

CHARACTERISTICS OF THE REGIONAL HUMAN MILK BANK IN POLAND - DONORS, RECIPIENTS AND NUTRITIONAL VALUE OF HUMAN MILK

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ABSTRACT

Background. In case of shortage of breast milk despite proper lactation care or the poor state of the mother's health, breast milk from human milk bank is recommended for feeding preterm infants.

Objective. This study retrospectively evaluated the first year of the operation of the Regional Human Milk Bank.

Material and methods. Data concerning donors was collected in the human milk bank during the cooperation. The clinical characteristics of the recipients was made on the basis of medical documentation from the Holy Family Hospital in Warsaw, Poland. Analysis of nutritional value was performed with the human milk analyzer (MIRIS AB).

Results. In the first year of activity, 45 voluntary donors established cooperation, donating from 650 to 32030 ml of human milk. The content of nutrients in milk provided by donors was variable - protein 0.4-1.5 g / 100 ml, fat 1.1-7.4 g / 100 ml, carbohydrates 6.3-7.9 g / 100 ml. The average length of using donated human milk was 4 days and the average volume of milk for one infant was 282 ml.

Conclusions. The donor profiles have a significant impact on the milk composition from HMB. The nutritional value can be improved by recruitment donors from mothers that gave birth prematurely and by beginning donation at earlier stages of lactation as soon as lactation is stabilized. In case of shortage of mothers own milk the immediate implementation of donors milk as a short-term support can significantly reduce the food intolerance incidence in the group of prematurely born infants.

Key words: milk banks, human milk, breast milk, premature infants, enteral nutrition

STRESZCZENIE

Wprowadzenie. W przypadku niedoboru pokarmu biologicznej matki, pomimo odpowiedniej opieki laktacyjnej lub złego stanu zdrowia matki, zalecane jest żywienie noworodków przedwcześnie urodzonych pokarmem pochodzącym z banku mleka kobiecego. W krajach Europejskich, w tym w Polsce następuje gwałtowny wzrost liczby banków mleka.

Cel badań. Celem badania była retrospektywna analiza pierwszego roku funkcjonowania Regionalnego Banku Mleka Kobiecego w Szpitalu im. Świętej Rodziny w Warszawie.

Material i metody. Charakterystykę dawczyń przygotowano na podstawie danych gromadzonych w banku mleka w trakcie okresu współpracy. Charakterystykę biorców oparto na dokumentacji medycznej pochodzącej ze Szpitala im. Świętej Rodziny w Warszawie. Analiza składu mleka kobiecego została przeprowadzona dla każdej partii mleka przy użyciu analizatora MIRIS AB.

Wyniki. W pierwszym roku działalności, współpracę nawiązało 45 dawczyń przekazując od 650 do 32030 ml mleka. Zawartość składników odżywczych w przekazanym pokarmie była zróżnicowana - białko 0,4-1,5 g / 100 ml, tłuszcz 1,7-7,4 g / 100 ml, węglowodany 6,3-7,9 g / 100 ml. Średnia długość żywienia biorców mlekiem z banku wynosiła 4 dni, średnia objętość mleka wykorzystanego do żywienia jednego noworodka wynosiła 282 ml.

Wnioski. Profil dawczyń zarejestrowanych w banku ma istotny wpływ na skład pokarmu z banku mleka kobiecego. Rekrutacja jako dawczyń większej liczby matek noworodków przedwcześnie urodzonych oraz rozpoczynanie współpracy na wczesnym etapie laktacji, zaraz po jej stabilizacji, może podnieść wartość odżywczą mleka. W przypadku braku pokarmu biologicznej matki, natychmiastowe wdrożenie żywienia pokarmem z banku mleka jako krótkoterminowego wsparcia, może znacząco zredukować częstotliwość występowania nietolerancji pokarmowych u noworodków przedwcześnie urodzonych.

Słowa kluczowe: bank mleka kobiecego, mleko dawczyń, mleko kobiece, noworodki przedwcześnie urodzone, żywienie enteralne

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INTRODUCTION

Mother's milk is the first choice for feeding infants, but in some situations it may be not available due to the shortage of breast milk despite proper lactation care or the poor state of the mother's health. In those situations, WHO recommends breast milk from a healthy wet-nurse or a human milk bank (HMB) [23], also AAP (American Academy of Pediatrics) and ESPGHAN (The European Society for Pediatric Gastroenterology Hepatology and Nutrition) recommends pasteurized donor milk for preterm infants if mother's own milk is unavailable [3, 11].

Sharing of human milk cause some concerns about the transmission of viruses or pathogens. For this reason it is appropriate to create milk banks following the safe procedures connected with donor screening, milk collection and storage, pasteurization and microbiology tests [2, 10, 14, 20].

Over the world there are many associations providing support for HMB and promotion guidelines regarding handling of human donor breast milk, among others The Human Milk Banking Association of North America (HMBANA) and European Milk Bank Association (EMBA) [10].

In Europe we currently observe rapid growth of HMB. Currently there are 221 active milk banks supported by EMBA and 17 more are planned. In some countries like Slovenia or Romania first HMB are just under development [12].

In Poland first HMB, operating on current recommendations was established in 2012 in cooperation with Human Milk Bank Foundation which is the official representative of the EMBA in Poland. It is internal HMB, operating only for the needs of one neonatology ward in Orlowski Hospital, at which it is located. Since then, there has been opened five more HMB, including launched in January 2015 Regional Human Milk Bank in the Holy Family Hospital in Warsaw, which cooperates with other hospitals in Mazovia District.

This study retrospectively evaluated the first year of the operation of this HMB. The study covered the period from the official establishment of human milk bank on January 14, 2015 until March 31, 2016. The first two months of activities have been dedicated to the organization of work in the institution. The regional human milk bank started working in full range of duties from the beginning of April 2015.

MATERIAL AND METHODS

Data concerning donors (n=45) came from questionnaires completed at the time of recruitment and data collected in the human milk bank during the cooperation. Each potential donor undergoes a detailed interview concerning the current state of health, the prevalence of chronic diseases and illnesses (i.e. tuberculosis, venereal diseases), drug use, lifestyle and diet. The next step is the

blood tests for diseases carried by the milk - hepatitis B and C, CMV, HIV, and syphilis. In addition, each donor makes a written declaration that she does not smoke cigarettes, does not drink alcohol or use illegal drugs and leads a lifestyle free from risk behaviors to HIV infection.

The clinical characteristics of the recipients (n=154) was made on the basis of medical documentation from the Holy Family Hospital in Warsaw.

Analysis of nutrient content of milk is a routine test in case of donor milk. Before pasteurization, milk collected from each donor was pooled from the period of maximum space of two weeks. From each pool there was taken three samples to analyze the nutritional value, as the result we used the average of three measurements. Analysis was performed with the human milk analyzer (MIRIS AB) according to the manufacturer's recommendation. The device is an analytical instrument for the direct determination of the nutritional content of human milk, based on mid-infrared transmission spectroscopy. The study used a weighted mean, regarding different volumes of milk donated by each woman. Data were analyzed using data analysis software systems STATISTICA version 10 (Stat Soft. Inc., 2011).

RESULTS

The donors

In the first year of activity, 45 voluntary donors established cooperation. 11 of them (24.4%) declared chronic diseases that were not contraindications to become a milk donor: type 2 diabetes, inhalant allergies, asthma, Hashimoto's thyroiditis, hypothyroidism, cardiac arrhythmias, congenital heart disease. The remaining 34 (75.6 %) were healthy. 11 of the donors (24.4%) were mothers of premature infants. Most donors (41 persons) declared a general healthy diet, 2 of them were vegetarians and 2 were on non-dairy diet.

Recruitment as a donor occurred 1-44 weeks after birth (average 14 weeks). The length of cooperation varied from 2 to 26 weeks, the volume of milk donated during this period varied from 650 to 32030 ml from each donor (Table 1).

Table 1. Characteristics of the donors

	Weighted average (SD)	Min - Max
Mother's age (years, n=45)	31.58 (4.71)	23-44
Milk volume (ml, n=45)	6481.98 (6929.95)	650-32030
Child age at the beginning of donation (weeks, n=45)	14.07 (10.21)	1-44
Child age at the end of donation (weeks, n=36)*	27.83 (12.98)	6-52
Length of donation (weeks, n=45)	13.18	2-26
* 9 of the donors registered within the first year was still active		

Human milk nutritional composition

In the first year of operation 295.88 liters of milk have been collected and processed, 21.59 liters have been disposed due to an equipment failure and the error in the process of pasteurization. There were prepared 179 pools of milk in 99 pasteurization processes. The content of nutrients in milk provided by donors was variable - protein 0.4-1.5 g/100 ml, fat 1.1-7.4 g/100 ml, carbohydrates 6.3-7.9 g/100 ml (Table 2).

Table 2. Nutritional value of human milk from human milk bank

	Weighted average (SD)	Min. – Max.
Fat (g/100 ml)	3.1 (0.8)	1.1 – 7.4
Crude protein (g/100 ml)	0.8 (0.2)	0.4 – 1.5
Carbohydrates (g/100 ml)	7.4 (0.3)	6.3 – 7.9
Energy (kcal/100 ml)	61.7 (6.5)	46.0 – 86.0
True protein (g/100 ml)	0.7 (0.2)	0.3 – 1.2

The recipients

Regional Human Milk Bank provided pasteurized human milk for 6 hospitals, including the Holy Family Hospital in Warsaw. In a local hospital, 154 infants received milk from the human milk bank (the total number of recipients from all hospitals exceeded 400). Most of them (91.5%) were born preterm before 37 week of pregnancy by cesarean delivery (73.4%). Only for the 2,6 % of infants skin-to-skin contact lasted two hours, and first breastfeeding took place during this time (Table 3).

Table 3. Characteristics of the recipients

	%	n
Gender (n=154)		
Female	48.7	75
Male	51.3	79
Number of infants in the pregnancy (n = 154)		
Single	68.8	106
Twins	31.2	48
Gestational age (n=154)		
<32 Hbd	5.8	9
32-36 Hbd	85.7	132
≥37 Hbd	8.4	13
Mode of delivery (n=154)		
Cesarean delivery	73.4	113
Vaginal delivery	26.6	41
Skin-to-skin contact (n=153)		
None	17.0	26
< 2 hours	80.4	123
2 hours	2.6	4
Breastfeeding during skin-to-skin contact (n=153)		
Yes	2.6	4
No	97.4	149
Feeding at discharge (n=153)		
Exclusive breastfeeding	77.8	119
Any breastfeeding	19.6	30
Exclusive formula	2.6	4

The major diagnoses of patients fed with the milk from the HMB were: prematurity (92.9%, n = 144), hyperbilirubinemia (54.5%, n=84), respiratory failure (43.2%, n=67), hypotrophy (15.5%, n=24), congenital pneumonia (11.0%, n=17), asphyxia (9.0%, n=14), congenital infection (7.7%, n=12), enteral nutrition intolerance (1.9%, n=3).

The average length of using donated human milk was 4 days and the average volume of milk for one infant was 282 ml (Table 4).

Table 4. Detailed characteristics of the recipients

	Average (SD)	Min-max
Mother's age (years, n=153)	31.02 (5.10)	15-45
Gestational age (weeks, n=153)	34.46 (2.01)	27-41
Length of hospitalization (days, n=152)	13.95 (9.70)	3-65
Length of using donated human milk (days, n=152)	4.03 (2.20)	1-15
The volume of donated human milk (ml, n=154)	282.06 (308.62)	3-3130
Birth weight (g, n=154)	2264.25 (514.53)	990-4016
Birth length (cm, n=154)	47.98 (3.64)	36-59
Head circumference (cm, n=152)	31.5 (1.92)	25-38
Chest circumference (cm, n=151)	28.92 (2.49)	22-36
Discharge weight (g, n=154)	2376.06 (371.69)	1866-3640
Parenteral nutrition (days, n=92; 59,7%)	4.95 (2.96)	1-18

DISCUSSION

In recent years, efforts are being made to restore the system of HMBs in Poland after their breakdown in 90'. The Regional Human Milk Bank in Holy Family Hospital was established after 8 years from collapse of The Human Milk Bank in Polish Mother's Memorial Hospital in Lodz, which was the last one in Poland. The Holy Family Hospital is Municipal Hospital containing II grade neonatology ward with intensive care unit. Approximately 5000 births occur in the Holy Family Hospital per year. Moreover, in this neonatology ward there are hospitalized the patients born prematurely in other hospitals, requiring further treatment and care. The Holy Family Hospital has long tradition in promoting breastfeeding - since 2007 it is certificated as Baby Friendly Hospital. The lactation support is a separate duty of dedicated personnel. This was a reason to settled down the Regional Human Milk Bank in this particular Hospital. The experience from

the activity of the first Polish modern bank of human milk at the Orłowski Hospital revealed that donor milk is widely accepted by family and professional society in Mazovia Region [22]. In fact, parents refuse of using milk from HMB is extremely rare. Resistance to use another mother's milk was a barrier in development human milk bank in Lodz late 90' [17]. Successful donor recruitments in currently operating HMBs is possible thanks to over ten years of promotion of human milk banking idea in Poland.

The unique procedure introduced with the establishment of Regional Human Milk Bank in Mazovia is an analysis of nutritional composition of donor milk. Previously it was not possible due to the limitation of equipment and lack of experience in staff. Knowledge of the macronutrients composition enables the implementation of individual nutrient supply for infants fed with the milk from HMB.

The composition of macronutrients in donors milk from different HMBs is varied. In some of them mean fat and energy content was lower than in analyzed population of donors for Regional Human Milk Bank in Warsaw (fat 2.2-3.0 vs 3.1 g/100 ml; energy 51.8-53.6 vs 61.7 kcal/100 ml) [1, 5, 21]. In the Perron Rotary Expressed Milk Bank the content of nutrients was higher (protein 1.35 g/100 ml; fat 4.16 g/100 ml; energy 69.7 kcal/100 ml) [5]. The content of lactose was 6.7 g/100 ml, which is difficult to compare - in the study we analyzed carbohydrates content (lactose and oligosacharydes) – obtaining 7.4 g/100 ml. The authors suggests that the 'richer' composition is connected with the fact that the majority of milk was received from mothers who have given birth prematurely. Further studies confirm the greater contents of protein in preterm mature milk [22]. Unfortunately in analyzed donors population there were only 11 premature mothers (24.4 %).

In fact the nutritional composition of milk from HMB is strongly dependent on the profile of the donors. Higher protein content is connected with prematurely birth [9] and earlier stages of lactation [13]. Earlier gestational age of children at birth and the start of donation at earlier stages of lactation are also associated with a larger quantity of donated milk. Also women who are previous donors deliver a greater volume of milk [18].

In the study the age of donors (31.57 years) was similar that in other HMBs [7, 15]. The average age of child at the beginning of donation was 3 months which is similar to some other HMBs [7, 18]. But some HMBs have lower average age – 7 weeks [18], which can have a beneficial effect on the nutritional value. The average time of donation (13.18 weeks) was similar to other HMBs [15, 18]. In Poland it is recommended to become the donors on the well – established stage of lactation, about 3-4 weeks after

delivery. However, the average time to start donating in studied population was 14 weeks after delivery. This can affect the nutritional value the milk obtained from the Regional Human Milk Bank in Warsaw. It will be better to start donating earlier to obtain milk with highest protein content.

Another factor influencing the composition might be the method of analysis of the composition of breast milk. Before the 2009 human milk composition was analyzed by standard laboratory methods. Modern HMBs use the human milk analyzers that uses mid-infrared reflectance. The study conducted with the similar method showed a similar protein content (0.9 vs 0.8 g/100 ml), higher fat (4.0 vs 3.1 g/100 ml) and lower carbohydrate content (6.6 vs 7.4 g/100 ml) [8, 15].

Due to the large variation of the composition of donor milk and the multitude of factors that affect it, the routine analysis of the composition of each pool of milk is a necessity.

Nutritional analysis of human milk based on the MIRIS Human Milk Analyzer require introducing the good manufacturing practices (GMP), validation and controlling process of the procedure. Regional Human Milk Bank in the Holy Hospital is a reference laboratory in Poland in the implementation of the nutritional analysis of human milk.

The establishment of regional human milk bank has improved the medical care for an infant born prematurely in the Mazowia Region in Poland. In 2015 in the region 4334 infants was born prematurely before 37 Hdb [6]. Our study revealed that nearly 10% of them received milk from the HMB.

Prematurity was the main reason for providing milk from HMB (92,9% of recipients), which is in accordance with Polish and international recommendations [3, 11, 23]. Some studies among the most common indications list the malabsorption and feeding intolerance [7]. In the analyzed population only 1,9% of infants suffered feeding intolerance. Feeding with donor's milk was initiated from the first days of life as prevention of such complications to all preterm infants that could not have been fed by biological mother.

Recipients had many features connected with serious health condition, that are the risk factors of the breastfeeding failure such as prematurity, caesarean birth, lack or very short time of skin to skin contact, no successful latch and suck. These factors may cause a shortage of mother's milk in the first days of life. In the Holy Family Hospital in the most cases, donor milk was used as a short-term intervention (average 4 days). In successive days, most children were feed with mothers own milk. At discharge 77.8 % of donor milk recipients were feed exclusively with mothers own milk.

The other studies [4, 16, 19] have shown that access to the milk from the HMB is associated with

the increase of breastfeeding of infants. In Italy the presence of HMB in a NICU was associated with the 13.6 % increase of exclusive breastfeeding and 7.6 % of any breastfeeding of VLBW infants at the discharge from the hospital [4]. To achieve this effect, it is necessary to implement adequate lactation care for the recipient's mothers. The other research indicates, the level of knowledge about breastfeeding is a crucial factor which influences exclusive breastfeeding rates [24]. Further research is needed to verify this hypothesis in case of Polish milk banks.

CONCLUSIONS

Supplementation with the pasteurized milk from milk bank should become a common procedure in all NICUs among the country. For this purpose, the activity of Regional Human Milk Banks in Mazovia District is crucial. In another parts of Poland it is recommended to establish HMBs based on relevant national norms and with cooperation with such NGO as Human Milk Bank Foundation that provides support for creating safe procedures connected with donor recruiting procedure, milk collection and storage, pasteurization and microbiology tests.

The donor profiles have a significant impact on the milk composition form HMB. The nutritional value can be improved by recruitment donors from mothers that gave birth prematurely and by beginning donation at earlier stages of lactation as soon as lactation is stabilized. Also due to variety of the human milk composition, human milk analysis should become the part of the routine work at every HMB.

Irrespective of the nutritional value of milk, feeding with donor milk is superior to the formula. Benefits from the use of milk from the HMB are significant. In case of shortage of mothers own milk the immediate implementation of donors milk as a short-term support can significantly reduce the food intolerance incidence in the group of prematurely born infants.

Conflict of interest

The authors declare no conflict of interest.

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