Correlation between parity and concentration of immunoglobulins A, G and M in human colostrum

Correlação entre a paridade e a concentração de imunoglobulinas A, G e M no colostro materno*

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ABSTRACT

Objective: To study the relationship between parity and immunoglobulin concentrations in human colostrum. **Methods:** 82 puerperas aged 21-41 years were selected, with gestational age ≥ 37 weeks, up to the fourth parity, good nutritional status and no gestational or puerperal diseases. The inclusion criteria for the newborn were: weight > 2,500 g, Apgar score > 7 in the first minute and exclusive maternal breastfeeding until discharge from the nursery. The mothers were divided into 2 groups: A - primiparous, B - multiparous. Colostrum was collected manually from 48 to 72 hours after delivery and the immunoglobulins were measured by ELISA technique. **Results:** No differences were observed regarding timing to collect colostrum; the earlier colostrum was collected, the higher the concentration of immunoglobulin A; primiparous women showed higher concentrations of IgA and IgM in their colostrum than multiparous women; there were no differences regarding IgG concentrations in the two groups. **Conclusion:** Primiparous women presented higher concentrations of IgA and IgM in their colostrum than multiparous women.

Keywords: Parity; Immunoglobulin A; Immunoglobulin G; Immunoglobulin M; Colostrum

RESUMO

Objetivo: Verificar a influência da paridade na concentração das imunoglobulinas A, G e M no colostro materno. **Métodos:** Foram selecionadas 82 puérperas com idade cronológica entre 21 e 41 anos, idade gestacional de 37 ou mais semanas, paridade até IV gesta, bom estado nutricional e sem afecções associadas durante a gestação e puerpério. Foram critérios de inclusão para os recém-nascidos: peso ≥ 2.500 g, escore de Apgar > 7 no primeiro minuto e aleitamento exclusivamente materno durante o período de internação. As puérperas foram divididas em dois grupos: A - primíparas, B - multíparas, sendo o colostro colhido manualmente entre 48 e 72 h pós-parto. As imunoglobulinas foram dosadas pela técnica de ELISA. **Resultados:** Não se observou diferença significativa nos tempos de coleta do colostro entre os dois grupos estudados; quanto menor o tempo de coleta, maior a concentração de IgA no colostro materno; as primíparas apresentaram concentrações mais elevadas de IgA e IgM no colostro que as multíparas; não se observou diferença significativa na concentração de IgG no colostro entre as primíparas e as multíparas **Conclusões:** As primíparas apresentam concentrações mais elevadas de IgA e IgM no colostro materno entre 48 e 72 h pós-parto.

Descritores: Paridade; Imunoglobulina A; Imunoglobulina G; Imunoglobulina M; Colostro

INTRODUCTION

Breastmilk is the best food for newborns in their first months of life both because of its chemical and immunological composition and its impact on the bonds between the mother and the baby[1-2]. Colostrum is produced in the first five days after delivery and presents high immunoglobulin concentrations. A newborn receives approximately 4 g of IgA in the first day of breastmilk sucking and 1 g/day up to the fourth day after delivery. IgA-secreting plasmocytes reach the underlying interstitium of the breast cell after migrating from the lymphoyd tissue of the intestine and from the airway tree ("gut-airway-breast path"). This means that the antibodies received by the newborn through colostrum protect them against the pathogens from the immediate environment shared by the mother and the baby[3].

Colostrum contains extremely important substances to protect newborns. Despite this fact, there are few studies that try to better understand the factors that could change its composition.

Some studies have been carried out to check possible factors that may influence the concentration

levels of these protecting substances in colostrum. The most often factors studied were: prematurity, the mother's socioeconomic status, the mother's nutritional status and type of delivery.

This study aims at examining the influence of parity on concentration levels of immunoglobulins A, G and M in human colostrum.

METHODS

This study was conducted at the maternity ward of Hospital Israelita Albert Einstein (HIAE), in the city of São Paulo, Brazil, in May-June, 1999. All medical charts of puerperas who were hospitalized in this ward in that period were assessed in a systematic and continuous manner. One hundred and two patients met all criteria (both for inclusion and exclusion) previously established for this study. The inclusion criteria were: chronological age (21 – 41 years); gestational age ($\geq$ 37 weeks); parity (up to the fourth parity); good nutritional status; absence of breast plastic surgery and absence of illnesses during pregnancy and puerperium. The inclusion criteria for newborns were: gestational age $\geq$ 37 weeks, as calculated by the Capurro method; birth weight > 2,500 g; Apgar score > 7 in the first minute; be exclusively breastfed; and stay in rooming-in care or in the nursery for normal newborns.

After the study protocol was approved by the Medical Research Ethics Committee of HIAE, the mothers selected were personally interviewed by the researcher in charge. Only after having signed the Informed Consent Term did the mothers take part in this study.

Ouf of 102 puerperas selected, 5 did not agree with colostrum collection. It was also not possible to collect 3 mL of colostrum from 15 participants.

The total sample size, N = 82, proved to be adequate and sufficient in most calculations performed by using 2x2 tables, with α = 0.05 and power of the test (1-β) = 0.80.

This cross-sectional study involved two groups of puerperae: group A – primiparous; group B – multiparous.

Colostrum collection was carried out 48-72 hours after delivery by two employees of the breastmilk bank at HIAE. The 3 mL samples were manually collected in the morning and at the patient's bedside. The samples were then sent to the breastmilk bank at HIAE, and stored in a freezer at -20°C. After having all the samples collected, they were taken in an insulated refrigerator to the Mucosa Immunology Laboratory of the Biomedical Sciences Institute, Universidade de São Paulo (ICB-USP), where the tests were performed.

At first, the test tubes containing the colostrum samples were centrifuged at high rotation (approximately 3,500 rpm) to remove lipids. The lipid phase was discarded and the water phase was used to measure immunoglobulins A, G, and M, using the enzyme linked immunosorbent assay (ELISA).

Data were processed and analyzed by the software Epi-Info, version 6.04. The quantitative variables were described by central trend measurements (mean and median), dispersion (standard-deviation), and by minimum and maximum values. Categorical variables were expressed in percentages and compared by the chi-square and Yates-corrected chi-square tests. Contingency tables were used to present these data. The means of the continuous variables were compared by Fisher's test. For correlation of two variables, Pearson's parametric correlation coefficient was used. Significant difference was considered to be that represented by p value < 0.05.

The median of each immunoglobulin isotype was calculated by using the concentration values of the whole population (n = 82). The percentage and the number of mothers according to the individual concentration of immunoglobulins in the colostrum were distributed in the contingency tables, being above the median (greater than the median value) or below the median (smaller than or equal to the median value).

The analysis of the medians was selected because of the high dispersion of values regarding concentration of immunoglobulins in the colostrum.

RESULTS

Table 1 shows the distribution of variables in the sample studied.

Table 1. Description of the variables studied and values of measurements performed

Measurements Variables	Median	Minimum Value	Maximum Value	Mean	Standard Deviation
Maternal age	30.00	21.00	41.00	30.61	4.50
Gestational age	39.28	37.00	41.14	39.25	0.93
Birth weight	3,272.50	2,665.00	4,310.00	3,279.76	404.55
Time for collection	59.72	48.00	72.00	58.81	7.14
ELISA IgA	750.00	92.00	5,500.00	1,600.00	1,800.00
ELISA IgG	2.80	0.90	53.00	6.26	9.95
ELISA IgM	112.50	11.00	3.184.00	250.10	475.10

Note: Maternal age in years; gestational age in weeks; weight in grams; time for collection in hours; and immunoglobulins in mg/dl.

Table 2 shows that there was no statistically significant difference regarding time to collect colostrum in the two groups studied.

Table 2. Number of primiparous and multiparous women whose colostrum was collected later or earlier (above and below the median)

Timing	Above the median	Below the median	Total
Primiparous	20 (43.5%)	26 (56.5%)	46
Multiparous	21 (58.3%)	15 (41.7%)	36
Total	41	41	82

$\chi^2_c = 1.24$ p = 0.26587 NS

Table 4. Number of primiparous and multiparous women with IgG concentrations below and above the median (2.80 mg/dl)

IgG concentration	Primiparous	Multiparous	Total
≤2.80 mg/dl	19 (41.3)	22 (61.1)	41
>2.80 mg/dl	27 (58.7)	14 (38.9)	41
Total	46	36	82

$\chi^2_c = 2.43$ p = 0.11932 NS

Table 5. Number of primiparous and multiparous women with IgM concentrations below and above the median (112.50 mg/dl)

IgM concentration	Primiparous	Multiparous	Total
≤112.50 mg/dl	17 (37.0)	24 (66.7)	41
>112.50 mg/dl	29 (63.0)	12 (33.3)	41
Total	46	36	82

$\chi^2_c = 5.99$ p = 0.01438 *

This finding is extremely important because, as shown in figure 1, when the whole sample was studied (n = 82), it was observed the earlier colostrum was collected within the 48-72-hour interval after delivery, the higher the concentration of IgA, confirming the fact that IgA in the colostrum decreases at a fast pace in the subsequent days after delivery. However, it is worth mentioning that as the volume of colostrum and later on, of breastmilk, increase very quickly, the newborn continues to receive high amounts of IgA.

Figure 1. Correlation between the concentration of IgA and the timing in which colostrum was collected – total sample (n = 82)
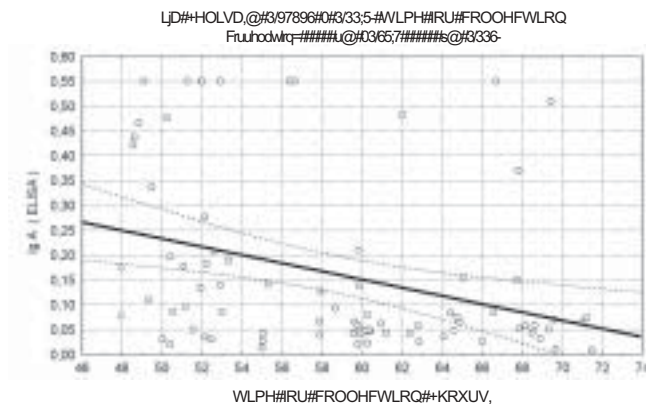
Timing regarding the collection of immunoglobulins G and M did not seem to significantly affect their concentrations in colostrum 48-72 hours after delivery.

Tables 3, 4, and 5 show the correlation between parity and immunoglobulin A, G, and M concentrations in colostrum. Primiparous mothers presented statistically higher concentrations of IgA and IgM, whereas IgG concentration did not show any significant variation regarding parity.

Table 3. Number of primiparous and multiparous women with IgA concentrations below and above the median (750 mg/dl)

IgA concentration	Primiparous	Multiparous	Total
≤750.00 mg/dl	17 (37.0%)	24 (66.7%)	41
>750.00 mg/dl	29 (63.0%)	12 (33.3%)	41
Total	46	36	Total

$\chi^2_c = 5.99$ p = 0.01438 *

DISCUSSION

Several variables may affect immunoglobulin concentration in colostrum. Prematurity has been studied as one of these variables. Some researchers have shown that colostrum of mothers that had premature babies presents higher concentrations of IgA[4-5] and IgM[6]. Other variables studied are nutritional status and socioeconomic status of the mother. There is no consensus in the literature. Some studies show colostrum of malnourished puerpera and of those that have poor socioeconomic status presents higher IgA and IgG concentrations[7-8], whereas other studies show that colostrum from mothers who present good nutritional status and have good socioeconomic status presents higher IgA concentrations[9-10]. The type of delivery was also studied as a possible factor that could affect the concentration of immunoglobulins in the colostrum. Kulski et al., in 1981, carried out a comparative study regarding the concentrations of IgA, IgG and IgM in colostrum of mothers who had normal delivery or had undergone elective C-section. The study showed that the type of delivery did not affect immunoglobulin concentration in colostrum[9]. Striker et al., in 2003, carried out the same type of study, but they compared colostrum of mothers who had given birth by normal delivery and of those submitted to elective C-section after labor, and observed the latter presented higher IgA concentration in colostrum than mothers who had vaginal delivery[10].

Regarding parity, only two studies were performed aiming at examining the influence of this variable on immunoglobulin concentration in the colostrum. Prentice et al., in 1983, observed that primiparous and multiparous (only up to second parity) mothers presented higher immunoglobulin concentrations in breastmilk than multiparous women who had 3 or more

pregnancies[11]. Coelho et al., in 1989, did not observe any differences in immunoglobulin concentrations in the colostrum associated to parity[7].

Chen et al., in 1998, performed a study comparing breastmilk letdown in primiparous and multiparous women. The results showed that the breast of multiparous women filled earlier and that the amount of breastmilk in the fifth day after delivery was bigger[12]. This fact could explain the findings that show higher IgA and IgM concentrations in the colostrum of primipara because these women present a later dilution of the colostrum when compared to multipara.

Few studies have then been carried out aiming at determining the mean immunoglobulin concentration in colostrum and the factors that may change it. Since immunoglobulins are extremely important for the immune defense of newborns who are immature to produce their own immunoglobulins, more studies should be performed to better understand these factors.

All these findings prove the need to highly encourage all the alternatives that promote breastmilk sucking by newborns in the first days of life. The most important options are rooming-in and follow-up and orientation of puerperae regarding breastfeeding.

CONCLUSIONS

1. **Primiparous women present higher concentrations of IgA and IgM in the colostrum than multiparous women do.**

2. **The earlier colostrum appears, the higher the concentration of IgA.**

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