

# Can CSII assist women with type 1 diabetes in breastfeeding?

Julie Abayomi, Gill Morrison, Kate McFadden, Lorna Wood, Tejpal Singh Purewal

## ARTICLE POINTS

**1** The health benefits of breastfeeding to both mother and child are well recognised.

**2** Health professionals need to be aware that mothers with type 1 diabetes potentially have more difficulties in successfully establishing lactation.

**3** Recent studies have indicated that continuous subcutaneous insulin infusion (CSII) can improve control of diabetes.

**4** Therefore, it is proposed that CSII may assist in minimising difficulties associated with diabetes and lactation and so aid mothers with type 1 diabetes to have a more 'normal' breastfeeding experience.

## KEY WORDS

- CSII
- Breastfeeding
- Lactation

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## Introduction

The health benefits of breastfeeding to both mother and child are well recognised and several studies show a protective effect of breastfeeding against type 1 diabetes in the child (Virtanen et al, 1991; Gerstein, 1994; Pettitt et al, 1997). Despite this motivating factor, prevalence of breastfeeding among UK women remains low (Hamlyn et al, 2002). For women with type 1 diabetes, evidence suggests that optimal glycaemic control during pregnancy, labour, delivery and the postnatal period is an essential component of successful breastfeeding (Ferris et al, 1988; Neubauer, 1990; Neubauer et al, 1993; Ostrom and Ferris, 1993; van Beusekom et al, 1993; Hartmann and Cregan, 2001). This article examines the use of continuous subcutaneous insulin infusion (CSII) in breastfeeding women with type 1 diabetes. The experiences of five such women at Liverpool Women's Hospital are described, and the cost-effectiveness of the use of CSII is explored.

Until recently, midwives and obstetricians advised women with type 1 diabetes against breastfeeding, mainly because of delays in lactation and periods of postpartum separation. However, improved management during pregnancy and better understanding of the condition now allows women with type 1 diabetes to breastfeed at rates similar to those of the general population (Ferris et al, 1988; Webster et al, 1995). Gagne et al (1992) found that most women with type 1 diabetes did not view diabetes as a significant factor when making the decision on feeding method. The women for whom type 1 diabetes was a factor were seeking a 'normal' childbearing experience, which included breastfeeding.

## Potential problems of breastfeeding with type 1 diabetes

Research has indicated that a large percentage of UK women stop breastfeeding within the first few weeks following delivery because of problems associated with poor management (that is, poor position and attachment; Hamlyn et al, 2002). Only 28% and 21% of UK mothers are still breastfeeding at 4 and 6 months, respectively. Moreover, 53% of

mothers with babies aged between 2 and 6 weeks gave 'insufficient milk' as the reason for ceasing breastfeeding (Hamlyn et al, 2002).

Delays in milk 'coming-in' and suppression of the 'let-down' reflex – the process of milk ejection, stimulated by a neuro-endocrine response to suckling (Sadler et al, 1999) – have both been related to mothers with type 1 diabetes. (Lactogenesis is the secretion of copious amounts of milk in the first few days after delivery; the feeling of fullness in the breast, resulting from this process, is often referred to as the milk 'coming-in' [Sadler et al, 1999].)

Such delays confirm beliefs regarding insufficient milk – undermining maternal confidence – and often result in supplementary feeds being offered to the baby, particularly if neonatal hypoglycaemia occurs (Haninger and Farley, 2001). Despite these additional problems, it is thought that breastfeeding rates among women with type 1 diabetes are comparable to those in the general population. Ferris et al (1988) found that at 6 weeks postpartum, an equal number of women in the two groups were breastfeeding, although greater difficulties were reported during the first postnatal week for the type 1 diabetes group.

The hormone prolactin is essential for milk production. Ostrom and Ferris (1993) identified that women with type 1 diabetes had lower serum prolactin concentrations during the first postnatal week. However, early breastfeeding activity, increased breastfeeding frequency and good glycaemic control were all associated with increased prolactin secretion.

Hartmann and Cregan (2001) stated that diabetes can either delay or suppress lactogenesis II (milk secretion) and can thus affect the successful establishment of lactation. They also found that women with type 1 diabetes took 24 hours longer to reach the lactogenesis milk-marker (lactose, citrate and total nitrogen) concentrations than women without type 1 diabetes.

Arthur et al (1989) suggest that a delay in lactose concentration changes in the colostrum of women with type 1 diabetes can result in reduced milk volume, as lactose draws water into the lactocyte by osmosis. This concurs with the findings of Neubauer et al (1993), who found that milk produced by women with type 1 diabetes had significantly lower levels of lactose, higher total nitrogen and reduced milk volume compared with women without type 1 diabetes. Nevertheless, they also stated that delayed lactogenesis was associated with poor metabolic control and that differences in milk composition did not prevent women with type 1 diabetes from breastfeeding.

It has been suggested that lactating women require an additional 500 kcal per day and that approximately 40–50 g of carbohydrate is lost via breast milk each day (Department of Health [DoH], 1991; Thomas, 2001; Reader and Franz, 2004). For women with type 1 diabetes, these losses can frequently result in hypoglycaemia (O'Sullivan, 1995; Diabetes UK, 2005), disrupting breastfeeding and causing distress. Ferris et al (1988) studied 30 breastfeeding mothers with type 1 diabetes and found that blood glucose levels were significantly lower during the exclusive breastfeeding period compared with non-breastfeeding women with type 1 diabetes, despite a higher calorie intake reported in the breastfeeding mothers.

Furthermore, maternal hypoglycaemia can increase secretions of epinephrine (adrenalin), which inhibits lactogenesis and interferes with the 'let-down' reflex (Walker, 2002).

To prevent such hypoglycaemic episodes, women are usually advised to increase their intake of carbohydrate, as snacks, either before or during a feed (Diabetes UK, 2005). This requires good organisational skills to ensure that snacks are prepared in advance, enabling them to be consumed when needed. For many women, this can prove to be too demanding, especially considering that during the first few post-natal weeks babies feed frequently during the night, when prolactin levels are highest (Walker, 2002). Moreover, attempts to provide extra snacks during hospital admissions, particularly during the night, are, in the authors' experience, often futile.

Conversely, other studies have shown marked hyperglycaemia in breastfeeding women with type 1 diabetes. Murtaugh et al (1998) found high postprandial blood glucose levels and increasing HbA<sub>1c</sub> values at 6 weeks postpartum, reflecting poor stability of diabetes. Van Beusekom et al (1993) found that the macro- and micronutrient content of breast milk was normal in women with tightly controlled type 1 diabetes (mean HbA<sub>1c</sub>, 5.2%), whereas nutritional abnormalities have been reported in milk from mothers with moderate or poor control (Plagemann et al, 2002; Neubauer, 1990).

Breastfeeding mothers with type 1 diabetes are also more likely to be diagnosed with mastitis (Ferris et al 1988; Gagne et al 1992); this may further deter them from successful breastfeeding.

Overall, the evidence suggests that optimal glycaemic control during pregnancy, labour, delivery and the postnatal period is an essential component of successful breastfeeding (Ferris et al, 1988; Neubauer, 1990; Neubauer et al, 1993; Ostrom and Ferris, 1993; van Beusekom et al, 1993; Hartmann and Cregan, 2001). Other important factors include:

- minimising postpartum separation of mother and baby (Haninger and Farley, 2001)

### PAGE POINTS

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**4** Overall, the evidence suggests that optimal glycaemic control during pregnancy, labour, delivery and the postnatal period is an essential component of successful breastfeeding.

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**1** Recent studies have indicated that continuous subcutaneous insulin infusion (CSII) can improve control of diabetes as indicated by improved HbA<sub>1c</sub> values and less hypoglycaemia.

**2** There is also evidence that CSII improves control of diabetes during pregnancy.

**3** Many centres in the UK only receive funding for insulin pumps to be used during pregnancy, resulting in the withdrawal of CSII immediately after birth.

- avoiding supplementary feeds (unless medically indicated; Haninger and Farley, 2001)
- early breastfeeding activity or stimulation (including breast milk expression during periods of separation; Ferris et al, 1988; Fagen, 1998)
- increased breastfeeding frequency (Neubauer, 1990; Ostrom and Ferris, 1993)
- mastitis monitoring and breast care (Ferris et al, 1988; Neubauer, 1990; Fagen, 1998)
- adequate maternal calories or maternal diet (Ferris et al, 1988; Neubauer, 1990; Fagen, 1998; Reader and Franz, 2004)
- appropriate counselling or support (Gagne et al, 1992; Ferris et al, 1993; Fagen, 1998)
- strategies for dealing with initial problems (Gagne et al, 1992).

### CSII and improved control of diabetes

Recent studies have indicated that continuous subcutaneous insulin infusion (CSII) can improve control of diabetes as indicated by improved HbA<sub>1c</sub> values and less hypoglycaemia. Pickup et al (2005) found a mean reduction of 1.4% (range, 0.4–2.7%) in HbA<sub>1c</sub> following 6 months on CSII and a fall in the number of hypoglycaemic episodes, even though individuals previously suffered frequent, unpredictable and disabling episodes on traditional therapy. In another study, Pickup et al (2002) found lower mean blood glucose concentrations (–1.0 mmol/l) and lower mean HbA<sub>1c</sub> (–0.51%) in people receiving CSII. It was further noted that the improved glycaemic control was achieved with 14% less insulin.

This concurs with Boland et al (1999), who found that HbA<sub>1c</sub> among CSII-treated adolescents was significantly lower at 6 and 12 months, with mean values of 7.7% and 7.5%, respectively. Despite the lower HbA<sub>1c</sub> in this group, severe hypoglycaemic events were reduced by up to 50%. Moreover, this study found that adolescents using CSII deemed coping with diabetes to be less demanding than adolescents using traditional therapy.

Bode et al (1996) found a distinct and persistent reduction in the incidence of severe hypoglycaemia with CSII, with a fall from 138 events to 22 events in the first year; 26, 39 and 36 events were reported in the second, third and fourth years, respectively.

There is also evidence that CSII improves control of diabetes during pregnancy. Consequently, insulin pumps are recommended for use in pregnancy by the National Institute for Health and Clinical Excellence (NICE; formerly the National Institute for Clinical Excellence) if needed (NICE, 2003):

***‘The additional tighter and more flexible control of blood glucose and avoidance of hypoglycaemia afforded by CSII therapy might be required.’***

However, NICE (2003) goes on to say:

***‘Many such women would eventually return to [multiple daily injection] therapy after their pregnancy and postpartum period.’***

Gottlieb et al (2002) stated that CSII in pregnancy promotes lifestyle flexibility and may reduce the incidence of hypoglycaemia. Coustan et al (1986) found that excellent metabolic control was achieved with CSII in pregnancy. Furthermore, Morrison et al (2005) found that women using CSII could be taught to self-manage glycaemic control throughout the intrapartum period, avoiding the need for intravenous infusion. However, in the authors’ opinion many centres in the UK only receive funding for insulin pumps to be used during pregnancy, resulting in the withdrawal of CSII immediately after birth.

### Breastfeeding and CSII

At Liverpool Women’s Hospital, five women have attempted breastfeeding alongside CSII. Despite these small numbers, the lessons learnt from their experiences are worth noting, as very little practical information regarding breastfeeding and CSII is currently available.

Three of the women commenced CSII while pregnant, with a mean gestation of 13 weeks (range, 9–19 weeks). Therefore, these individuals did not have an ‘established’ basal rate that they could return to post-delivery. A practice adopted arbitrarily by many centres suggests that pre-delivery basal rate should be reduced by 50% post-delivery. However, the experience at the hospital has been that this is often too aggressive. For example, one woman required a basal rate of 20.5 units per day at 36 weeks of gestation, whereas following delivery at 37 weeks she only required 2.4 units for the first 24 hours (0.1 unit per hour) to maintain glycaemic control. This ‘honeymoon’ phase, where little or no insulin is required, is a result of hormone depletion following delivery of the placenta and usually lasts for several hours (Fagen, 1998). With traditional therapy, this individual would have been continuously hypoglycaemic, seriously impairing her ability to breastfeed.

Frequent blood glucose monitoring during this time is essential to achieve a new balance between food intake and insulin dosage. Increased insulin sensitivity post-delivery must be considered, as insulin demands (including correction dose and insulin-to-carbohydrate ratio) may vary dramatically.

Strategies employed at the hospital to manage breastfeeding with CSII include:

- use of a conservative basal rate
- further reducing the post-delivery basal insulin rate by 20%
- testing blood and correcting any low blood glucose levels prior to feeding.

Some of the breastfeeding women experienced hypoglycaemia initially in a minor form, despite the strategies outlined above, but the following interventions corrected this:

- encouraging additional carbohydrate snacks prior to or during breastfeeding
- reducing the carbohydrate-to-insulin ratio for an insulin bolus given with these extra snacks (that is, 1 unit:20g instead of 1 unit:10g).

Two women continued to have persistent hypoglycaemic episodes, despite receiving the above advice, but it became apparent that they were determined to lose weight

quickly following their pregnancy and were avoiding additional snacks as a result. One was also exercising regularly, after the morning feed, without any additional carbohydrate intake. Both women had expressed a desire to limit weight gain during their pregnancy, despite having normal pre-pregnancy body mass index.

The inclusion of additional snacks is recommended to meet the increased energy requirements of lactation, and CSII should allow more flexibility regarding the timing and nature of these snacks in the diet. For example, women could include snacks during the day, when it is more convenient to prepare them, despite increased breastfeeding activity being during the night. Reducing the basal insulin rate further overnight may be sufficient to prevent nocturnal hypoglycaemia in these circumstances.

Currently, all women with type 1 diabetes opting to breastfeed at the hospital are provided with written guidelines, outlining recommendations on balancing diet and insulin requirements and indicating how they can access additional support if needed.

Changes in body weight and control of diabetes, as indicated by HbA<sub>1c</sub>, were unremarkable in all five breastfeeding women. Mean body mass index was 25.5 kg/m<sup>2</sup> (range, 22–34 kg/m<sup>2</sup>) and mean HbA<sub>1c</sub> was 7.0% (range, 6.1–7.7%), indicating good glycaemic control.

### Is CSII a cost-effective way of managing lactation?

It is estimated that if 1% of people with type 1 diabetes used CSII, the cost to the National Health Service (NHS) in England and Wales would be approximately £3.5 million (Colquitt et al, 2004). Nevertheless, research indicates that CSII is a cost-effective method of managing hypoglycaemia, considering the cost of admitting and treating multiple hypoglycaemic episodes on traditional therapy every year (Scuffham and Carr, 2003). Furthermore, Roze et al (2005) found that CSII was associated with an improvement in mean quality-adjusted life expectancy, owing to reduced incidence of diabetes complications.

### PAGE POINTS

**1** The inclusion of additional snacks is recommended to meet the increased energy requirements of lactation, and continuous subcutaneous insulin infusion (CSII) should allow more flexibility regarding the timing and nature of these snacks in the diet.

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**1** There are many studies highlighting the significant cost to the NHS of not breastfeeding, suggesting that successful breastfeeding could be a very cost-effective method of reducing NHS expenditure.

**2** It could be argued that continuous subcutaneous insulin infusion (CSII) has the potential to save the NHS money by facilitating successful breastfeeding among women with type 1 diabetes, who may otherwise struggle and eventually cease breastfeeding using traditional therapy.

**3** Research indicates that optimum control of diabetes enhances milk production and quality and boosts maternal confidence.

**4** It is proposed that CSII may assist in minimising difficulties associated with diabetes and lactation and so aid mothers with type 1 diabetes to have a more 'normal' breastfeeding experience.

No such studies regarding CSII and lactating women exist. However, there are many studies highlighting the significant cost to the NHS of not breastfeeding, suggesting that successful breastfeeding could be a very cost-effective method of reducing NHS expenditure. For example, it is estimated that £35 million is spent on treating formula-fed babies with gastro-enteritis per year, and that for each 1% rise in breastfeeding rate at 13 weeks, the NHS would save £500 000 from reduced incidence of gastro-enteritis alone (DoH, 1995).

In the USA, it is predicted that a minimum of \$3.6 billion could be saved if breastfeeding rates increased from present levels (64% at initiation; 29% at 6 months) to recommended levels (75% at initiation; 50% at 6 months). These figures are based on reduced incidence of otitis media, gastro-enteritis and necrotising enterocolitis only (Weimer, 2001).

It could therefore be argued that CSII has the potential to save the NHS money by facilitating successful breastfeeding among women with type 1 diabetes, who may otherwise struggle and eventually cease breastfeeding using traditional therapy.

## Conclusion

In the authors' opinion, breastfeeding is the best way to feed babies and should be encouraged among women with type 1 diabetes as it is in the general population. Health professionals need to be aware that mothers with type 1 diabetes potentially have more difficulties in successfully establishing lactation and need appropriate advice and support to minimise these difficulties.

Research indicates that optimum control of diabetes (including the avoidance of hypoglycaemia), enhances milk production and quality and boosts maternal confidence. Studies also suggest that CSII can be a useful tool in improving control of diabetes, as indicated by lower HbA<sub>1c</sub> levels and reduced frequency of hypoglycaemia. Therefore, it is proposed that CSII may assist in minimising difficulties associated with diabetes and lactation and so aid mothers with type 1 diabetes to have a more 'normal' breastfeeding experience. ■

## Recommendations

- Women with type 1 diabetes should be given additional information and support to reduce potential difficulties and enable them to breastfeed successfully.
- The authors of this paper propose that the National Institute for Health and Clinical Excellence should review its recommendations regarding continuous subcutaneous insulin infusion (CSII) in pregnancy with the intention of extending its use to include lactation.
- More research is required looking at breastfeeding and diabetes in general and regarding CSII in particular.

Arthur PG, Smith M, Hartmann PE (1989) Milk lactose, citrate, and glucose as markers of lactogenesis in normal and diabetic women. *Journal of Paediatric Gastroenterology and Nutrition* **9**(4): 488–96

Bode BW, Steed RD, Davidson PC (1996) Reduction in severe hypoglycemia with long-term continuous subcutaneous insulin infusion in type 1 diabetes. *Diabetes Care* **19**(4): 324–7

Boland EA, Grey M, Oesterle A, Fredrickson L, Tamborlane WV (1999) Continuous subcutaneous insulin infusion. A new way to lower risk of severe hypoglycaemia, improve metabolic control, and enhance coping in adolescents with type 1 diabetes. *Diabetes Care* **22**(11): 1779–84

Colquitt JL, Green C, Sidhu MK, Hartwell D, Waugh N (2004) Clinical and cost effectiveness of continuous subcutaneous insulin infusion for diabetes. *Health Technology Assessment* **8**(3). <http://www.nchta.org/execsumm/summ843.htm> (accessed 24.10.2005)

Coustan DR, Reece EA, Sherwin RS, Rudolf MC, Bates SE, Sockin SM et al (1986) A randomized clinical trial of the insulin pump vs intensive conventional therapy in diabetic pregnancies. *Journal of the American Medical Association* **255**(5): 631–6

Department of Health (DoH; 1991) *Dietary Reference Values for Food, Energy & Nutrients for the UK*. Her Majesty's Stationery Office, London

DoH (1995) *Breastfeeding: Good Practice Guidance to the NHS*. DoH, London

Diabetes UK (2005) *Recommendations for the management of pregnant women with diabetes (including Gestational diabetes)*. Diabetes UK, London. Available at <http://www.diabetes.org.uk/infocentre/carerec/preg4.doc> (accessed 24.10.2005)

- Fagen C (1998) Preparing pregnant women with diabetes for special breast-feeding challenges. *Journal of the American Dietetic Association* **98**(6): 648
- Ferris AM, Dalidowitz CK, Ingardia CM, Reece EA, Fumia FD, Jensen RG, Allen LH (1988) Lactation outcome in insulin-dependent diabetic women. *Journal of the American Dietetic Association* **88**(3): 317–22
- Ferris AM, Neubauer SH, Bendel RB, Green KW, Ingardia CJ, Reece EA (1993) Perinatal lactation protocol and outcome in mothers with and without insulin-dependent diabetes mellitus. *American Journal of Clinical Nutrition* **58**(1): 43–8
- Gagne MP, Leff EW, Jefferis SC (1992) The breast-feeding experience of women with type I diabetes. *Health Care for Women International* **13**(3): 249–60
- Gerstein HC (1994) Cow's milk exposure and type I diabetes mellitus. A critical overview of the clinical literature. *Diabetes Care* **17**(1): 13–9
- Gottlieb PA, Frias JP, Peters KA, Chillara B, Garg SK (2002) Optimizing insulin therapy in pregnant women with type I diabetes mellitus. *Treatments in Endocrinology* **1**(4): 235–40
- Hamlyn B, Brooker S, Oleinikova K, Wands S (2002) *Infant feeding 2000*. The Stationery Office, London
- Haninger NC, Farley CL (2001) Screening for hypoglycemia in healthy term neonates: effects on breastfeeding. *Journal of Midwifery & Women's Health* **46**(5): 292–301
- Hartmann P, Cregan M (2001) Lactogenesis and the effects of insulin-dependent diabetes mellitus and prematurity. *Journal of Nutrition* **131**(11): 3016S–20S
- Morrison G, Weston PJ, Hill K, Walkinshaw SA, Purewal TS (2005) Can women be empowered to self manage CSII during labour in a stand-alone maternity unit? *Diabetes UK Annual Professional Conference*. Glasgow, UK, 2–22 April 2005. Oral A105
- Murtaugh MA, Ferris AM, Capacchione CM, Reece EA (1998) Energy intake and glycemia in lactating women with type I diabetes. *Journal of the American Dietetic Association* **98**(6): 642–8
- National Institute for Clinical Excellence (NICE; 2003) *Full Guidance on the use of continuous subcutaneous insulin infusion for diabetes*. Technology Appraisal 57. NICE, London. Available at <http://www.nice.org.uk/page.aspx?o=58213> (accessed 24.10.2005)
- Neubauer SH (1990) Lactation in insulin-dependent diabetes. *Progress in Food & Nutrition Science* **14**(4): 333–70
- Neubauer SH, Ferris AM, Chase CG, Fanelli J, Thompson CA, Lammi-Keefe CJ et al (1993) Delayed lactogenesis in women with insulin-dependent diabetes mellitus. *American Journal of Clinical Nutrition* **58**(1): 54–60
- O'Sullivan DF (1995) Diabetes and breast feeding. *British Medical Journal* **311**(6997): 123
- Ostrom KM, Ferris AM (1993) Prolactin concentrations in serum and milk of mothers with and without insulin-dependent diabetes mellitus. *American Journal of Clinical Nutrition* **58**(1): 49–53
- Pettitt DJ, Forman MJ, Hanson RL, Knowler WC, Bennett PH (1997) Breastfeeding and incidence of non-insulin-dependent diabetes mellitus in Pima Indians. *Lancet* **350**(9072): 166–8
- Pickup J, Mattock M, Kerry S (2002) Glycaemic control with continuous subcutaneous insulin infusion compared with intensive insulin injections in patients with type I diabetes: meta-analysis of randomised controlled trials. *British Medical Journal* **324**(7339): 705
- Pickup JC, Kidd J, Burmiston S, Yemane N (2005) Effectiveness of continuous subcutaneous insulin infusion in hypoglycaemia-prone type I diabetes: Implications for NICE guidelines. *Practical Diabetes International* **22**(1): 10–4
- Plagemann A, Harder T, Franke K, Kohlhoff R (2002) Long-term impact of neonatal breast-feeding on body weight and glucose tolerance in children of diabetic mothers. *Diabetes Care* **25**(1): 16–22
- Reader D, Franz MJ (2004) Lactation, diabetes and nutrition recommendations. *Current Diabetes Reports* **4**(5): 370–6
- Roze S, Valentine WJ, Zakrzewska KE, Palmer AJ (2005) Health-economic comparison of continuous subcutaneous insulin infusion with multiple daily injection for the treatment of Type I diabetes in the UK. *Diabetic Medicine* **22**(9): 1239–45
- Sadler MJ, Strain JJ, Caballero B, eds. (1999) *Encyclopedia of Human Nutrition*. Academic Press, London
- Scuffham P, Carr L (2003) The cost-effectiveness of continuous subcutaneous insulin infusion compared with multiple daily injections for the management of diabetes. *Diabetic Medicine* **20**(7): 586–93
- Thomas B (2001) *Manual of Dietetic Practice* (3rd edition). Blackwell Science, Oxford
- van Beusekom CM, Zeegers TA, Martini IA, Velis HJ, Visser GH, van Doormaal JJ, Muskiet FA (1993) Milk of patients with tightly controlled insulin-dependent diabetes mellitus has normal macronutrient and fatty acid composition. *American Journal of Clinical Nutrition* **57**(6): 938–43
- Virtanen SM, Rasanen L, Aro A, Lindstrom J, Sippola H, Lounamaa R et al (1991) Infant feeding in Finnish children less than 7 yr of age with newly diagnosed IDDM. Childhood Diabetes in Finland Study Group. *Diabetes Care* **14**(5): 415–7
- Walker M, ed. (2002) *Core Curriculum for Lactation Consultant Practice*. Jones and Bartlett, London
- Webster J, Moore K, McMullan A (1995) Breastfeeding outcomes for women with insulin dependent diabetes. *Journal of Human Lactation* **11**(3): 195–200
- Weimer J (2001) *The Economic Benefits of Breastfeeding: A Review and Analysis*. Economic Research Service, Washington, DC. Available at <http://www.ers.usda.gov/publications/fanrr13/fanrr13.pdf> (accessed 24.10.2005)

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