottles and stored in refrigerator to freeze them during shifting them to laboratory.

#### Nutritional analysis

The nutritional analysis of colostrum and milk samples includes the chemical and physical analysis was carried out by methods given by A.O.A.C 2005<sup>9</sup>. All the samples analyzed were taken in triplicate and mean of the values are shown in results.

#### Protein determination

Protein contents of milk and colostrum were determined by Kjeldhal method. 10gms of the milk and colostrum samples were taken in digestion flasks. Then it was dried in oven. The organic matter of the samples was digested with 18ml conc. H<sub>2</sub>SO<sub>4</sub> in the presence of catalyst tablets and simultaneously formation of ammonium salt and amines from the nitrogen present in milk and colostrum. The ammonia and amine were distilled off when the solution was made alkaline by 40% NaOH solution. The distillate was trapped in standard boric acid indicator solution. On changing indicator's color it was titrated against N/70 HCl for determination of nitrogen.

#### Fat determination

Fat contents of colostrum and milk were determined by Gerber Method. 10 ml of conc. H<sub>2</sub>SO<sub>4</sub> was taken in butyrometer for liberation of fat from sample without charring. 10.94ml of milk or colostrum sample was added along the glass walls of butyrometer in order to avoid its mixing with acid. 1.0ml of amyl alcohol was added to lower down the surface tension of the mixture to facilitate the separation of fat from aqueous phase. Contents of the butyrometer were mixed and centrifuged for 4 to 5 minutes at 1200rpm in Gerber Centrifuge. The fat being lighter was separated out on the top of the solution.

#### Determination of lactose

Lactose in colostrum and milk of goat was determined by Lane- Eynon method. Lactose solution reduces quantitatively alkaline cupric salt solution on boiling to red cuprous oxide from the amount of copper salt reduced the quantity of lactose is calculated. 10gms of sample was taken in beaker. 05g citric acid added for hydrolysis. The sample was cooled down and neutralized with 20% NaOH. 100 ml volume was made, solution was filtered and taken in burette for titration against 10ml Fehling Reagent until it became brick red in color.

#### Determination of moisture

The moisture contents of colostrum and milk were determined by means of air over drying. 5gms of sample was taken in pre-weighed crucibles and placed overnight in oven at constant temperature of 100°C. The crucibles were cooled in desiccator. The

moisture content was calculated by difference of the weight of crucibles before and after drying.

#### Determination of ash

The ash contents were determined by means of air furnace. 5gms of samples of colostrum and milk were taken in pre-weighed crucible and placed in oven for drying. Then the crucibles were placed in Muffle Furnace at 550°C until the white ash was obtained. Ash contents were calculated on the basis of difference of the weights of the crucibles before and after the ignition of samples.

## RESULTS AND DISCUSSION

#### Protein contents in colostrum and milk

Figure 1 shows the protein contents in the first three days goat's colostrum and milk. The protein contents in first day's colostrum was 14.18% (w/v), decreased to 7.14% and 5.53% w/v on the second and third days respectively whereas protein contents in mature milk of goat was found 3.44% w/v. Casein is the essential component of colostrum and milk. The high contents of protein in colostrum as compared to mature milk were due to the presence of immunoglobulin, leukocytes, lactoferrin, lysozyme, proline rich polypeptides, cytokines, lymphokines, growth hormones, insulin-like growth factors, fibroblast growth factors, epithelial growth factors and some amino acids<sup>10</sup>. The presence of these specific types of proteins proves the colostrums as the most suitable source for the nutritional and immunological source for newborn in the early days of life. Pellegrini et.al<sup>11</sup> also described the protein as a source of antimicrobial peptide precursors which enhance the natural defense of the newborn calves against invading pathogens.

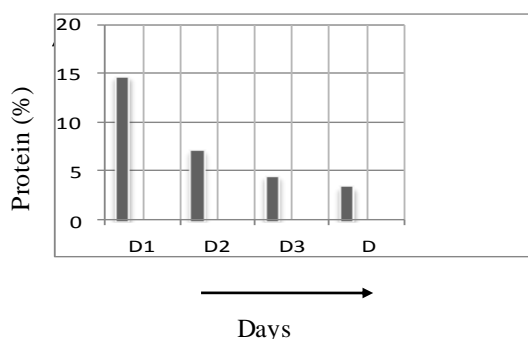


Figure 1: Average protein (%) in first three days colostrum and milk

#### Fat contents of colostrum and milk

Fat of colostrum and milk is richest source of energy. Figure 2 shows the fat contents of goat's colostrums and milk. The quantity of fat in first day's colostrum was found much lower i.e. 3.8% (w/v) as

compared to mature milk i.e. 5-7% (w/v) then a continuous increase in fat contents was observed on second (4.5% w/v) and third day (5.2% w/v). The lower contents of fat in colostrum was due to the presence of lower proportion of fatty acids, triglycerides, phospholipids and cholesterol and its ester as compared to the mature milk of goat. The lower contents of fat in goat's colostrum helpful due to its digestibility problems which plays a vital role for the health of newborn.

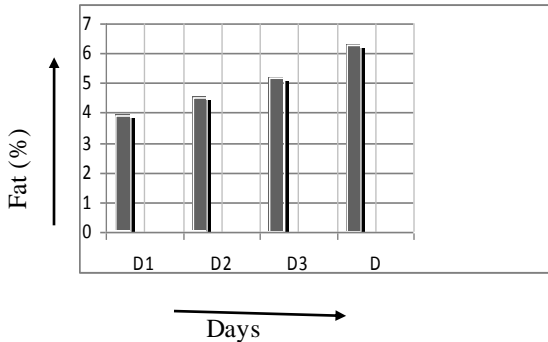


Figure 2: Average Fat (%) in first three days colostrum and milk

**Lactose contents of colostrum and milk**

Milk sugar, lactose, is the major carbohydrate in goat's colostrum and milk. It is synthesized from glucose in the mammary glands with the required active participation of milk protein  $\alpha$ -lactalbumin<sup>12</sup>.

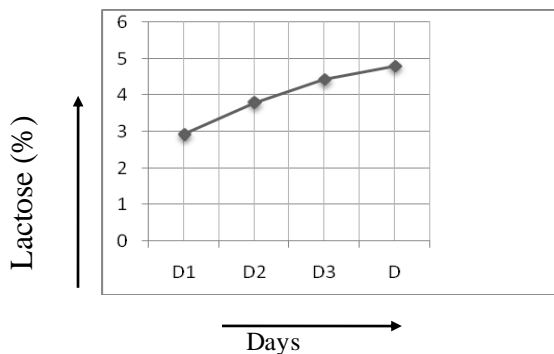


Figure 3: Average Lactose (%) in first three days colostrum and milk

Figure 3 shows that percentage of lactose in colostrum is less as compared to goat's mature milk. Lactose in first day's colostrum is 2.93% (w/v) and then it increase to 3.8% and 4.4% w/v on second and third days colostrum whereas goat's mature milk contains 4.8% w/v lactose which is a valuable nutrient, because it favors intestinal absorption of calcium, magnesium and phosphorus utilization of vitamin D<sup>13</sup>. The low contents of lactose of colostrum

at the initial stage and then increment in its quantity resembles with some previous study<sup>14</sup>.

**Moisture contents of colostrum and milk**

Figure 4 shows the moisture contents of first three days colostrum and milk of goat. The moisture contents continuously increased from first day i.e. 73.3 % w/v to third day i.e. 84.9 % w/v in case of colostrum but it was less as compared to milk i.e. 88.1 % w/v. The increment of moisture level in colostrum was due continuous decrease in protein contents of colostrum from first to third day is also in agreement with the findings of Ming et.al<sup>15</sup>.

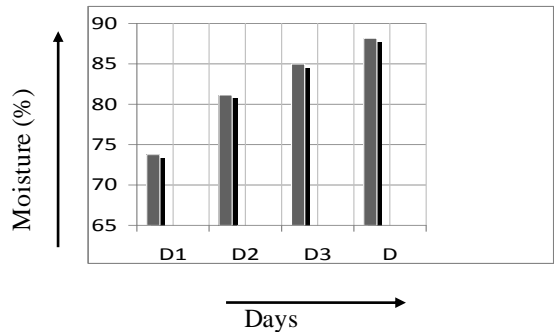


Figure 4: Average Moisture (%) in first three days colostrum and milk

**Ash contents of colostrum and milk**

Figure 5 shows a continuous decrease of ash contents of colostrum with the passage of time up to three days. The ash percentage decreases from 1.05% w/v to 0.87% w/v. Third day's colostrum ash content becomes equal to ash contents of milk. The goat's colostrum and milk as a rich source of minerals such as sodium, calcium, magnesium and phosphorus along with lactose is very important for normal osmotic balance of newborn<sup>14</sup>. The decrease in the ash contents is probably due to the low level of lactose in colostrum, because lactose and ash contents maintain the osmolarity of the milk and colostrum. Therefore ash contents in the first day colostrum were high and lactose contents were low, as the lactose percentage in the proceeding days increased then a gradual decrease was observed in the ash contents.

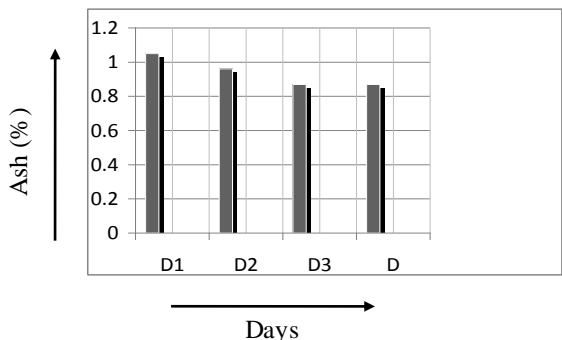


Figure 5: Average Ash (%) in first three days colostrum and milk

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