

TITLE: Experiences of expressing and storing colostrum antenatally; a qualitative study of mothers in regional Western Australia

Joanna M Brisbane

BSc(Hon) Grad Dip Genet Counsell MPH

Roslyn C Giglia (corresponding author)

PhD MPH GradDipDiet BAppSc

Curtin University

School of Public Health

WA Centre for Health Promotion Research

GPO Box U1987 Perth WA 6845

Tel | +61 8 9266 9592

Fax | +61 8 9266 2958

R.Giglia@exchange.curtin.edu.au

Word Count

Abstract: 151 words

Main Text: 3474 words (excluding references)

Key Words: antenatal, breast milk, colostrum, efficacy, expression

Acknowledgements

The authors thank all the women who participated in the study and the continuous support of the midwifery staff.

1 **ABSTRACT**

2

3 This qualitative study explored the experiences and breastfeeding outcomes of a group of
4 mothers who expressed colostrum in the antenatal period.

5 In depth interviews were conducted over the telephone with twelve women who had attended
6 a unique antenatal lactation clinic appointment at 37 weeks gestation. Seven main response
7 themes were identified. Most women reflected positively upon their attendance and reported
8 that the experience of expressing colostrum allowed them to become familiar with their
9 breasts and gave them a sense of security by having a supply of colostrum stored for possible
10 use after birth. The main negative emotions reported were a sense of embarrassment at
11 expressing the colostrum, particularly in front of another person, the difficulties with
12 expressing colostrum, and in one instance the physical pain associated with the process.

13 Antenatal expression of colostrum may improve maternal breastfeeding confidence. Further
14 research using long-term records will determine whether this practice improves breastfeeding
15 outcomes.

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20 **KEY WORDS**

21 antenatal, breastmilk, colostrum, efficacy, expression

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1 INTRODUCTION

2 Historically, pregnant women were encouraged to express colostrum during late pregnancy as
3 a means of potentially encouraging breastmilk production and to allow the storage of
4 colostrum for the neonate.(Cox, 2006) However the practice of antenatal breastmilk
5 expression fell out of favour during the late 1970s following concerns that the nipple
6 stimulation and the concomitant release of oxytocin may induce uterine contractions and the
7 commencement of labour.(Cox, 2010) This is despite the fact that breastfeeding of another
8 child often continues safely throughout pregnancy for many women.(Madarshahian and
9 Hassanabadi, 2012)

10 Previous research has shown that the expression of colostrums daily from 37 weeks gestation
11 onwards resulted in a reduced reliance on artificial infant milk at delivery and a more rapid
12 arrival at full breastfeeding, when compared to a control group.(Singh et al., 2009; Gurneesh
13 and Ellora, 2009) Despite the unique composition of colostrum, its role in stimulating
14 breastmilk production and unique immuno-protective properties,(National Health and
15 Medical Research Council, 2013) it is surprising that the practice of antenatal expression has
16 almost disappeared from modern society.

17 As the composition of colostrum changes and breastfeeding is established, the breastmilk also
18 delivers sustenance and immune protection for the growing infant. Breastmilk is widely
19 acknowledged as the optimal food for infants, and it is recommended that infants be
20 exclusively breastfed for the first six months and breastfed in conjunction with
21 complementary foods for 12 months or beyond.(National Health and Medical Research
22 Council, 2013)

23 Initiation rates of breastfeeding are high in Australia, with almost 96% of babies being
24 breastfed at birth.(Australian Institute of Health and Welfare, 2011) However with increasing

1 age this figure declines rapidly and national indicators show only 70% of children receiving
2 any breastmilk at three months of age, 60% at six months, and less than 18% by 12
3 months.(Australian Institute of Health and Welfare, 2011) The most commonly cited reason
4 as to why women cease to breastfeed their child is due to a perception that they are not able
5 to produce enough milk for their child.(Australian Institute of Health and Welfare, 2011) This
6 is followed by an inability to attach the baby properly to the breast, or due to the infant being
7 unsettled, which is often interpreted by mothers as being due to an inadequate milk
8 supply.(Australian Institute of Health and Welfare, 2011; Binns and Scott, 2002) Interestingly
9 maternal self report of low milk supply is typically linked to lower self-confidence in
10 parenting abilities.(McCarter-Spaulding and Kearney, 2001)

11 Most women in Australia attend some form of antenatal education classes during their
12 pregnancy.(Lumley and Brown, 1993) Antenatal classes are typically run by the health care
13 provider (e.g. hospital, midwifery service) and cover topics such as prenatal care, birthing
14 options and care of the infant, including feeding options.(Gagnon and Sandall, 2007)

15 Numerous studies have focussed specifically on the efficacy of antenatal breastfeeding
16 education programs for increasing the rate of initiation and the duration of
17 breastfeeding.(Lumbiganon et al., 2011) Typically these studies involve the delivery of
18 formal breastfeeding education programmes via printed, spoken or electronic mediums.

19 Individual consultations between health professionals and expectant mothers have been
20 shown to be particularly effective in maintaining extended breastfeeding.(Pannu et al., 2010)

21 To date however, there have been few reported studies involving physical examination or
22 manipulation of the breasts during pregnancy included as part of the antenatal breastfeeding
23 education. This paper will discuss the qualitative outcomes of women who attend a unique 37
24 week gestation clinic which supports the antenatal expression of colostrum.

1 METHODOLOGY

2 The Pregnancy Care Clinic is offered as an optional part of routine antenatal care to all
3 pregnant women who are scheduled to deliver at a six bed obstetric ward, in a regional
4 hospital in the South West of Western Australia.

5 The clinic visit is typically held at around 37 weeks of gestation and takes approximately one
6 hour. The meeting is conducted by a single midwife and only one pregnant woman attends
7 per clinic with their support person if applicable. The clinic focuses on breastfeeding
8 education and ascertains previous breastfeeding experience, outlines the benefits of
9 breastfeeding, difficulties which may be encountered and breastfeeding techniques. There is a
10 particular emphasis on the expression of colostrum commencing at 37 weeks gestation and
11 this is demonstrated by viewing one or more instructional DVDs. The pregnant woman is
12 able to practice expressing breastmilk either on the model or on herself at the clinic. The
13 woman is then given instructions and materials (e.g. syringes) to collect and safely store any
14 expressed breastmilk prior to the birth. She is asked to bring any frozen expressed breastmilk
15 in the syringes provided, to the hospital upon returning for delivery.

16 Women who had been subjects in a larger state wide cohort study called the Regional Infant
17 Feeding Study (RIFS), and had attended the Pregnancy Care Clinic up to 18 months prior,
18 and had a successful delivery, were contacted by telephone and verbally invited to participate
19 in the study. The RIFS investigated breastfeeding outcomes over 12 months in regional
20 Western Australian (WA) women and details relating to the methodology of this study have
21 yet to be published. Agreement to be involved was taken as consent and a time and date for
22 the telephone interview was organised between the mother and researcher.

23 The telephone interviews were conducted in July and August 2012 using Skype via a
24 computer connection and were recorded. A previously piloted questionnaire script was used

1 as a prompt by the interviewer to ensure topics were covered, but was only referred to when
2 focus was required. Breastfeeding in this instance is referred to as 'any instance of
3 breastfeeding' as per the WHO guidelines.(World Health Organisation, 2008)

4 Interviews were transcribed and then read through by the researcher. Qualitative content
5 analysis was then used to summarise recurring themes (Morgan, 1993). Specifically,
6 significant themes were identified upon an initial read through of the transcripts. Each
7 interview line which conveyed a participant emotion or response was then assigned to one of
8 these categories. Further readings were then performed to ensure that all themes were
9 captured.

10 Ethics approval for this study was granted by the Curtin University Human Research Ethics
11 Committee and the Western Australian (WA) Country Health Service Ethics Committee of
12 the Department of Health, WA.

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14

1 RESULTS

2 Forty-six women had participated in the RIFS and had delivered at the regional hospital
3 between December 2010 and December 2011. Of these, two women had withdrawn from the
4 RIFS and so were not contacted and the telephone numbers provided by a further three
5 women were invalid, leaving a total of 41 women eligible to participate. Of these, 12 women
6 were contacted but did not attend the clinic and a further 17 were unable to be contacted
7 despite repeated attempts. One of the major reasons given by mothers for not attending the
8 clinic was that the mother had prior breastfeeding experience. Overall a subsample of 12
9 women consented to be interviewed. The response rate for this survey was therefore 29.3%
10 (12/41).

11 Baseline data was available for 45 of the 46 women who delivered at the regional hospital. Of
12 the 45 women, 37.8% were primiparous with a mean age of 30.4 years. The mean age of the
13 12 participating women was also 30.5 years. These figures are similar to the latest perinatal
14 statistics released for the state of Western Australia in which 42.4% of mothers were
15 primiparous with a mean age of 29.6 years (Joyce and Hutchinson, 2012). Approximately
16 28% of the women (n=45) from which the sample was drawn and 33.3% of women from
17 sample population (n=12) respectively, delivered babies via Caesarean section compared with
18 33.6% state wide. Breastfeeding was initiated in 95.6% of the 45 women and 100% of the
19 sample population, compared with 96% Australia-wide for the same time period (Australian
20 Institute of Health and Welfare, 2011). Reflecting the low-risk nature of the regional hospital
21 facility, there were no low birthweight babies (<2500g) in the overall population and sample
22 population.

23 Interviews were obtained from twelve women who had attended the clinic at around 37
24 weeks of gestation. The eldest infant was around 18 months old at the time of interview and

1 the youngest was 10 months old. All of the babies were born at full-term gestation. There
2 were seven female babies and five male babies. Nine babies were the mother's first child
3 while the remaining three were the mother's second child. At the time of delivery, all women
4 resided in one of three postcode areas, surrounding the hospital.

5 Ten of the 12 participants breastfed for at least six months. The average breastfeeding
6 duration for these ten women was 10.8 months. The two that ceased before this time
7 developed mastitis and stopped breastfeeding at five weeks and five months respectively.
8 Four participants were still breastfeeding at the time of interview (at 10 months, 11 months,
9 14 months and 18 months).

10 Three women chose not to express colostrum. Of the remaining nine women, four used the
11 colostrum to supplement their newborn. Of those women who attempted to express
12 colostrum, the average number of syringes collected was 6.1 (range = 1-12).

13 After an initial read through of interview transcripts, seven common themes relating to the
14 participant experiences of the clinic were identified.

15 *Embarrassment/awkwardness*

16 Embarrassment and awkwardness were reported by many participants, both primiparous and
17 multiparous, and particularly by those who undertook colostrum expression in the presence of
18 the midwife. Although, most women preferred to attempt the expressing of colostrum in
19 private, practice at expressing colostrum in the presence of the midwife was offered to all
20 participants. Mothers were asked if they attempted expressing colostrum during the clinic.

21

1 *'The actual experience of going there was quite awkward and embarrassing.... it was*
2 *a bit weird at first..... She <the midwife> probably saw that I was embarrassed and*
3 *that I would rather go home and work it out, which I did.'*

4 ***Confidence/mastery***

5 Several women reported that the experience of breastmilk expression helped to bolster their
6 confidence in their breastfeeding journey. The visualisation of the expressed colostrum in
7 particular, provided reassurance that their breasts were performing as required.

8

9 *'...but I think that in terms of giving me confidence that the colostrum was there and*
10 *that my boobs were normal and working fine and that I'd be able to breastfeed, it*
11 *really gave me that confidence.....then I got the hang of it <expressing> and it helped*
12 *me to relax when it actually came to breastfeeding. I don't know how easy*
13 *breastfeeding would have been if I hadn't done it actually.... it sort of shows, "yeah,*
14 *there's colostrum in there. It's working, they work. All you've got to do now is have*
15 *the baby and you should be 'right.'" So it's one less thing to worry about, I think.*
16 *About whether you're normal and whether it will be OK. I reckon I would have*
17 *struggled without that actually.'*

18

19 ***Familiarity***

20 Closely linked to the issue of breastfeeding mastery, was that of familiarity with the breasts.
21 Many participants reported that it was useful to become familiar with how to manipulate their
22 breasts for breastfeeding as well as a change in mindset in which their breasts were to be
23 used, as a source of nutrition for their child. Several women also reported that it was useful to

1 become comfortable and adept at expressing milk as a means of preventing or treating
2 mastitis.

3

4 *'I think it was also for me to get used to me feeling my breasts in that way. I know*
5 *that sounds funny to say, but I never did that before and <after> having a baby I*
6 *realised it was quite a common feeling and thing to do.'*

7

8 ***Difficulty/Challenging***

9 For many women, the physical aspects of colostrum expression were challenging. One
10 woman found it physically painful and was reluctant to continue expressing for this reason.

11

12 *'...then over the next few weeks I practiced hand-expressing and I was getting quite*
13 *annoyed and nervous every time I tried to do it, but then I got the hang of it... I found*
14 *it quite hard.'*

15

16 ***Security***

17 The thought of having a ready supply of breastmilk for use in the event of neonatal feeding
18 problems proved reassuring to many women.

19

20 *'I think that expressing leading up to the birth was probably quite reassuring actually,*
21 *knowing that it was just one less thing that I have to worry about, and a bit of a safety*

1 *net... you get a couple of days to get yourself sorted... rather than it's all gone wrong,*
2 *what do we do now?'*

3

4

5 ***Vicarious learning***

6 Some women appreciated the opportunity to observe other women breastfeeding or
7 expressing breastmilk. Repeated viewing of the educational DVD, particularly in conjunction
8 with actual breastfeeding or expressing, was recalled as a positive experience by participants.

9

10 *'We watched it again in the hospital after the baby was born... the video showed over*
11 *and over again baby attaching which I thought was really, really good, I think that*
12 *really helped.'*

13

14 One woman commented negatively about the presentation of the material.

15 *'....they probably need to redo the video with someone who looks like they're actually*
16 *a mother.... I think that probably put me off a bit, the breastfeeding...'*

17

18 ***Futility***

19 One woman stated that she saw the exercise of breastmilk expression as not being worthwhile
20 when asked about using the colostrum in hospital to feed the baby.

21

1 *'I didn't, no. I just thought, what's that really going to do? ... I don't know what the*
2 *point of this is really.'*

3

1 **DISCUSSION**

2 Breastfeeding is the optimal method of infant feeding and any level of breastfeeding,
3 preferably exclusive, delivers unparalleled benefits to the infant, mother and community.

4 Despite national and international breastfeeding policy recommendations and support, current
5 long term breastfeeding outcomes in Australia are falling short of projected goals.(Australian
6 Institute of Health and Welfare, 2011)

7 Anecdotally it has been suggested that expressing colostrum prenatally may result in
8 improved long-term breastfeeding outcomes, and this has been proven to be the case in the
9 immediate neonatal period.(Gurneesh and Ellora, 2009; Singh et al., 2009; Forster et al.,
10 2011; Soltani and Scott, 2012) The mechanism by which this operates may be both
11 physiological, as has been demonstrated in animal studies,(Rastani et al., 2007) and
12 psychological, by increasing the mothers confidence and preparedness for
13 breastfeeding.(Forster et al., 2011)

14 According to Bandura's Social Cognitive Theory, the performance of a given health
15 behaviour is dependent upon an individual's self efficacy or belief in their ability to succeed
16 at a specific task.(Bandura, 1986; National Cancer Institute, 2005) In choosing to perform a
17 specific health behaviour, an individual's response is typically modulated by four main
18 factors and in the example of breastfeeding this would be; previous breastfeeding experiences
19 (enactive mastery); exposure to breastfeeding (vicarious experience); encouragement from
20 peers or health professionals (verbal persuasion); and physiological responses.

21 With respect to breastfeeding, enactive mastery relates to any previous breastfeeding
22 experience that the mother has had. Where that experience was considered a success by the
23 participant, the self-efficacy of the participant is likely to increase, making it more likely that
24 the health behaviour will be initiated and maintained. In this study, although breastfeeding

1 itself was not directly examined, it was postulated that successful prenatal expression of
2 colostrum may contribute towards mastery of the task, thus improving breastfeeding
3 outcomes. Indeed, several women reported that they felt that the experience of expressing the
4 colostrum gave them confidence in the fact that their bodies were able to perform as
5 expected, particularly as they were able to observe the expressed colostrum, the absence of
6 which has been noted as a contributing factor to perceived milk insufficiency.(Morse and
7 Bottorff, 1988; Dykes and Williams, 1999)

8 Additionally, some of the women in this study reported that they gained a sense of familiarity
9 with their breasts and how they worked prior to the actual experience of breastfeeding a baby.
10 Although research specifically examining the connection between breastmilk expression and
11 long-term breastfeeding outcomes has not been conducted, several studies have demonstrated
12 a positive association between prior, successful breastfeeding experiences and the intention,
13 initiation and duration of breastfeeding.(Mitra et al., 2004; Kools et al., 2005; Simard et al.,
14 2005; Haas et al., 2006; Racine et al., 2009) It may eventuate that the familiarity and
15 confidence gained from the positive colostrum expressing experiences may translate into
16 improved breastfeeding outcomes. This represents an important consideration for future
17 studies and for the development of antenatal education programs.

18 In contrast, a few women in this study noted that they found the expression of breastmilk to
19 be difficult and challenging, a response which may be considered opposite to the mastery of
20 the task outlined above. Expressing breastmilk poses a challenge for many women and one
21 study found that the inability to express milk contributed to feelings of maternal inadequacy,
22 reinforcing perceptions of milk insufficiency.(Morse and Bottorff, 1988) The corollary of this
23 is that difficulties in antenatal milk expression may be predictive of breastfeeding problems
24 and if investigated in future studies, could serve as an important alert for midwifery staff.

1 Observing the breastfeeding experiences of other women, whether real or recorded,
2 represents an important reference point and source of information for women attempting to
3 breastfeed (Dennis, 1999). This is especially true of primiparous women and can have a
4 great impact upon the mother's confidence at breastfeeding.(Bandura, 1986) It has been
5 demonstrated that increased breastfeeding knowledge is strongly correlated with
6 breastfeeding confidence and also with the duration of breastfeeding.(Chezem et al., 2003)
7 The provision of information to the participants may again help to improve breastfeeding
8 self-efficacy. A few women in this study noted that they found observing the DVDs to be a
9 worthwhile experience, particularly when they were able to practice expressing or feeding
10 their infant at the same time. The observation of others breastfeeding also serves to normalise
11 the breastfeeding experience in a culture which sometimes views it unfavourably and can
12 help alleviate feelings of embarrassment and awkwardness.(Morse and Bottorff, 1988) As a
13 whole, vicarious learning experiences tend to be most effective when the participant is able to
14 relate to the presenter in some way, usually through a demographic affinity.(Dennis, 1999) In
15 this study, one of the participants noted that the presenter in the instructional DVDs was quite
16 dated and difficult to relate to, which would be worth considering as a potential amendment
17 to future sessions.

18 Embarrassment at expressing colostrum in the presence of a midwife or health professional
19 proved to be a major challenge for most participants with most opting to practice expressing
20 in private. The acknowledgement of breastmilk expression as a private activity has been
21 noted in previous studies(Morse and Bottorff, 1988) and interestingly was considered a more
22 private activity than breastfeeding which in many instances, the woman's partner or small
23 children are not permitted to observe. Body image issues and self-consciousness tend to be
24 particularly prevalent amongst younger women who may be reluctant to breastfeed for this
25 reason.(McIntyre et al., 1999; Noble-Carr and Bell, 2012) The feelings of self-consciousness

1 and embarrassment when expressing breastmilk, may then inhibit the release of colostrum by
2 the milk ducts (the so-called “let down” reflex), further fuelling feelings of
3 inadequacy.(Morse and Bottorff, 1988) This issue should be (and was) treated sensitively and
4 carefully by midwifery staff with the mother allowed privacy as required with successful
5 colostrum expression then proceeding at home.

6 There has been a reluctance to introduce the tuition of antenatal breast expression (ABE) in
7 hospital antenatal care services due the perceived risk of the onset of early labour.(Kavanagh
8 et al., 2005) This is supported by previous research in which there was a higher admission to
9 the Special Care Baby Unit in infants whose mothers had practiced ABE.(Soltani and Scott,
10 2012; Forster et al., 2011) However in a recent critical review of the literature the authors
11 conclude that the substantial benefits of early feedings of colostrum outweigh the lack of
12 evidence associated with the risk of preterm labour.(Chapman et al., 2013) However, to
13 prevent the possible onset of early labour the practice of ABE should not be introduced until
14 approximately 37 weeks gestation when the pregnancy [would be considered full term](#)
15 [anyway](#).

16

1 CONCLUSION

2 Findings from this qualitative study indicate that many women found the teaching of ABE to
3 be a positive and worthwhile experience. The antenatal expression of colostrum allowed the
4 women to become both competent and familiar with breastmilk expression which has shown
5 to lead to positive breastfeeding experiences. The security that came from having a supply of
6 colostrum that was stored was reassuring for those women who achieved this, and may help
7 to alleviate maternal stress over breastmilk supply in the immediate postpartum period, a
8 scenario which has been shown to inhibit lactogenesis. Aside from feelings of
9 embarrassment, which most women were able to overcome by expressing in private, feelings
10 of futility or difficulty should be closely monitored by midwifery staff to ensure that genuine
11 distress does not ensue, and as part of a follow-on study, should be examined to determine if
12 there is any correlation with long-term breastfeeding outcomes.

13

14 Extending the current study on a wider scale and examining more completely any changes in
15 breastfeeding confidence and self-efficacy amongst women who participated in the clinic
16 with women who did not participate, is also an important consideration. This could then be
17 extended to further examine longer term breastfeeding outcomes such as initiation rate and
18 duration of exclusive or any breastfeeding in an effort to support improved long term
19 breastfeeding outcomes in Australia.

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REFERENCES

- 1
2
- 3 Australian Institute of Health and Welfare. (2011) 2010 Australian National Infant Feeding
4 Survey: indicator results. Canberra: AIHW
- 5 Bandura A. (1986) *Social foundations of thought and action: A social cognitive theory*,
6 Englewood Cliffs, NJ: Prentice-Hall.
- 7 Binns C and Scott J. (2002) Breastfeeding: Reasons for starting, reasons for stopping and
8 problems along the way. *Breastfeeding Review* 10: 13-19.
- 9 Chapman T, Pincombe J and Harris M. (2013) Antenatal breast expression: a critical review
10 of the literature. *Midwifery* 29: 203-210.
- 11 Chezem J, Friesen C and Boettcher J. (2003) Breastfeeding knowledge, breastfeeding
12 confidence, and infant feeding plans: effects on actual feeding practices. *J Obstet*
13 *Gynecol Neonatal Nurs* 32: 40-47.
- 14 Cox S. (2006) Expressing and storing colostrum antenatally for use in the newborn period.
15 *Breastfeeding Review* 14: 11-16.
- 16 Cox S. (2010) An ethical dilemma: Should recommending antenatal expressing and storing of
17 colostrum continue? *Breastfeeding Review* 18: 5-7.
- 18 Dennis CL. (1999) Theoretical underpinnings of breastfeeding confidence: a self-efficacy
19 framework. *J Hum Lact* 15: 195-201.
- 20 Dykes F and Williams C. (1999) Falling by the wayside: a phenomenological exploration of
21 perceived breast-milk inadequacy in lactating women. *Midwifery* 15: 232-246.
- 22 Forster D, McEgan K, Ford R, et al. (2011) Diabetes and antenatal milk expressing: A pilot
23 project to inform the development of a randomised clinical trial. *Midwifery* 27: 209-
24 214.

- 1 Gagnon A and Sandall J. (2007) Individual or group antenatal education for childbirth or
2 parenthood, or both. *Cochrane Database of Systematic Reviews 2007*.
- 3 Gurneesh S and Ellora D. (2009) Effect of antenatal expression of breast milk at term to
4 improve lactational performance: A prospective study. *Journal of Obstetrics and*
5 *Gynecology India 59*: 308-311.
- 6 Haas DM, Howard CS, Christopher M, et al. (2006) Assessment of breastfeeding practices
7 and reasons for success in a military community hospital. *J Hum Lact 22*: 439-445.
- 8 Joyce A and Hutchinson M. (2012) Western Australia's Mothers and Babies, 2010: Twenty-
9 eighth Annual Report of the Western Australian Midwives' Notification System.
10 Department of Health, Western Australia.
- 11 Kavanagh J, Kelly AJ and Thomas J. (2005) Breast stimulation for cervical ripening and
12 induction of labour. *Cochrane Database Syst Rev*: CD003392.
- 13 Kools EJ, Thijs C and de Vries H. (2005) The behavioral determinants of breast-feeding in
14 The Netherlands: predictors for the initiation of breast-feeding. *Health Educ Behav*
15 *32*: 809-824.
- 16 Lumbiganon P, Martis R, Laopaiboon M, et al. (2011) Antenatal breastfeeding education for
17 increasing breastfeeding duration. *Cochrane Database of Systematic Reviews 2011*.
- 18 Lumley J and Brown S. (1993) Attenders and nonattenders at childbirth education classes in
19 Australia: How do they and their births differ? *Birth 20*: 123-130.
- 20 Madarshahian F and Hassanabadi M. (2012) A comparative study of breastfeeding during
21 pregnancy: impact on maternal and newborn outcomes. *J Nurs Res 20*: 74-80.
- 22 McCarter-Spauldning DE and Kearney MH. (2001) Parenting self-efficacy and perception of
23 insufficient breast milk. *J Obstet Gynecol Neonatal Nurs 30*: 515-522.

- 1 McIntyre E, Hiller JE and Turnbull D. (1999) Determinants of infant feeding practices in a
2 low socio-economic area: identifying environmental barriers to breastfeeding. *Aust N*
3 *Z J Public Health* 23: 207-209.
- 4 Mitra AK, Khoury AJ, Hinton AW, et al. (2004) Predictors of breastfeeding intention among
5 low-income women. *Matern Child Health J* 8: 65-70.
- 6 Morgan DL. (1993) Qualitative content analysis: a guide to paths not taken. *Qual Health Res*
7 3: 112-121.
- 8 Morse JM and Bottorff JL. (1988) The emotional experience of breast expression. *J Nurse*
9 *Midwifery* 33: 165-170.
- 10 National Cancer Institute. (2005) Theory at a Glance: A Guide for Health Promotion and
11 Practice. Second ed.: National Cancer Institute.
- 12 National Health and Medical Research Council. (2013) Australian Dietary Guidelines.
13 Canberra: National Health and Medical Research Council.
- 14 Noble-Carr D and Bell C. (2012) Exposed: younger mothers and breastfeeding. *Breastfeed*
15 *Rev* 20: 27-38.
- 16 Pannu P, Giglia R, Binns C, et al. (2010) The effectiveness of health promotion materials and
17 activities on breastfeeding outcomes. *Acta Paediatrica* 100: 534-537.
- 18 Racine EF, Frick KD, Strobino D, et al. (2009) How motivation influences breastfeeding
19 duration among low-income women. *J Hum Lact* 25: 173-181.
- 20 Rastani RR, Del Rio NS, Gressley TF, et al. (2007) Effects of increasing milking frequency
21 during the last 28 days of gestation on milk production, dry matter intake, and energy
22 balance in dairy cows. *J Dairy Sci* 90: 1729-1739.
- 23 Simard I, O'Brien HT, Beaudoin A, et al. (2005) Factors influencing the initiation and
24 duration of breastfeeding among low-income women followed by the Canada prenatal
25 nutrition program in 4 regions of Quebec. *J Hum Lact* 21: 327-337.

1 Singh G, Chonan R and Sidhu K. (2009) Effect of antenatal expression of breast milk at term
2 in reducing breast feeding failures. *MJAFI* 65: 131-133.

3 Soltani H and Scott AM. (2012) Antenatal breast expression in women with diabetes:
4 outcomes from a retrospective cohort study. *Int Breastfeed J* 7: 18.

5 World Health Organisation. (2008) *Indicators for assessing infant and young child feeding*
6 *practices—part 1: definitions: conclusions of a consensus meeting held 6–8*
7 *November 2007 in Washington DC, USA.* . Available at:
8 [http://www.who.int/nutrition/publications/infantfeeding/9789241596664/en/index.ht](http://www.who.int/nutrition/publications/infantfeeding/9789241596664/en/index.html)
9 [ml](http://www.who.int/nutrition/publications/infantfeeding/9789241596664/en/index.html).

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1 **Funding and Conflict of Interest**

2 The authors declare no funding source and no conflict of interest.