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Human milk banking to 1985

ABSTRACT

This paper provides a literature review of the use of donor human milk by hospitals in Australia and elsewhere from the postwar period through to the early 1980s, and establishes the context for a small study of practices which happened in that period. The latter study will be reported elsewhere. The purpose of this paper is to provide a resource for future comparison when the history of the new hospital milk banks of the 21st century is written. Relevant literature in English and two articles in French were accessed.

Keywords: *human milk banks, hospitals, history, voluntary organisations, Australia*

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INTRODUCTION

Australian hospitals routinely shared the milk of in-patients for much of the 20th century until 1985. With the establishment of highly-regulated milk banks in four Australian locations in recent years, Perth, the Gold Coast, Sydney, and Melbourne (Hartmann et al 2007; Lording 2009; Mothers Milk Bank 2007, 2009; Opie G 2011, pers comm 23 February), it is timely to examine the use of expressed human milk during the period when it was used routinely in Australian hospitals. Sources used for this article include medical journal reports and correspondence from the 1952–1985 period, more recent medical literature to provide context, and publications of the Australian Breastfeeding Association, formerly the Nursing Mothers' Association of Australia (NMAA).

While sometimes a mother expressed for a particular baby, her own or another, the pooling of expressed breastmilk (EBM) from mothers on the postnatal wards was common in maternity facilities in the postwar period, both in Australia and elsewhere (Sauve et al 1985; Thorley 2000). Pooling of milk involved mixing all the expressed milk, rather than keeping it in separate batches from individual mothers. This sometimes meant that milk from a mother expressing for her premature baby would go into the pool, rather than specifically to her own baby. The pooled EBM was also used for frail premature or sick babies if their mothers were not

breastfeeding or had not yet established a sufficient milk supply (Thorley 2000). It was also used to supplement babies at night, when mothers were not allowed to breastfeed their babies in a central nursery. Routine expression of milk after breastfeeds by mothers in the postnatal wards was believed to prevent breastfeeding problems and promote a good supply (Hytten 1954; Section of Paediatrics 1952). However, in some hospitals it was recommended for specific reasons, rather than as a universal procedure. Women expressed their milk by hand or with a noisy electric pump or an unhygienic 'breast reliever' with a rubber squeeze bulb.

While mothers appear to have complied with instructions to express their milk, they were not necessarily comfortable about doing so. An anonymous letter writer, who signed herself 'Doctor's Wife', wrote in the *Medical Journal of Australia* in 1961 concerning practices she believed deterred mothers from breastfeeding. One of these was the routine expressing of the breasts in the maternity hospital, which she considered 'distasteful' and painful and a cause of cracked nipples. Her words suggest that her experience involved a pump of some sort. Advocating that the practice should be optional, she wrote:

All mothers should be asked if willing to express for the premature babies and thanked for doing so. The only

painless contraption for expression is a baby ('Doctor's Wife' 1961).

The practice of using EBM from the postnatal wards for infants in the Special Care Unit (SCU) or Neonatal Intensive Care Unit (NICU) or as routine supplementation was gradually replaced by the use of artificial alternatives. The reasons for this were complex. They included the greater availability of commercial substitutes for mothers' milk, including the provision of free or subsidised supplies from the companies, the marketing of 'premature' preparations to neonatologists and a culture shift where routine postnatal expression of milk had gone out of favour.

LITERATURE REVIEW

Method

For this literature review, a search was done for the period 1950–1983 on Medline and PubMed for English-language articles using the search terms 'milk bank' and 'hospital'. Reports in publications of the Australian Breastfeeding Association (ABA) had already been manually located in the author's own collection, in the office of the Queensland Branch of the ABA, and in the Virginia Thorley Papers in the Fryer Memorial Library of the University of Queensland. The correspondence pages of the *Medical Journal of Australia* were also manually searched for the year 1961 when a particular reference could not be accessed online. A search using the terms 'necrotising enterocolitis' and 'septicaemia and prematurity', was conducted to investigate the literature of the time as a basis for the practice of dispensing of colostrum and EBM to vulnerable babies for protection against enteric infections (Davies 1982; György 1971; Tassovatz & Kotsitch 1961) and necrotising enterocolitis (Addy 1976; Barlow et al 1974; Korcok 1983). Many of the articles which did refer to an association between the lack of human milk and the prevalence of necrotising enterocolitis and enteric infections were from later periods and so do not describe earlier beliefs and experience (Gregory 2008; Lucas & Cole 1990; Morgan et al 2011; Noerr B 2003; Quigley et al 2007; Rinaldi, Brierley & Bekker 2009; Updegrave 2004). Relevant articles relating to the reasons for using human milk and the operation of milk banks were found in the references cited by other papers and sourced by document delivery. Two articles in French were accessed. One of the French-language articles had been cited by several other authors and it was necessary to read the original.

Hospital milk banking

During the early post-World War II period, some maternity hospitals in Australia housed milk banks or milk rooms for the processing of EBM. These included the Lady Goodwin in Rockhampton (Annual Report of Health & Medical Services Queensland 1952–1953) and the larger Brisbane Women's Hospital (Thorley 2000). Smaller facilities commonly pooled EBM from the mothers on

the postnatal wards and either used it in-house (Thorley 2000) or sent it to larger facilities. For instance, in the late-1940s, this milk was collected daily and delivered to the Maternal and Child Welfare Homes in Brisbane for the premature babies cared for there (Thorley 2000). Some children's hospitals, such as the Royal Children's Hospital in Melbourne and the Royal Alexandria Hospital for Children in Sydney, also maintained small human milk banks for sick babies (Harmer 1974; NMAA 1982). However, the Royal Women's Hospital in Brisbane expanded its old milk room to provide facilities for preparing artificial feeds, till they were replaced in 1973 with pre-mixed artificial feeds (Patrick 1988). Milk banks housed in the maternity wards of Australian hospitals and in some children's hospitals, continued to exist after the advent of new milk rooms designed to dispense artificial substitutes had been established in other institutions (Allison 1975; Connelly 1975; Harmer 1974; Hooper 1978; Lohse 1978; Thorley 2008).

Milk from postnatal mothers (Thorley 2000) was no longer as readily available after the practice of routine expression declined and, consequently, hospitals began to draw on mothers in the community for EBM for vulnerable babies (Dowsett 1979; NMAA 1974, 1982). In the second half of the 1970s a milk bank housed in the paediatric ward of the Townsville General Hospital in North Queensland and coordinated by volunteers from the NMAA, drew on mothers in the community to provide this scarce resource to sick, postoperative or premature infants (Beal, Ashdown & Mackay 1978). The Townsville milk bank was established because of local doctors' frequent requests to the association for EBM for premature or sick babies (NMAA 1977). Thorley (2011) has described how the Board of the NMAA developed policies and detailed procedures for all parties involved in milk donations in the 1970s, with a view to establishing a network of milk banks. This was in response to the situation where some local NMAA groups were providing EBM informally (Thorley 2009b). As far as can be ascertained, the Townsville milk bank was the only such milk bank to eventuate (Thorley 2011). The dependence on volunteers was believed to be unique in Australia (Beal, Ashdown & Mackay 1978), though a general hospital in outer London was also using volunteers, in this case from the National Childbirth Trust (McEnery & Chattopadhyay 1978).

During the study period a number of analyses were made in the United Kingdom of the bacteriological condition of milk samples from milk banks, as part of the debate on whether donor human milk could be given to sick or premature babies raw (unheated) or pasteurised. Methods of expression were also discussed, including careful instruction of mothers who expressed milk in their homes for collection later for a milk bank (Beal, Ashdown & Mackay 1978; Davidson, Poll & Roberts 1979; Greenwood Wilson 1951; Williamson, Hewitt et

al 1978). Williamson and colleagues (1978) believed the bacterial counts could be reduced by instructing mothers to discard the first 5–10 mL and to collect only the ‘midstream’ milk. Mothers donating their milk to the Townsville milk bank were instructed to discard the first 5 mL expressed because of concerns of contamination by enteric bacteria (Beal, Ashdown & Mackay 1978). However, Carroll and colleagues (1980) found no difference in bacterial load in paired samples expressed from the same mother, consisting of the first 2–3 mL and midstream milk. This practice is no longer recommended as best practice through lack of evidence (Jones 2011).

Some disparities between studies may be attributable, firstly, to the use in some studies of drip milk (Evans et al 1979; Lucas & Roberts 1979), that is, milk collected in breast shells during feeding from the other side, allowing contamination with skin bacteria, and, secondly to the differences in the length of time that EBM was stored in home refrigerators before being collected by the nurse. This storage could be for 24 hours (Williamson, Finucane et al 1978), up to 48 hours (Davidson et al 1979; Evans et al 1978), or every 3–4 days (Lucas & Roberts 1979). Elsewhere, the milk expressed at home was snap frozen (Beal, Ashdown & Mackay 1978; Björkstén et al 1980). Davies (1982) reported that drip milk had a significantly lower fat content than milk that was expressed, and he suggested that combining expressed milk with drip milk would raise the fat content to provide more energy.

Screening of the milk donors was conducted by the Cardiff Human Milk Bank, which in the early 1950s sent milk all over Britain (Greenwood Wilson 1951). Mothers providing their expressed milk to the Cardiff milk bank in 1951 were paid a small fee (Section of Paediatrics 1952). Payment of donors during this period was unusual. During earlier periods there had been concerns about the transmission of syphilis or pulmonary tuberculosis (TB) via human milk, but by this period pregnancy blood screens tested for syphilis and national public health campaigns against TB in Australia had reduced its incidence in the community (Tyler 2006).

While the most attention has been devoted to the clinical and microbacterial aspects of milk banking, later authors have addressed the sociological and ethical aspects of this sharing of milk. Golden (2001) has traced the change from commodity, where wet nurses were paid to provide milk for institutional milk banks, to a gift that was freely given, a change that has ever since elevated altruistic donation of this bodily fluid to a virtuous act, while conversely creating a negative attitude towards reimbursement. Shaw (2010) has explored the complex ethical implications of milk banking, drawing on concepts of the mother-child relationship, the complexities of a gift relationship, dichotomous views of women’s milk as a bodily fluid, public health promotion of breastfeeding and women’s autonomy.

Premature and other vulnerable babies

This was a period when research findings supporting breastfeeding were being published, while ambivalence existed among clinicians (Anon 1961; Dugdale 1981). Although factory-made artificial milk mixtures were beginning to be preferred in some institutions, premature or sick babies were prioritised to receive EBM, when it was available, because of their known vulnerability to enteric infections, necrotising enterocolitis and septicaemia if they were artificially fed (Hanson & Winberg 1972; Honour & Dolby 1979; Narayanan et al 1984). Papers published since the period under study have confirmed the association of artificial feeding with these serious and potentially fatal events in premature babies (El-Mohandes et al 1997; Morgan et al 2011; Noerr 2003; Quigley et al 2007; Wambach et al 2005). During the 1970s the protection afforded to newborns by human milk was beginning to be understood by biochemists, even if some of the mechanisms for this protection were not fully understood (Anon 1976; György 1971). Lack of clarity of definitions of breastfeeding intensity, or even the absence of definitions, meant that differences in outcomes between exclusively and non-exclusively breastfed (or breastmilk-fed) infants were not studied, and thus not understood. A study by Winberg and Wessner (1971) did note differences, finding that even in babies born at or close to term, those who developed infections had received less breastmilk than non-cases in an environment of routine use of artificial top-ups. Later, a study of the whole cohort of very low birth weight infants born in Norway in 1999–2000 found significant increases in septicaemia and necrotising enterocolitis in cases where there was a delay in full enteric feeding with human milk (mother’s own milk or banked milk) (Rønnestad et al 2005).

Dispensing the milk: raw, pasteurised or boiled?

Tassovatz and Kotsitch (1961) reported a persistent outbreak of enteric infection in a Belgrade SCU in 1959–1960, which continued despite care with classic infection control measures. This paper was cited by a number of other authors (Anon 1976; Gerrard 1974; Hanson & Winberg 1972; Honour & Dolby 1979). When data from the first 6-month period was analysed, the 883 infants able to feed directly at the breast, who also received a small quantity of sugar water, were free from illness, despite exposure to the pathogen. However, 16 out of 125 babies who received EBM heated to high temperatures became infected. The authors concluded that boiled human milk lacked the protective properties present in raw milk and predisposed infants to infection (Tassovatz & Kotsitch 1961). (Some English-speaking authors have translated the French word ‘cuit’ as ‘boiled’, because the context supports this; the present author agrees with this interpretation.) During the 3-month experimental period that followed, the Belgrade nursery stopped heat treating EBM and provided it raw and fresh to the premature, sick or debilitated infants who were unable to breastfeed directly. No new cases of gut infection occurred and this regimen was continued. In

their report in the French-language *Annales de Pédiatrie*, the authors credited the *bifidus* factor, in particular, with protecting the babies from *E. coli*, and blamed heating the milk to high temperatures for destroying this and other protective mechanisms (Tassovatz & Kotsitch 1961).

In a small Australian study (Stark & Lee 1982) in which all the preterm infants received pooled and frozen EBM which was heated to boiling point (100°C) before use, these infants were colonised by similar levels of facultatively anaerobic bacteria to artificially-fed term neonates. Colonisation with beneficial bifidobacteria was delayed. The authors concluded that the differences in the preterm infants *versus* breastfed infants born at term were due to gut environments related to prematurity and that frozen, heated EBM was of little value because the cellular components were destroyed. Kliegman and colleagues (1979) found that infants fed refrigerated human milk had a similar incidence of NEC to infants receiving other feedings. They attributed this to contamination of the EBM and the negative effects of storage. Williamson, Finucane and colleagues (1978) reported previous use of boiling of donor milk for sick or premature babies, but boiling was discontinued because of concerns about lower weight gains in the infants receiving it and the negative effects on the anti-infective properties.

The literature of the 1970s and 1980s identified species of *Staphylococci*, including *Staphylococcus aureus* (Beal, Ashdown & Mackay 1978; Law et al 1989; Williamson, Finucane et al 1978) and cytomegalovirus (Sauve et al 1985) as infection concerns for the use of the milk of an unrelated donor. The latter authors recommended freezing at -20°C, or pasteurisation, to eliminate cytomegalovirus from milk. The source of staphylococcal organisms was likely to be the donor's skin, nose and mouth. In Canada, Law and colleagues (1989) used raw human milk for premature infants, and discarded milk with excess bacterial levels only if it came from a donor other than the infant's own mother.

Milk banks in Norway have used raw donor milk from screened donors since the first one was established in 1941, and careful screening of donors continues today (Grøvslien & Grønn 2009). During this period, other hospitals in Australia and overseas used raw donor EBM after microbiological testing (Beal, Ashdown & Mackay 1978; Björkstén, et al. 1980; Law et al 1989; Williamson, Finucane et al 1979;). The procedure followed in the Townsville milk bank, similar to that used in Norway, was to conduct microbacteriological testing of samples of each milk batch and, after freezing and thawing, to feed the raw milk to the recipient babies (Beal, Ashdown & Mackay 1978). Other authors also considered human milk, provided it was microbiologically tested and gave low bacterial counts, safe to feed raw to hospitalised babies, provided milk with higher counts was either pasteurised or discarded (Davidson, Poll & Roberts 1979; Evans et

al 1978; Williamson, Finucane et al. 1978; Williamson, Hewitt et al 1978;). The bacterial load reported in non-heat-treated milk by Carroll and colleagues (1978) may well have been due to the drip method of collection, in breast shells while feeding from the other side. However, elsewhere bacterial load seems not to have been a problem (Williamson, Finucane et al 1978).

Other milk banks heat-treated the milk, either by pasteurisation or by boiling (Carroll et al 1978; Sauve et al 1985; Thorley 2000). Some reports from the period raised concerns about loss of immunological proteins and other factors from milk if the pasteurisation process used higher temperatures such as 73°C, either by design or inadvertently (Evans et al 1978). While there is some loss of protective factors associated with pasteurisation, acceptable concentrations remain if Holder pasteurisation at 63°C for 30 minutes is used, unlike in boiling (Tully, Jones & Tully 2001). As Hartmann and colleagues have pointed out, artificial baby milks completely lack these protective components (Hartmann et al 2007). However, a recent study by Untalan and colleagues suggests that, because of the marked decrease in the protective factors erythropoietin and interleukin-10, Holder pasteurisation of human milk may reduce its effectiveness against necrotising enterocolitis (Lawrence 2009; Untalan et al 2009).

The following examples from milk banks in other countries provide a wider context to this discussion of the use of raw or processed EBM. In their early years of operation, the two milk banks in Denmark sometimes used raw mothers' milk if it had been freshly expressed, though generally one or other method of pasteurisation was conducted (Pedersen 1982). The quality control for one of these milk banks, at the Fuglebakken Children's Hospital, involved instruction of donors on hygienic expression of their milk, in addition to visual, olfactory and bacteriological assessment and serology (Pedersen 1982). During the 1971–1973 period, the milk bank at Florence in Italy pasteurised and froze donor milk, which was collected from mothers in the community by a mobile van (Ragazzini, Bartolozzi & Boccadoro 1975). A recent study of the procedures for handling maternal or donor milk for premature infants in Sweden found that the 27 facilities with their own milk banks differed in their methods (Omarsdottir et al 2008). Donors were screened and most of the units pasteurised donor milk, but milk for the mother's own baby was neither cultured for bacteria nor pasteurised. Eleven of the facilities froze the expressed milk to prevent transmission of cytomegalovirus.

Following the publication of a paper on milk banking by Björkstén and colleagues (1980) there was a lively debate about the safety of using raw human milk from donors, some authors expressing concern (Baum 1980; Hall 1980) while others supported the use of raw EBM from

screened donors (Björkstén et al. 1981; Hoby, Hopper & Laurance 1980). In the medical literature during the 1980s, screening was controversial for other reasons. A 1984 survey of Canadian milk banks found that 58% of them did not conduct any form of screening, whether by questionnaire or by bacteriological testing of the milk (Sauve et al 1984, Nutrition Committee, Canadian Paediatric Society 1985). For different reasons, Bell and Marcovitch (1988) disputed the UK Department of Health & Social Services directive to use a questionnaire to conduct HIV screening of all women donating their milk to hospital milk banks, while not screening all maternity patients. They viewed the directive as certain to discourage milk donations and damaging to the goodwill between staff and donors. Law and colleagues (1989) were not convinced that screening programs involving culturing the milk were effective. Concern about transmission of HIV through breastmilk was not evident in the literature before 1985 (Ziegler et al 1985), though transmission through blood transfusions was already understood.

Implications for practice

Current discussion in professional literature, bureaucracies and the media about the use of banked EBM from an unrelated donor focuses on whether it is safe. This is an important issue, but a disproportional focus on this often leads to a disregard for the reasons why donor EBM is being considered in the first place. In other words, human milk is required to prove itself, whereas a constantly reformulated commercial product is regarded as so normal that its use goes unquestioned. In a society in which artificial substitutes, including preterm ABM, are considered the default option (to borrow computer terminology), it is timely to remember that human milk is a living fluid which provides active protection to the child, as well as species-specific nourishment. Even in a highly developed society, there is evidence that the consequences of not providing human milk to the most vulnerable of infants include an increase in the incidence of debilitating or life-threatening diseases of prematurity (Rønnestad et al 2005). Even for term infants, on a population basis there are measurable health costs from lack of breastfeeding (McNiel, Lobbok & Abrahams 2010), this includes deaths of infants in their first year who could have been saved with breastmilk, even in an advanced economy such as the United States (Chen & Rogan 2004).

In summary, this literature review of the use of donor human milk in Australia and elsewhere, with particular emphasis on the period to 1985, provides a context for the discussion of the safety of donor milk. The literature cited here reports the safe usage of both raw and pasteurised EBM in the past, and the protocols used, and provides reasons why the milk should not be heat treated to high temperatures such as boiling point. By examining past practices, as well as more recent protocols, clinicians and policy makers are better equipped to work towards

a resumption of the use of women's expressed milk as a normal procedure in hospitals.

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