

Study of Colostrum Composition in Lactating Women with Anemia

Meraj Sultana¹, Vineetha KR¹ Sushma BJ²

¹Assistant Professor, Dept. of Biochemistry, PES Institute of Medical Sciences and Research, Kuppam, AP

²Professor, Dept. of Biochemistry, Peoples College of Medical Sciences & Research Centre, Bhopal, MP

How to cite this article: Meraj Sultana, Vineetha KR, Sushma BJ. Study of Colostrum Composition in Lactating Women with Anemia. Indian Journal of Public Health Research and Development 2023;14(1).

Abstract

Background: Colostrum is a pre-milk substance, thick lemon yellow coloured viscous mammary secretion, that is produced immediately after birth, during the first 1-5 days of the lactation. Pregnancy induced Anaemia (PIA) is the most common complication of pregnancy in the India. PIA is defined as blood hemoglobin level of less than 11 gm % (WHO). In India, ICMR defines anaemia as hemoglobin less than 10 gm %. It is commonly due to maternal malnutrition resulting in deficiencies of iron, anti anemic factors, folic acid and vitamin B12. Maternal nutritional status has been found to influence the composition of milk, leading to conditions which alters the total proteins, calcium and IgA concentration of the colostrum.

Aim and Objectives: The aim of this study is to compare the composition of following biochemical parameters (total proteins, triglycerides, immunoglobulin A, lactose and calcium) in colostrum of normal pregnancy and pregnancy with anaemia patients, in primigravida, to find out whether there are any significant changes.

Materials and Methods: We included a total of 60 lactating women from the postnatal wards of Owaisi hospital /princess Esra hospital, Hyderabad after obtaining their consent. Out of which 30 were Controls (Group A) and 30 lactating anemic women (Group B). Approximately 5ml of colostrum was collected from a single breast within 24 hours of delivery from each subject into sterile storage vials and stored at -20°C and were analyzed within two weeks. The following parameters were analyzed in each sample of colostrum, total proteins, triglycerides, Ig A, lactose and calcium.

Statistical Analysis: The data was analysed using SPSS software version 17.0 descriptive results are expressed as mean and SD of various parameters in both the groups. p value less than 0.05 was considered as significant and value above 0.05 was considered as non-significant.

Discussion & Conclusion: Colostrum is a dynamic, multi-faceted fluid containing nutrients and bioactive factors needed for infant health and development. Nevertheless, knowledge of human milk composition is increasing, leading to greater understanding of the role of human milk in infant health and development, which can be extremely beneficial for preventive and protective aspects of paediatrics and neonatology. Human milk also contains many hundreds to thousands of distinct bioactive molecules that protect against infection and inflammation and

Corresponding Author: Vineetha KR, Assistant Professor, Dept. of Biochemistry, PES Institute of Medical Sciences and Research, Kuppam, AP.

E-mail: vineetharajappan@gmail.com

contribute to immune maturation, organ development, and healthy microbial colonization. Therefore, neonates who are effected and deprived of essential components of colostrum due to anaemia during pregnancy should be provided with the necessary supplements and protection from infections.

Key-words: colostrum, total proteins, triglycerides, calcium, immunoglobulin A, lactose, lactating women.

Introduction

Colostrum is a pre-milk substance, thick lemon yellow coloured viscous mammary secretion, that is produced immediately after birth, during the first 1-5 days of the lactation.

The important functions of breast milk are nutritional immunological, behavioural and economic. It provides all the essential components of nutrition required by the neonate like high quality of proteins, fats, carbohydrates (lactose), minerals, electrolytes, vitamins and many anti-infective agents such as immunoglobulins which protect the newborn from infections. so, presence of higher quantities of immunoglobulins in colostrum when compared to mature milk is beneficial for the newborn.¹⁻³

The biochemical composition of human milk makes it the best infant food during the first 6 months of life and with supplementation for months thereafter. About 150-300ml of colostrum is secreted by the lactating mother in 24hrs during the first 1-5 days of postpartum period.⁴⁻⁶

Colostrum (1-5 days) provides 58 Kcal/100 ml of energy, Transitional milk (6-14 days of postpartum) provides 74 Kcal /100 ml of energy, whereas Mature milk, which is considered to be after 14 days of postpartum, provides about 71 Kcal/ 100 mL, of energy.⁷⁻⁹

A dynamic, bioactive fluid, human milk changes in composition from colostrum to late lactation, and varies within feeds, diurnally, and between mothers. Human milk provides the normative standard for infant nutrition. Nevertheless, many micronutrients vary in human milk depending on maternal diet and body stores (see article in this issue by Valentine and Wagner, 2012), including vitamins A, B1, B2, B6, B12, D, and iodine.¹⁰

Human milk composition is dynamic, and varies within a feeding, diurnally, over lactation, and between mothers and populations. Influences

on compositional differences of human milk include maternal and environmental factors and the expression and management of milk. Certain maternal conditions like eclampsia, diabetes and anemia can affect the composition of colostrum. Pregnancy induced Anaemia (PIA) is the most common complication of pregnancy in the India. PIA is defined as blood hemoglobin level of less than 11 gm % (WHO). In India, ICMR defines anaemia as hemoglobin less than 10 gm %. it is commonly due to maternal malnutrition resulting in deficiencies of iron, anti anemic factors, folic acid and vitamin B12. Maternal nutritional status has been found to influence the composition of milk, leading to conditions which alters the total proteins, calcium and IgA concentration of the colostrum.

Aim & Objectives

The aim of this study is to compare the composition of following biochemical parameters (total proteins, triglycerides, immunoglobulin A, lactose and calcium) in colostrum of normal pregnancy and pregnancy with anaemia patients, in primigravida, to find out whether there is any significant changes.

Materials & Methods

Sample Size: We included a total of 60 lactating women from the postnatal wards of owaisi hospital /princess esra hospital, Hyderabad after obtaining their consent. Out of which 30 were Controls (Group A) and 30 lactating anemic women (Group B).

Sampling Procedure: Approximately 5ml of colostrum was collected from a single breast within 24 hours of delivery from each subject into sterile storage vials and stored at -20°C and were analyzed within two weeks. The following parameters were analyzed in each sample of colostrums, total proteins, triglycerides, Ig A, lactose and calcium.

Inclusion Criteria: lactating women with and without anemia were included.

Exclusion Criteria: GDM, PIH and Other pregnancy related complications (medical or gynaecological)

Informed Consent: Patients fulfilling the selection criteria were informed about the purpose and nature of the study and were enrolled after obtaining a written informed consent.

Biochemical Analysis: Total proteins, triglycerides, Ig A, lactose and calcium were estimated in the stored sample. Total proteins were estimated by Biuret method, Triglycerides by GPO-PAP method, Immunoglobulin A by immunoturbidimetric method, lactose by benedict's quantitative method and calcium by Arsenazo III method.

Definition of case: The diagnosis of anaemia during pregnancy was confirmed by clinicians of the department of obstetrics and gynaecology, OHRC/PEH, Hyderabad. The criteria for diagnosing anaemia during pregnancy was a hemoglobin level less than 10 g/dL.

Statistical Analysis: The data was analysed using SPSS software version 17.0 descriptive results are expressed as mean and SD of various parameters in both the groups. Independent 't' was used to calculate significance (p value) in between the groups. p value less than 0.05 was considered as significant and value above 0.05 was considered as non-significant.

Results

We included a total of 60 lactating women based on inclusion and exclusion criteria.

Table 1: Shows various parameters in study subjects during antenatal period

Parameter	Group A	Group B
SBP	120±6.5	115±5.7
DBP	79±3.1	78±3.6
Oedema	Absent	Absent
Proteinuria	Nil	Nil
Hb	10.8±0.7	7.74±0.5
FBS (mg/dL)	94±9.8	92.4±11.5
PPBS (mg/dL)	130.8±7.6	122±5.8

In the present study, the Normotensive control with mean systolic blood pressure is 120±6.5 mm. of Hg and mean diastolic blood pressure is 79±3.1 mm

of Hg with no signs of oedema and proteinuria. The mean hemoglobin concentration is 10.8±0.7 g/dl. The mean blood glucose level FBS is 94±9.5 mg/dl and PLBS is 130.7±7.6 mg/dl in control group.

In group B (Anaemic) the mean hemoglobin concentration is 7.74±0.5 g/dl. So, they have low hemoglobin concentration. Their mean systolic blood pressure is 115±5.7mm of Hg, and mean diastolic blood pressure is 78±3.6 mm of Hg and mean blood glucose level FBS is 92±14.6 mg/dl and PLBS is 122±44.2 mg /dl, with normal OGTT finding. Hence are considered as non-hypertensive and non-diabetic, representing Anaemic cases.

Table 2: Shows comparison of biochemical parameters in study subjects during antenatal period

Parameter	Group A	Group B
Total protein	6.05±0.578	4.31±0.642
Triglycerides	940±159.98	980±286.04
IgA	2.1±0.602	1.3±0.256
Lactose	4.5±0.836	4.5±0.181
Calcium	27±2.90	21.5±3.27

From the table 2 it is evident that the,

1. The mean values of total proteins are significantly lowered in Anaemia compared to control group (p<0.005).
2. Mean value of triglycerides is slightly increased in anaemia group when compared to control groups and is statistically significant (p<0.005).
3. Mean value of IgA is significantly decreased in Anaemia group when compared with control group.
4. There is no change in Mean value of lactose in Anaemia group and control group.
5. Mean value of calcium is significantly decreased in Anaemia group control groups (p<0.005).

Discussion

Colostrum plays a dual role by providing all components required for normal metabolism and also provides important nutritional, protective and immunological factors required to protect the newborn.

The present study was done on concentration of total protein triglycerides, IgA, Lactose, calcium in colostrum of 2 groups of women.

In group A: These patients were normotensive with no oedema and no proteinuria and non-diabetic and non anemic. In this group mean total protein concentration were found to be in the range of 6.05 ± 0.578 , mean triglycerides concentration were found to be 940 ± 159.98 mean Ig A concentration was 2.1 ± 0.602 , mean lactose concentration 4.5 ± 0.836 , mean calcium concentration 27 ± 2.90 thus suggesting to be in normal range. The results of this investigation showed values of lactose similar to those reported in earlier studies.

Group B: subjects were found to be anemic according to the criteria's mentioned above, Anaemia is the commonest complication during pregnancy in Indian women.' It is an important clinical manifestation of malnutrition and is associated with low socioeconomic status. In these lactating women, total protein concentration (4.31 ± 0.642), mean IgA concentration (1.3 ± 0.256), and mean calcium concentration (21.5 ± 3.27) was found to be significantly lowered and was statistically significant ($p < 0.005$). Mean triglycerides concentration was slightly increased (980 ± 286.04) which is not statistically significant. The proteins present in milk are casein, lactalbumin and lactoglobulin. These are synthesized in mammary gland from amino acids derived from blood. Proteins present in colostrum provide amino acids for growth as well as aid in digestion, host defence and tissue maturation. The Triglycerides constitute the major part of the lipids present in colostrum.¹¹⁻¹³ Lipids are important for development of brain in neonates and have protective functions. IgA is the predominant immunoglobulin of colostrum that provides immunity against many infections which the newborn is susceptible to. Lactose is an important source of energy to the newborn. It is synthesized in the mammary gland from glucose and glycogen. Calcium in milk is partitioned between free calcium and calcium bound to citrate, casein and phosphate. It has been reported that the free calcium concentrations are relatively constant in lactogenesis. The decrease in protein contents may also be due to a corresponding decrease in Ig A contents,

indicating that malnourished status has a bearing on Ig A synthesis in the mammary gland. Therefore, it seems likely that anaemia being an important clinical manifestation of malnutrition, significantly influences the Ig A synthesis.¹⁴⁻¹⁵

In earlier studies Platt (1961)⁹⁸ and more recently Yoneyama (1994)¹²⁰ also found lower milk protein in malnourished women. In addition to the above complications if the colostrum is also deficient in nutritive and protective factors it further increases the morbidity and mortality in the perinatal period. Therefore, neonates who are effected and deprived of essential components of colostrum due to anaemia during pregnancy should be provided with the necessary supplements and protection from infections.

Conclusion

Human milk is uniquely suited to the human infant, both in its nutritional composition and in the non-nutritive bioactive factors that promote survival and healthy development. Human milk remains the unique and potent standard for feeding infants. Colostrum is a dynamic, multi-faceted fluid containing nutrients and bioactive factors needed for infant health and development. Nevertheless, knowledge of human milk composition is increasing, leading to greater understanding of the role of human milk in infant health and development, which can be extremely beneficial for preventive and protective aspects of paediatrics and neonatology.

Human milk also contains many hundreds to thousands of distinct bioactive molecules that protect against infection and inflammation and contribute to immune maturation, organ development, and healthy microbial colonization. Therefore, neonates who are effected and deprived of essential components of colostrum due to anaemia during pregnancy should be provided with the necessary supplements and protection from infections.

Conflict of Interest: Nil

Ethical Committee Clearance: Taken from Institute

Source of funding: Self

References

1. Acker DB, Sachs BP, Friedman EA. Risk factors for shoulder dystocia. *Obstet Gynecol.* 1985;66:762-768.
2. Ahmed L, Nazrul Islam SK, Khan MNI, Hugue s, Ahsan M. Antioxidant micronutrient profile of Vitamin E,C,A, copper, zinc, iron) of colostrum : association with mother characteristics. *J Trop Pediatr* 2004; 50: 357-358.
3. Ahmed L, Nazrul Islam SK, Khan NI, Nahid SN. Vitamin C content in human milk (colostrum, transitional and mature) and serum of a sample of Bangladeshi mothers. *Mal J Nutr* 2004; 10 : 1-4. 581)
4. A.Kausik et al: Unusual changes in colostrum composition in lactating Indian women having medical complications during pregnancy. *Indian journal of clinical biochemistry*, 2002, 17(2) 68-73.
5. Allen L H.B n vitamins in breast milk: relative importance of maternal status and intake, and effects on infant status and function. *Adv Nutr.* 2012;3(3):362-369.
6. Allen S. Cunningham, Cooperstown, N.Y.: Morbidity in breast fed and artificially fed infants II. *The Journal of Pediatrics*, November 1979, Vol.95, No.5, part I , pp685-689.
7. Andersson Y, Lindquist S, Lagerqvist C, Hernell O. Lactoferrin is responsible for the fungistatic effect of human milk. *Early Hum Dev.* 2000; 59: 95-105.
8. Aperia, A., Broberger, O., Herin, P. & Zetterstroem, R. (1979) Salt content in human breast milk during the first three weeks after delivery. *Acta Paediatr. Scand.* 68:441-442.
9. Ashida K, Sasaki H, Suzuki YA, Lönnerdal B. Cellular internalization of lactoferrin in intestinal epithelial cells. *Biometals.* 2004; 17: 311-315.
10. Beckmann CRB, Ling FW, Smith RP, et al., editors. *Obstetrics and Gynecology.* 5th ed. Philadelphia, PA: Lippincott Williams & Wilkins; 2005.
11. Bitman, J., Hamosh, P., Lutes, V., Neville, M.C., Seacat, J. and Wood, D.L (1989) Milk composition and volume during the onset of lactation in a diabetic mother. *Am. J. Clin. Nutr.* 50, 1364-1369.
12. Chemistry. Vol.32, No.1, 1986. J.K. Welsh et al: Anti-infective properties of breast milk. *The Journal of Paediatrics*, January 1979, Vol.94 No.1 , pp1-9
13. Chen Q, Bläckberg L, Nilsson A, Stenby B, Hernell O. Digestion of triacylglycerols containing long-chain polyenoic fatty-acids in vitro by colipase- dependent lipase, and bile-salt stimulated lipase. *Biochim. Biophys. Acta.* 1994; 1210: 239- 243.
14. Cousins L, Baxi L, Chez R, Coustan D, Gabbe S, Harris J, Landon M, Sacks D, Singh S: Screening recommendations for gestational diabetes mellitus. *Am J Obstet Gynecol* 165:493 -496, 1991
15. Cunningham, F.G., MacDonald, P.C., Gant, N.F., Leneno, K.J. and Gilstrap, L.C. (1993). *Endocrine Disorders.* In: William's Obstetrics 19th edn. Prentice-Hall International Inc. p. 1201-1227.