

Evaluation of Breast Milk in Lactating Pregnant and Non-Pregnant Mothers. Is it a Crime for the Pregnant Woman to Breastfeed her Infant?

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Abstract: The aim of this study was to compare milk composition in lactating pregnant and lactating non-pregnant mothers in order to know to what extent pregnancy could affect milk composition, and how this could be reflected on both child development and health. The study included 64 lactating females attending the Outpatient Obstetrics and Gynecology Clinic of El-Sahel Teaching Hospital during the period from March 2006 to February 2009. The cases were classified into three groups: **Group I** included 23 lactating and amenorrhoeic females, **Group II** included another 23 lactating and menstruating females and **Group III** included 18 lactating pregnant women with a gestational age that ranged from 8-16 weeks. The milk samples obtained from the patients were analyzed for their total protein, lipid and lactose contents. The quantity of milk lactose and lipids were significantly lower in pregnant lactating mothers than non-pregnant lactating women. These two nutrients are essential for the physical development of the newly born in general and for the development of its nervous system in particular. In conclusion, it is our responsibility to strongly advice against pregnancy during lactation, so that the newly born receives the best nutritional support to ensure its full physical and neurological development.

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1. Introduction

Human breast milk is uniquely suited to our biologic needs and remains the best source of nutrition for the human infant (Kunz *et al*, 1999). It provides the necessary support for the developing immune system (Goldman *et al.*, 1994 ; Garofalo and Goldman, 1999). The powerful anti-infective qualities of breast milk are measured by decreased infant mortality in developing countries where exclusive breastfeeding is the norm (Scariati *et al*, 1997 ; Ball and Wright, 1999).

The human breast milk is composed of about 6% carbohydrates, about 4% fats, about 1% proteins and about 89% water. The composition of human milk is very different than artificial milk or "formula". Most artificial breast milk products use bovine milk as a substrate. The latter has more proteins and less lactose when compared to human milk (Kunz, *et al*, 1999). Lactose levels correlate well with brain size across species. Given their large brain size, it is not surprising that humans have a higher concentration of lactose in their milk than any other species (Newton, 2004).

From the Islamic religion point of view, although it is recommended to prolong adequate lactation for up to two years, Prophet Mohamed pointed that the milk of the pregnant women is harmful for the infants and strongly advised that pregnant mothers should never breastfeed their infants.

The aim of this study was to compare milk composition in lactating pregnant and lactating non-

pregnant mothers in order to know to what extent could pregnancy affect milk composition, and how this could be reflected on both child development and health.

2. Subjects and Methods

I- Subjects

This study was carried out on 64 urban healthy lactating females attending the Outpatient Obstetric and Gynecology Clinic of El-Sahel Teaching Hospital, Cairo, Egypt during the period from March 2006 to February 2009. All the subjects were in the third to tenth month of their lactation and all the infants were full term. The cases were classified into three groups: **Group I** included 23 lactating and amenorrhoeic females, **Group II** included another 23 lactating and menstruating females and **Group III** included 18 lactating pregnant women with gestational age ranged from 8-16 weeks. Exclusion criteria were age less than 19 years or more than 30 years, body mass index less than 19 or more than 27, smokers, low socioeconomic class, undernourished women, women under diet control, and women with medical disorders.

The study protocol was approved by the hospital ethics committee and informed consent was obtained from the lactating women.

A full history and full general, abdominal and pelvic examinations were done for all cases. Pregnancy was diagnosed by history, and by general and local examinations, and was confirmed by routine

pregnancy test and ultrasonography. Lactating mothers were questioned about the social and economic statuses to exclude patients with low socioeconomic class. The patients were asked to fill a quantitative questionnaire about the main constituents of the diet consumed in the three days before obtaining the milk sample.

Milk samples were obtained in the mid-morning before lunch. About 15-20 ml of human milk were obtained in a sterile glass bottle and stored frozen at -20 C till analyzed later. The samples were analyzed for their total protein, lipid and lactose contents.

II- Methods

The lactose in milk was estimated using the method of Folin and Wu (1920). The protein free milk filtrate was heated with alkaline copper solution using a special tube to prevent reoxidation of the cuprous oxide formed. The latter was treated with phosphomolybdic acid solution, and the blue colour obtained was compared with that of a standard.

The method of estimation of total lipids in milk was written in detail in the Association of Official Agricultural Chemists, Washington (1960). This method involves the breaking of the emulsion of milk lipids by means of concentrated sulfuric acid (Sp. Gr. 1.82) and amyl alcohol, centrifugation of the solution in the special Gerber's tube, and the subsequent reading of lipids percentage in the graduated neck of the tube.

The dye binding method of Ashworth *et al.* (1960), was used in estimation of the total proteins in milk. In this method, Orange G dye binds to milk protein forming a colour complex that could be measured colourimetrically.

Statistical analysis

Data were statistically described as mean \pm standard deviation (SD). Comparison between the three groups was performed using Kruskal-Wallis test, followed by Mann-Whitney U test for two group comparison. A probability value (p value) less than 0.05 was considered statistically significant. Statistical calculations were done using computer programs Microsoft Excel version 7 (Microsoft Corporation, NY, and USA) and SPSS (Statistical Package for the Social

Science; SPSS Inc., Chicago, IL, USA) statistical program.

3. Results

There were no differences between the three groups with regard to age, body mass index and duration of lactation (Table 1). Furthermore, there were no significant differences between the three groups with regard to the daily caloric intake or the percentage of the main constituents (complex carbohydrates, proteins and fats) of their diet. In all the patients included in the study, complex carbohydrates (rice, bread and grains) were the main constituent of the diet forming more than 60% of their daily energy requirements (Table 2).

The milk lactose level was significantly lower in lactating pregnant women compared to lactating amenorrhoeic women. Moreover, the milk lactose level was lower in lactating pregnant women compared to lactating menstruating women (5.75 ± 1.34 Vs 6.53 ± 0.77 g/dl, P value= 0.055), but this difference failed to reach statistical significance because of small sample size of both groups (Table 3).

The milk lipid level was significantly lower in lactating pregnant women compared to lactating menstruating women. Moreover, the milk lipid level was lower in lactating pregnant women compared to lactating amenorrhoeic women (3.84 ± 1.94 Vs 4.25 ± 1.95 g/dl, P value= 0.092), but this difference failed to reach statistical significance because of small sample size of both groups. The milk protein levels were significantly higher in the lactating pregnant and lactating amenorrhoeic women compared to lactating menstruating women (Table 3).

Comparison of milk lactose, lipid and protein levels (g/dl), between the lactating pregnant participants, and the lactating non pregnant participants (either menstruating or amenorrhoeic) showed a significant decrease of both milk lactose and milk lipid levels in the lactating pregnant females. On the other hand, the level of milk proteins showed no significant difference between them (Table 4).

Table 1. Demographic criteria of the three groups of patients

	Group I Lactating amenorrhoeic	Group II Lactating menstruating	Group III Lactating pregnant
Age (years)	25.26 \pm 3.19	25.43 \pm 2.64	24.44 \pm 3.05
BMI(Kg/m ²)	23.09 \pm 2.02	22.22 \pm 2.15	23.17 \pm 2.26
Duration of lactation(months)	7.57 \pm 2.23	7.61 \pm 2.84	7.94 \pm 2.69

Values are expressed as mean \pm SD.

There was no significant difference between the three groups

Table 2. Maternal dietary intake

	Group I Lactating amenorrhoeic	Group II Lactating menstruating	Group III Lactating pregnant
Energy (Kcal/day)	2377± 454	2315± 553	2334±586
Fat (% of Kcal)	69.91± 5.99	67.43± 5.62	69.11± 6.47
Lipids (% of Kcal)	14.74±3.78	15.57±3.69	15.67±3.41
Carbohydrates(%of Kcal)	14.48± 5.69	16.82± 5.91	15.5±6.16

Values are expressed as mean ± SD

There were no significant differences between the three groups

Table 3. Comparison of milk lactose, lipid and protein levels between the three groups of patients

	Group I Lactating amenorrhoeic	Group II Lactating menstruating	Group III Lactating pregnant	P value		
				G1 Vs GII	GI Vs GIII	GII Vs GIII
Lactose(g/dl)	7.56± 0.64	6.53± 0.77	5.75± 1.34	< 0.001	< 0.001	0.055
Lipids(g/dl)	4.25± 1.95	5.13± 1.23	3.84± 1.94	0.092	0.422	0.007
Proteins(g/dl)	2.64± 0.53	2.41± 0.29	2.64± 0.39	0.038	0.989	0.015

Values are expressed as mean ± SD

Table 4. Comparison of milk lactose, lipid and protein levels between lactating pregnant participants and lactating non pregnant participants (either menstruating or amenorrhoeic).

	Lactating non pregnant (n=46)	Lactating pregnant (n=18)	P value
Lactose(g/dl)	7.05± 0.87	5.75± 1.34	< 0.001
Lipids(g/dl)	4.69± 1.67	3.84± 1.94	0.044
Proteins(g/dl)	2.52± 0.44	2.64± 0.39	0.154

4. Discussion

According to the best of our knowledge this was the first study to determine the impact of pregnancy on the composition of breast milk. The result of our study revealed that the major nutrients of maternal milk are affected by pregnancy. The quantity of milk lactose and lipids were significantly lower in pregnant lactating mothers than non-pregnant lactating women. These two nutrients are essential for the physical development of the newly born in general and for the development of the nervous system in particular.

The decreased lactose and lipid levels in pregnant lactating women could be explained by the increased demands and the effect of stress of pregnancy (Tucker, 1979). Moreover, anorexia, emesis and even hyperemesis complicating early pregnancy will reduce the dietary and nutritional status of the mother. On the other hand milk proteins are synthesized in the breast and their quantities appear to be little dependant upon the protein intake (Forsum and Lonnerdal, 1980; Nommensen *et al.*, 1991).

Lactose constitutes 90% of carbohydrates in the human milk. Lactose is a disaccharide composed of 2 mono-saccharides: galactose and glucose. Lactose is synthesized by the breasts. In the infants' gut it stimulates the growth of microorganisms which produce organic acids and many of the B-vitamins.

Lactose is specific for newborn growth especially for the brain, as it is the major energy source. Lactose is a ready source of galactose which is essential to the production of galactolipids including cerebrosides that are essential to central nervous system development (Newton, 2004). Galactose is also essential for the synthesis of proteoglycans and glycoproteins. These are constituent of the outer leaflet of the plasma membrane playing an important role in intercellular communication and contact. They also play a role in receptor function and cell permeability to different nutrients (Jensen *et al.*, 1992).

There is a positive correlation between lactose level in the milk and brain size in different mammalian species and the humans have the largest brain size and the highest lactose concentration in the milk (Newton, 2004). Therefore it is reasonable to expect that the reduced lactose level in the milk of pregnant lactating women may affect mental and physical growth of the infants.

Lipids are the second largest constituent of milk. Human milk fat is composed of 98% triglycerides, 0.7% phospholipids and 0.5% cholesterol. Lipids function in at least 3 critical roles, they are an important source for energy as they supply over 50% of the required calories, the digestion of lipids to fatty acids and monoglycerides produces protective effect

against viral infection and parasites, and fatty acids, phospholipids and cholesterol are major substrates for somatic and central nervous system growth (**Jensen et al., 1992; Rodriguez – Palmero et al., 1999**).

Linoleic and linolenic acids are essential fatty acids for the synthesis of long-chain poly-unsaturated fatty acids that are critical in the formation and function of neural tissue. For example; Arachidonic acid and docosahexaenoic acid are characteristic of grey matter; while linoleic and linolenic acids are characteristic of myelin laid down. (**Carlson et al., 1996**). Linoleic acid and other essential fatty acids are also concerned with the integrity of the mitochondrial membranes. Docosahexaenoic acid, which is synthesized from linolenic acid, is present in high concentration in the retina and cerebral cortex and it is particularly needed for brain development. In the first year of life, the brain size nearly triples, 85% of the growth occurs in the cerebrum and 60% of this tissue is lipid (**Newton, 2004**).

Stopping breastfeeding, should pregnancy occur; to avoid its adverse effect on the nursed infants may expose them to many hazards as gastroenteritis and malnutrition diseases. And so, it is our responsibility to strongly advice against pregnancy during lactation so that the newly born receives the best nutritional support to ensure its full physical and neurological development.

This is what exactly recommended by the Islamic religion to prolong adequate lactation, up to two years, to face infant's requirements and at the same time to avoid pregnancy on top of lactation with its bad effects on both the nursed infant and the fetus. It is hoped that further works will be done to study the effect of pregnancy on other milk constituents that could also possibly affect the nursed infant.

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