

# The study of biochemical composition of breast milk in malnourished mothers versus well-nourished mothers

Sharmila M Mane<sup>1</sup>, Neelam J Patil<sup>2\*</sup>, Alka V Nerurkar<sup>3</sup>, Sachin Patharkar<sup>4</sup>

<sup>1</sup>Sr. Scientific Officer, <sup>2,4</sup>Associate Professor, <sup>3</sup>Professor and HOD, Department of Biochemistry, Topiwala National Medical College and B.Y.L. Nair Ch. Hospital, Mumbai, Maharashtra, INDIA.

Email: [neelamb99@gmail.com](mailto:neelamb99@gmail.com)

## Abstract

**Background:** Malnutrition and undernutrition among mothers in developing countries is a major problem and is closely associated with impaired, maternal, foetal and infant health. The usual diet of women in India is found to be nutritionally inadequate. The state of physiological stress during pregnancy may aggravate chronic dietary inadequacy, and thus adversely influence the course and outcome of pregnancy, foetal growth and composition of lactation. Hence this study was taken up to find out if maternal nutritional status influences the important biochemical constituents in colostrum of mother. **Methods:** 100 mothers were enrolled in the study after obtaining prior informed consent. They were divided into 2 groups - Group I had 50 malnourished mothers and group II had 50 well-nourished mothers. The pre-fed milk sample which was collected was stored at - 20°C until it was processed. It was thawed and analysed for total lipids, lactose and proteins. **Results:** The colostrum content for well-nourished mothers was significantly higher for lipid, protein, and lactose content as compared to malnourished mothers. **Conclusions:** The parameters of weight, height weight/height ratio and hemoglobin varied significantly between the well-nourished and malnourished mothers. Total protein levels in colostrum of malnourished mothers are significantly lower than those in well-nourished mother. Total lipid levels in milk of malnourished mothers are significantly lower than those in well-nourished mothers. Total lactose levels in colostrum of malnourished mothers are significantly lower than those in well-nourished mothers. Hence this study suggest that the nutritional status of women influences the composition of breast milk and as well as the growth and development of her neonate.

**Key Words:** Colostrum, well-nourished, malnourished.

## \*Address for Correspondence:

Dr. Neelam J. Patil, Associate Professor, Department of Biochemistry, Topiwala National Medical College and B.Y.L. Nair Ch. Hospital, Mumbai, Maharashtra, INDIA.

Email: [neelamb99@gmail.com](mailto:neelamb99@gmail.com)

Received Date: 16/01/2018 Revised Date: 11/02/2018 Accepted Date: 03/03/2018

DOI: <https://doi.org/10.26611/202731>

Access this article online	
Quick Response Code:	Website: <a href="http://www.statperson.com">www.statperson.com</a>
	Volume 8 Issue 2

## INTRODUCTION

Human milk is the first food a baby receives after birth in the majority of children in our country. Breast milk is by nature, extraordinarily well adapted to the needs of the infant and its superiority in feeding infants has been

undisputed over the years. That is why (WHO/UNICEF) recommends universal exclusive breast feeding in first 4-6 month of life especially in the developing countries. The question of composition and volume of breast milk produced by mother on different planes of nutrition at different phases of lactation is a major issue in paediatric public health in the world, especially in resource poor countries. Fundamentally, ultimate concerns are the nutritional adequacy of such milk for babies in relation to calories, proteins, vitamins and minerals.<sup>1,5</sup> Several workers in different parts of the world have extensively studied the chemical composition of breast milk. The variability of the composition of human milk is well known.<sup>17</sup> Not only does the concentration of many nutrients change as lactation progresses but milk composition also varies between women, between the beginning and end of a feed and between reflex drip milk

and expressed milk.<sup>[4]</sup>Chronic, severe undernutrition has been associated with reduced breast milk volume and lower concentration of several nutrients in milk including fats and protein. It is assumed the breast milk yield is affected by a complex of interrelated factors such as maternal dietary intake, nutritional status during pregnancy and lactation, feeding frequency and the fact whether the infant is given additional foods or not. Lactation performance appears to be preserved over a wide range of maternal status. The gross composition of human milk is remarkably constant among women of varying nutritional status. The amount of milk produced by nutritionally depleted women is a matter of controversy and consequences of long term outcome with regard to baby. However only a few studies conducted have correlated to maternal status with milk composition. In case of insufficient calorie intake by the malnourished mothers is reflected in unsatisfactory weight gain in the corresponding children during the first month of life and also showed unsatisfactory growth curves as these infants received significantly less supplements in the form low calories and protein intake through the mother's milk.<sup>7,8</sup> This will also enable us to ascertain whether a child exclusively breastfed by a malnourished mother is more prone to specific nutritional deficiencies or to infections. In such cases she may then have to seek other options, such as elevating maternal nutritional status or providing supplements to the infants. There is a paucity of data on the effect of nutrition on the composition of milk and its effect on the infant. Hence a comparison made between the levels of protein, lipid and lactose in milk of malnourished and well-nourished mothers in order to determine the effect of maternal nutrition on the quality of milk and its effect on the growth and physical development of the new-born. Biologically human milk is a highly complex and unique secretion with many marked differences from the milk of other species, including cow, buffalo, goat, reindeer, yak, camel and horse. The composition and output of human milk varies with many factors, including the stage of lactation, maternal nutrition and individual variations. There are three stages of milk viz, colostrum, transitional and mature milk. The present study was undertaken to compare the quality of milk produced by the well and malnourished mothers in terms of bio-chemical composition that are necessary for the general well-being and development of the infant.

## MATERIALS AND METHODS

The study was conducted at the Human Milk Bank and Research Centre, Department of Neonatology in a Tertiary Care Hospital. 100 mothers were enrolled in the study after obtaining prior informed consent. The study

protocol was approved by the Institutional Ethical Committee. They were divided into 2 groups.

**Group I:** had 50 malnourished mothers.

**Group II:** had 50 well-nourished mothers.

Mothers were considered well or malnourished depending on the following criteria:

- Criteria for malnourished mothers was, W/H ratio less than 0.3 in (group I)
- Criteria for well-nourished mothers was, W/H ratio more than 0.3 in (group II).

### Inclusion Criteria

- Mothers who have undergone full term normal vaginal delivery of normal neonate
- Mothers with well babies on breast-fed.
- No major detectable medical or obstetric illness diagnosed in the mother (other than malnutrition).

### Exclusion Criteria

- Operative/ Instrumental delivery.
- Medical/ Obstetric disease in mother.
- Mother on medication.

Detailed maternal and neonatal history was recorded on a printed proforma, following information were noted.

Maternal- Age, parity, haemoglobin %, weight, height, W/H ratio and nutritional status.

- The weight of the mothers was recorded by weighing scale. (Libra)
- The height of the mothers was recorded by the height chart.
- Haemoglobin concentration was determined by Sahli's method.

### Method of milk collection

Colostrum was collected on third day after the delivery between 10.0 to 11.0 a.m. The mothers were made to manually express the colostrum into sterile glass test tubes for biochemical estimation. Anthropometry of the baby was recorded before the milk collection. The pre-fed milk sample which was collected was stored at - 20°C until it was processed. It was thawed and analysed as follows. Milk obtained was then used for analysis of following parameters:

- Estimation of total lipids from milk by the method of Frings, Fendley, *et al* (1972)<sup>35</sup>
- Estimation of lactose from milk by Folin –Wu Method 1920<sup>11</sup>
- Estimation of proteins by the method of Lowry and Daughaday 1952<sup>34</sup>

Statistical analysis: In this study each parameters of both the group mean and standard deviation were calculated by using SPSS software package. To compare the significance difference between two groups “student unpaired t test” was used.

## OBSERVATIONS AND RESULTS

Mothers delivering at Tertiary Care Hospital were selected as per inclusion criteria and were classified into two groups of 50 each: Group (I) malnourished mothers, and Group (II) well-nourished mothers.

### Maternal Demographic Profile

**Table 1:**

Parameter	Well-nourished (n=50)	Malnourished (n=50)
Age of mothers (years)	@22.8±2.99	22.72±3.43
Weight of mothers (weight)	<b>*50.4±5.91</b>	41.5±3.17
Height of mothers (cm)	<b>*152.34±5.54</b>	149.94±4.17
Weight/height ratio (kg/cm)	<b>*0.33±0.032</b>	0.27±0.018
Haemoglobin (g%)	<b>*10.37±1.03</b>	9.64±0.75

\*p<0.05 significant and p > 0.05 not significant

The two groups were matched in age. The parameters of weight, height, weight/ height ratio and haemoglobin varied significantly between the well-nourished and malnourished mothers while the change was not significant with respect to the age.

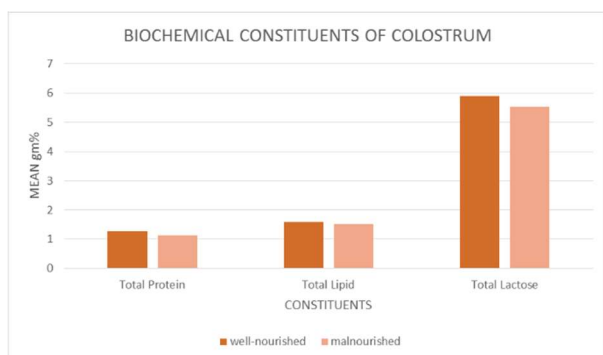
### Comparison of Biochemical Constituents of Colostrum between well and mal nourished mothers

**Table 2:**

Parameter	Well-nourished(n=50)	Malnourished(n=50)
Total protein (g%)	*1.26±0.09	1.14±0.16
Total lipid (g%)	*1.60±0.24	1.519±0.24
Total lactose (g%)	*5.88±0.36	5.52±0.36

\*p < 0.05 significant

Total protein, lipid and lactose levels in colostrum of malnourished mothers are significantly lower than those in well-nourished mothers.



**Figure 1:**

## DISCUSSION

The question of composition and volume of breast milk produced by mothers on different planes of lactation is a major issue in paediatric public health in the world, especially in resource poor countries. Fundamentally, ultimate concerns are the nutritional adequacy of such

milk for young infants in relation to calories, proteins, vitamins and minerals. Pregnant women and nursing mothers constitute a vulnerable group because of their special needs. Maternal nutritional status is also known to influence the condition of the offspring<sup>9,10,14</sup>. In view of these considerations, the nutritional problems of pregnancy and lactation assume importance. This perspective study over a period of one year was conducted at postnatal ward and outpatient neonatal centre. It included 50 well-nourished and an equal number of malnourished women. The milk composition of these two groups was compared for total lipid, proteins and lactose.

**Demographic Profile:** Table I reveals the demographic profile of the mothers in the two groups for age, weight, height, weight/height ratio and haemoglobin concentration. The (average) age of mothers in the two groups was similar. However there was statistically significant difference between the weight, height, weight/height ratio and haemoglobin concentration between the well-nourished and malnourished mothers. The weight (kg)/height (cm) ratio in study group was 0.27 ± 0.018 in malnourished and 0.03 ± 0.032 in well-nourished respectively. The criterion for maternal malnutrition in this study was weight/height ratio less than 0.3. The mean weight of the mothers in the malnourished group was 4.15 ± 3.17(kg) and the mean of the mothers in well-nourished group was 50.44 ± 5.9 (Table1). The mean height of the mothers in malnourished group was 149.94 ± 4.17(cms) and the mean height of the mothers in well-nourished group was 152.34 ± 5.54 (cms) (Table1) It has been proposed that quantity and quality of breast milk and adversely affected by maternal under nutrition and the growth pattern of infants of these mothers is not satisfactory<sup>18,20</sup>

It has been also indicated that maternal nutrition during pregnancy and lactation has little direct impact on birth weight and the infant growth. The haemoglobin levels in malnourished women were 9.64 ± 0.75gm% while those in the well-nourished women were 10.37 ± 1.03gm%. This difference was found to be statistically significant. However, these levels are below the normal value (11gm%) stated for the pregnant women. Table II shows the colostrum composition for proteins, lipids and lactose. The colostrum content for well-nourished mothers was significantly higher for lipid, protein, and lactose content.

## CONCLUSION

The milk composition of well and malnourished mothers varied significantly for protein, lipids and lactose content in malnourished women. The significant difference in milk composition in both the groups of mother's confirms that maternal nutritional intake has significant effect on

breast milk composition and in turn growth of babies. Contradictory to above undertaken study most of the data available suggest that food supplementation to undernourished women does not have a significant impact either on quantity or micro nutrient composition of breast milk<sup>19,20,31</sup>. Therefore it seems that the already parentally disadvantaged low birth weight infants remained so during lactation and early infancy. Insufficient nutrient intake of the mother may be only one causative factor in the intricate which burdens the woman with undivided house hold duties and child care, added by the strain of poverty and often the husband's antisocial behavior, such as alcoholism may affect the breast feeding capacity.

## REFERENCES

1. Chi-Ren Tsai B, Jiin-Tsae Liang E, Teh-Ming Wang B et al. Changes in Preterm Breast Milk Nutrient Content in the First Month Pediatrics and Neonatology (2014)55, 449 e 454.
2. Jacqueline Bauer A, Joachim Gerss. Longitudinal analysis of macronutrients and minerals in human milk produced by mothers of preterm infants Clinical Nutrition 30 (2011) 215-220.
3. Roseli Souza Santos Da Costa et al. Trace Elements Content of Colostrum Milk in Brazil Journal of Food Composition and Analysis (2002) 15, 27-33.
4. Dror Mandel et al. Fat and Energy Contents of Expressed Human Breast Milk in Prolonged Lactation Pediatrics Vol.116 no.3 Sep 2005.
5. Olivia Ballard, J Da, Ardythe L. Morrow. Human Milk Composition: Nutrients and Bioactive Factors Pediatr.Clin. N Am 60 (2013) 49-74.
6. Cesar G Victoria et al. Breast feeding and growth in Brazilian infants Am. J. Clin. Nutr. (1998) 67; 452-458.
7. C. Manjrekar, M.P.Vihalakshi, J.A.Begum, G.N.Padma Breast feeding ability of undernourished mothers and physical development of their infants during 0-1 year IndPaed. (1985) Nov; 22 801-809.
8. Cheirici R, Saccomandi D, Vigi V. Dietary supplements for the lactating mothers: Influence on the trace element content of milk ActaPaediatrSuppl (1999) Aug;88(430):7-13.
9. D.V. Mavalankar et al. Maternal weight, height and risk of poor pregnancy outcome in Ahmedabad, India Indian Pediatrics (1994)31:1205-1212.
10. Emmett PM, Rogers IS. Properties of human milk and their relationship with maternal nutrition Early Hum Dev.(1997) Oct 29;49 Suppl;S7-28.
11. Folin & Wu H. Estimation of lactose from milk J of Biol Chem. (1920) 41:367-369.
12. Forsum et al. Effect of protein intake on protein and nitrogen composition of breast milk Am. J. Clin. Nutr.(1980) 33:1809-1813.
13. GerdHarzer et al. Changing patterns of human milk lipids in the course of the lactation and during the day Am. J. Clin. Nutr. (1983) 37; 612-621.
14. Herra M.G., J.O. Mova et al Maternal weight/ height and the effect of food supplementation during pregnancy and lactation pp-252-263 in H Albi and R. whitehead eds : Maternal nutrition during pregnancy & lactation Hans. Huber publishers, Bern (1980).
15. Jafer Ali et al Changes in human milk Vitamin E and total lipids during the first twelve days of lactation Am. J. Clin. Nutr. (1986) 43; 925-930.
16. Karmarkar M.G. & Ramakrishnan C.V. Studies on human lactation: Relation between the dietary intake of lactating women and the chemical composition of milk with regard to the principle and certain inorganic constituents Acta.Paed.Scand (1969) 49: 599-604.Karmarkar et al.
17. Studies on human lactation Ind. J. of. Med. Res.(1959) 47.
18. Lindblad BS Rahimtoola A. A pilot study of the quality of human milk in a lower socioeconomic group in Karachi, Pakistan Acta.Paediat.Scand. (1974)63:125-8.
19. Lonnerdal B. Biochemistry and physiology function of human milk proteins Am. J. Clin. Nutr. (1985) 42:1299
20. Lonnerdal B. Effect of maternal dietary intake on human milk composition J. Nutr. (1986) 116:499.
21. Miranda et al. Effect of maternal malnutritional status on immunological substances in human colostrum and milk Am. J. Clin. Nutr. (1983) 37; 632-640.
22. Nancy F. Butte et al. Human milk intake and growth in exclusively breast-fed infants J. Paediatrics (1984) 104:187-195
23. Nancy F. Butte et al. Effect of maternal diet and body composition on lactational performance Am. J. Clin. Nutr. (1984) 39; 296-306.
24. N.D. DattaBanik et al. The influence of maternal factor on birth-weight of the new born Indian. J. Paediat. (1969) 36:278-283.
25. N.D. Patil, M.S. Phadke. Proximate principle and energy content of human milk in well-nourished urban mother Indian Paediatrics (1986) 26: 1211-1213.
26. N. Thilothammal, R. Sujaritha, K.G. Kamala et al. Maternal nutritional status and neonatal head circumference Indian Paediatrics(1993) 30:1130-1133.
27. Picciano M.F. The composition of human milk in malnutrition: Determinants and consequences (White, P.L & Selvey, N., eds.) (1984) pp. 111-122.
28. Reinhardt MC, Lauber E. Maternal diet breast-feeding and infant growth J. Trop. Pediatr. (1981) 27: 229-236.
29. Roberto Frisancho, Jorge Matos, Pam Flegel. Maternal nutritional status and adolescent pregnancy outcome Am. J. Clin. Nutr.(1983)38:739-746.
30. Ruth. A. Lawrence. Biochemistry of human milk Breast feeding (third Edition) (1989) 73-117.
31. S. Gopalan, R.K. Puri. Breast feeding and infant growth. Indian Paediatrics(1992) 29; 1079-1085.
32. Saleha Qureshi et al. Effect of maternal nutrition supplementation on the birth-weight of the newborn Indian Paediatrics (1973) 9; 541-544.
33. Sushma Malik et al.Maternal biosocial factor affecting low birth weight Indian Paediatrics(1997)64:373-377.
34. Lowry O.H. and Daughaday W.H. J.LabClin Med.(1952) 39:663
35. Frings C.S., Fendly J.W.,Dunn R.T. and queen C.A. Clin.Chem(1972)18:673.

Source of Support: None Declared  
Conflict of Interest: None Declared