Caloric profile of pasteurized milk in the human milk bank at a university hospital

Perfil calórico do leite pasteurizado no banco de leite humano de um hospital escola

Perfil calórico de la leche pasteurizada en el banco de leche humana de un hospital escuela en Londrina, Paraná, Brasil

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ABSTRACT

Objective: To verify the caloric and sanitary profile of human milk stored at the Human Milk Bank at Londrina University Hospital.

Methods: Cross-sectional study. Data were obtained from the Human Milk Bank registry regarding the source, the amount collected in liters, the amount of calories by liter assessed by crematocrit, and the acidity of human milk determined by titration in degrees Dornic.

Results: Between 2006 and 2009, 30,846 samples of human milk were collected from donors coming from different locations and analyzed. A total of 5,869L of milk were collected and distributed. From the total human pasteurized milk, 53,5% was classified as hypocaloric (<580kcal/L); 36.4% as caloric, and 8.3% as hypercaloric (>711kcal/L). Regarding the several locations where the milk was collected, the Human Milk Bank at Londrina University Hospital was the location in which a larger number of donations were observed in the three classifications. The result of the Dornic test for acidity of the collected milk revealed that 60.8% had 4.1º to 8.0º Dornic.

Conclusions: A large volume of the collected human milk is hypocaloric and appropriate for human consumption. There is the need to intensify collection procedures in order to meet the demand for hypercaloric milk for preterm newborn infants.

Key-words: infant, premature; milk, human; breast feeding.

RESUMO

Objetivo: Conhecer o perfil calórico e higiênico sanitário do leite humano do Banco de Leite Humano do Hospital Universitário de Londrina.

Métodos: Estudo quantitativo transversal do levantamento de dados obtidos de fontes secundárias de registros dos exames de teor calórico, avaliado pelo crematócrito, e da titulação de acidez pelo método de Dornic do leite humano, coletado pelo Banco de Leite Humano do Hospital Universitário de Londrina.

Resultados: Entre 2006 e 2009, foram analisadas 30.846 amostras de leite humano de doadoras de várias localidades, totalizando 5.869L de leite coletado e distribuído. Deste leite humano pasteurizado, 53,5% foi classificado como hipocalórico (menos que 580kcal/L), 36,4% como calórico e 8,3% como hipercalórico (maior que 711kcal/L). De acordo com as várias localidades de origem dos leites, o Banco de Leite Humano de Londrina foi o local onde se observou uma maior quantidade de doação nas três classificações. Ao exame da titulação de acidez Dornic do leite humano coletado, encontrou-se 60,8% com valores entre 4,1º e 8,0º Dornic.

Conclusões: Grande parte do leite coletado é hipocalórica e está própria para o consumo em relação ao perfil higiênico sanitário. É preciso intensificar a coleta deste alimento para atender à demanda de leite hipercalórico para os recém-nascidos prematuros.

Palavras-chave: recém-nascido prematuro; leite humano; aleitamento materno.

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Conflito de interesse: nada a declarar

Recebido em: 16/4/2012
Aprovado em: 28/9/2012

RESUMEN

Objetivo: Conocer el perfil calórico de la leche humana del Banco de Leche Humana del Hospital Universitario de Londrina y el perfil higiénico sanitario obtenido por el examen de titulación de acidez Dornic.

Métodos: Estudio cuantitativo transversal del inventario de datos obtenidos de fuentes secundarias de registros de los exámenes de tenor calórico, evaluado por el crematócrito, y de la titulación de acidez por el método de Dornic de la leche humana, recogida por el Banco de Leche Humana del Hospital Universitario de Londrina.

Resultados: Entre 2006 y 2009 fueron analizadas 30.846 muestras de leche humana de donantes de varias localidades, totalizando 5.869L de leche recogida y distribuida, siendo que el 55,3% de esta leche humana pasteurizada fue clasificada como hipocalórica (menos que 580kcal/L), el 36,4% como calórico y el 8,3% como hipercalórico (más que 711kcal/L). Conforme a las varias localidades de origen de las leches, el Banco de Leche Humana de Londrina fue el local en el que se observó una mayor cantidad de donación en las tres clasificaciones. Al examen de la titulación de acidez Dornic de la leche humana recogida, se encontró el 60,8%, con valores entre 4,1° y 8,0° Dornic.

Conclusiones: Gran parte de la leche recogida es hipocalórica y está propia para el consumo respecto al perfil higiénico sanitario. Es necesario intensificar la recolección de este alimento para atender a la demanda de leche hipocalórica para los recién nacidos prematuros.

Palabras clave: recién nacido prematuro; leche humana; lactancia materna.

Introduction

Human milk gives infants all the necessary nutrients of excellent quality, confirmed by expected weight gain[1]. It acts as an immunity agent, supplies the biological and psychological needs of infants and promotes the bonding between mother and infant[2-4]. Exclusive breastfeeding is recommended as the only source of nutrients in the first six months of life. After that, breastfeeding, complemented with other foods, should continue at least up to the second year[5].

One of the strategies to promote breastfeeding and contribute with the renewed adoption of this practice for newborns that have to be hospitalized was the Brazilian Network of Human Milk Banks [R*ede Brasileira de Bancos de Leite Humano*, (REDEBLH)], which opened its first Human Milk Bank (HMB) in 1943[6]. Currently, this network has 208 units distributed in all Brazilian states and is the largest and best structured HMB network in the world[6,7]. In addition to promoting, supporting and protecting breastfeeding, HMBs collect, process and distribute human milk to premature newborns and infants with nutritional disorders and allergy to heterologous proteins[8].

The following procedures are currently adopted for the control of the quality of pasteurized milk: A microbiological and two physical and chemical tests, one specific for acidity titration, and the other, the creamatocrit, which determines the amount of fat and the energy content of expressed human milk (EHM)[9].

Breastfeeding is important for newborns in the first months of life and essential for preterm newborns (PTNB). Some of the characteristics of PTNB are few carbohydrate and fat reserves, greater glucose demands for energy and metabolism, greater transepidermal water loss and slower peristalsis[10]. After birth, many PTNB have to fast for the shortest possible time, as recommended. After that time, human milk is the ideal food. An efficient and possible solution is to collect milk from the mother and store it for later consumption. In that case, the HMB should provide information and help the mother to collect milk, as well as to collect, store, process and control quality[11].

Therefore, HMBs should provide an adequate food that supplies the needs of its main clients, premature infants. This contributes to shortening the infant's hospital stay and speeding their discharge home. For that purpose, infants should receive, preferentially, hypercaloric human milk, that is, milk that contains more than 711kcal/L[12]. If human milk does not have that caloric value, it should be fortified, usually with elements from cow's milk, to supply the nutritional needs for the healthy growth of premature infants. In this case, the early contact with the heterologous protein may increase the incidence of necrotizing enterocolitis and the appearance of potentially harmful allergies[13].

This study evaluated the energy content and the acidity of human milk collected in the HMB of the Londrina University Hospital (LUH).

Method

This descriptive cross-sectional study was conducted in the HMB of the LUH, a tertiary hospital with 316 beds and a catchment area that includes 250 counties in the state of

Paraná, Brazil, and 100 towns in other Brazilian states. The LUH joined the Brazilian Baby-Friendly Hospital Initiative in 2000[14]. The HMB of the LUH (HMB/LUH) was founded in 1988, and today supplies pasteurized human milk mainly to premature infants hospitalized in the neonatal intensive care units (NICU) of Londrina and other towns in the area.

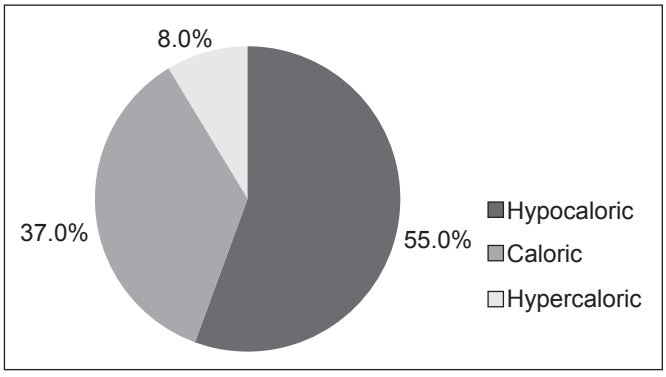
This study was conducted with milk donated by mothers registered in this service from January 2006 to December 2009, at a total of 30,846 samples, which corresponds to 5,869L of human milk. Data were collected from secondary sources, that is, by reviewing test results to determine caloric content and titratable acidity of human milk collected by the HMB/LUH.

The caloric value was determined using the creamatocrit, first described in 1978[15], which was tested and adapted for Brazilian HMBs by the REDEBLH team at Fundação Oswaldo Cruz (Fiocruz). The creamatocrit technique consists in centrifuging milk for 15 minutes to separate serum from cream. Using a ruler, the length of the cream column (mm and the total column are measured. These values are used in the formulas described below to calculate the amount of cream, fat and caloric content (kcal/L)[16]:

% cream – cream column (mm) x 100 ÷ total column (mm)
% fat = (% cream – 0.59) ÷ 1.46
kcal = % cream x 66.8 + 290

Titratable acidity was determined using the Dornic method. Samples were classified as suitable for consumption if their acidity was below 8°Dornic[17].

Data were analyzed statistically, and results were described as absolute quantities and percentages. This study was approved by the Ethics in Research with Human Beings of Universidade Estadual de Londrina.



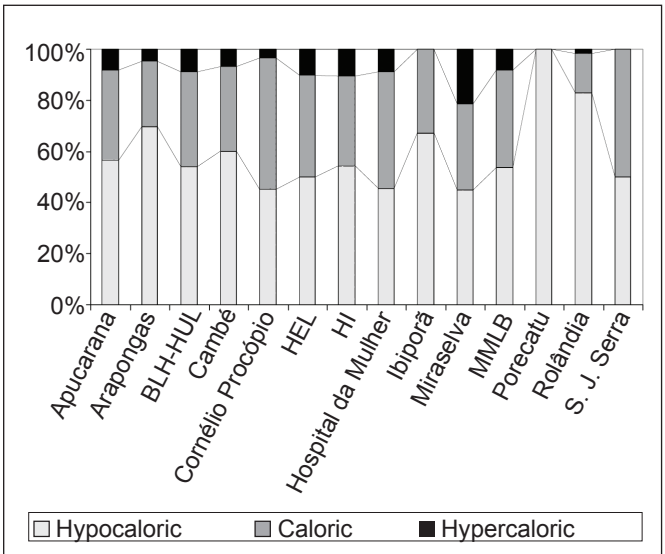
Graph 1 - Characteristics of pasteurized human milk of the Human Milk Bank of the Londrina University Hospital from January 2006 to December 2009, according to caloric content

Results

Graph 1 shows all types of milk from the HMB/LUH, classified according to their caloric content. Most of the collected milk was hypocaloric.

The HMB/LUH is responsible for collecting or receiving milk collected in Londrina and in other towns in the area, as well as for processing and distributing the product to its origin or other destinations. The places where milk is collected and taken to the HMB/LUH are shown in Graph 2 according to caloric content and volume. The HMB/LUH is the bank that collected the highest volume donated in the three classes.

Table 1 shows titratable acidity of pasteurized milks according to the Dornic scale. Most milk samples met



BLH-HUL: Banco de Leite Humano - Hospital Universitário de Londrina; HEL: Hospital Evangélico de Londrina; HI: Hospital Infantil; MMLB: Maternidade Municipal Lucilla Balalai.

Graph 2 - Distribution of human milk collected from January 2006 to December 2009 by the Londrina University Hospital and in other towns in the area, according to place of origin and caloric content

Table 1 - Characteristics of human milk donated to the Human Milk Bank of the Londrina University Hospital from 2006 to 2009 according to titratable acidity

Titratable acidity	Percentage
Up to 4.0º Dornic	19
from 4.1º to 8.0º Dornic	80
Greater than 8.1º Dornic	1
Total	**100**

acceptable standards, that is, titratable acidity was below 8º Dornic and milk was suitable for consumption.

The association of high caloric content, in this study described in kilocalories (kcal), with a low titratable acidity characterizes milk that is qualitatively more suitable for PTNB. Of all the samples analyzed, 70L had the characteristics described above.

Discussion

Most newborns in NICU are premature, and sometimes extreme premature with low birth weight. They demand special attention from the health care team and an adequate structure to provide high quality care, which may reduce the number of sequelae and the duration of their stay in the hospital[18].

The importance of human milk has been described in numerous studies that have demonstrated its protective effect against infant morbidity and mortality and its importance for the emotional development of human beings and for the establishment of the bond between mother and infant[19,20]. However, no studies have evaluated HMBs and their stocks of pasteurized milk, the number of donors and the origin of milk collected[21].

In our study, most milk collected was hypocaloric, which may be explained by donor characteristics and their breastfeeding stage, that is, whether the milk expressed is colostrum, transition milk or mature milk. It may also be explained by the time when milk was collected, whether in the beginning or end of the breastfeeding session, because human milk fat varies according to that[22].

The difficulty in obtaining hypercaloric milk has also been described in study in which most of the milk collected was caloric, but not hypercaloric[23]. In 2006, another study reported similar results, and only 8.95% of the milk was hypercaloric[24]. A study conducted in the city of Bauru, Brazil, found similar results: 63% was caloric milk and only 12%, hypercaloric[25]. In Rio de Janeiro, Brazil, 62% of the human milk collected was caloric, and only 11%, hypercaloric[26].

When titration is performed using recently expressed milk, results show that it is free of lactic acid, and total acidity, ranging from 1.0º to 4.0º Dornic, corresponds to initial values of acidity. As microorganisms find favorable conditions to grow, lactic acid is produced, and acidity increases consequently. If this is equal to or greater than 8.0º Dornic, the product is not suitable for human consumption[17]. The greatest amount of milk with acidity ranging from 4.0º to 8.0º Dornic was found in the HMB/LUH. A study conducted in Sorocaba, Brazil, in 2006, also found a large amount of milk with titratable acidity below 8.0° Dornic (76%), and only 24% of the samples were rejected because acidity was above 8.0° Dornic[27]. Another study conducted in 2001 found that 58% of the collected milk samples had titratable acidity from 1.5º to 3.0º Dornic[28]. Another author found similar results and a higher percentage of titratable acidity (80%) of 3.0º to 6.0º Dornic[29].

Our findings suggest that a large amount of the milk collected in the HMB/LUH is hypocaloric and suitable for consumption according to its acidity, which is of paramount importance, because most infants that receive this product are premature newborns. Collection guidelines for human milk donors should be more intensively communicated, so that larger amounts of hypercaloric milk, better for premature newborns, are collected.

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