

Causes of perception of insufficient milk supply in Western Australian mothers

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Abstract

A perception of insufficient milk supply (PIMS) is associated with early discontinuation of breastfeeding. Ideally, an objective measure of milk supply would either dispel or confirm this perception and provide reassurance or guide professional advice. Clinical signs of sufficient milk intake (steady growth, sufficient elimination, infant alertness and breasts feeling full before breastfeeds and soft after breastfeeds) should provide confidence in milk supply. We surveyed 423 mothers in early lactation who had breastfeeding problems to determine the proportion that had PIMS and to determine if the mothers with PIMS relied on these clinical signs or other perceptions of their infants' behaviour as indications of insufficient milk supply. By 3 weeks after birth, we found that the rate of PIMS among mothers with breastfeeding problems was 44%. Supplementary infant formula was being given to 66% of the infants, so the clinical indications were that milk intake was sufficient, but 74% of the mothers with PIMS cited concerns that their infants did not appear satisfied after breastfeeds. After targeted advice from lactation consultants, mothers with PIMS showed positive changes in their perceptions of their milk supply, underlining the value of professional guidance soon after birth. We conclude that an appearance of infant dissatisfaction is the major cause of PIMS in Western Australia.

KEYWORDS

breast milk production, breastfeeding problems, perceived insufficient milk

1 | INTRODUCTION

In Western Australia, 93% of mothers initiate breastfeeding, with 70% exclusively breastfeeding and 16% mostly breastfeeding. However, by 9 weeks after birth, only 49% are still exclusively breastfeeding and 16% are mostly breastfeeding, and the greatest risk for early cessation of breastfeeding is within the first 3 weeks after birth (Hauck, Fenwick, Dhaliwal, & Butt, 2011).

Breastfeeding problems in general contribute to early discontinuation of exclusive breastfeeding (Amir, 2014). In Australia, 83% of mothers experience breastfeeding problems before leaving hospital, and by 2 weeks after birth, 21% have weaned, and 29% of those still breastfeeding are experiencing problems (Binns & Scott, 2002). The problems include a perception of insufficient milk supply (PIMS). PIMS is defined as when a mother believes she is not producing enough breast milk for her infant's satisfaction or weight gain (Hill &

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Humenick, 1989) and is a major reason given by breastfeeding mothers who discontinue breastfeeding (for example Gatti, 2008; Hauck et al., 2011). In addition, PIMS is associated with low breastfeeding self-efficacy and loss of confidence in breastfeeding, and this lack of confidence contributes to early cessation of exclusive breastfeeding (Ertem, Votto, & Leventhal, 2001; Galipeau, Baillet, Trottier, & Lemire, 2018; Hauck et al., 2011).

For infants who are fully breastfed, signs of sufficient breast milk intake include the infant showing steady growth (Neifert et al., 1990), normal elimination, periods of calm alertness and an appearance of satisfaction after breastfeeds, and the mother's breasts feeling full before breastfeeds and softer after breastfeeds (Eglash, Montgomery, & Wood, 2008; Neifert, 2001; WHO Multicentre Growth Reference Study Group, 2009). However, mothers can lack confidence in their breastfeeding even if these indications are being met (Kent, Hepworth, Langton, & Hartmann, 2015).

Physiological factors that affect initiation of milk production or actual milk supply include retained placenta, insufficient glandular tissue, breast surgery, breast irradiation, severe maternal illness such as postpartum haemorrhage with Sheehan's syndrome, infection, hypertension (Neifert, 2001), hypothyroidism (Miyake, Tahara, Koike, & Tanizawa, 1989), smoking (Vio, Salazar, & Infante, 1991), insulin-dependent diabetes (Arthur, Smith, & Hartmann, 1989), mastitis, premature delivery, breastfeeding to schedule, use of pacifiers (Righard, 1998), delay in milk removal soon after birth and few breastfeeds or expressions soon after birth (Yamauchi & Yamanouchi, 1990). Obesity is also a contributing factor to early cessation of breastfeeding, because obese women report PIMS earlier and are more likely to stop breastfeeding than those with BMI in the healthy range (Beauchamp & Mennella, 2009; Binns & Scott, 2002; Mok et al., 2008). In addition, although nitrous oxide has been shown to have no effect on full breastfeeding (Torvaldsen, Roberts, Simpson, Thompson, & Ellwood, 2006), pethidine administration during labour can affect the delay of the infant's first breastfeed after birth and their sucking technique (Righard & Alada, 1990). Another study found no difference between pethidine and remifentanyl anaesthesia in breastfeeding within an hour of birth, but a significant decrease in the rate of any breastfeeding at 6 weeks after birth among the mothers who received pethidine (Moran et al., 2019).

There is no reported correlation between epidural anaesthesia and delayed onset of lactation, but further studies are required on the effects of epidural anaesthesia and short and long-term breastfeeding success (Mauri et al., 2015). It has been shown that epidural anaesthesia is associated with a lower rate of exclusive breastfeeding in the first week, and an increased likelihood of complete weaning by 24 weeks (Torvaldsen et al., 2006). However, all of these infants were delivered by caesarean section (Torvaldsen et al., 2006), and there is no consensus on the effect of caesarean delivery on breastfeeding duration (Hobbs, Mannion, McDonald, Brockway, & Tough, 2016). It has been suggested that the negative effect of caesarean section on both exclusive breastfeeding and PIMS is a result of suboptimal early breastfeeding (longer time to first breastfeed, shorter duration of first breastfeed, early introduction of supplemental infant formula) rather

Key messages

- In this study in Western Australia, 44% of the mothers had a perception of insufficient milk supply within 3 weeks of birth.
- The most common reason for this perception was that their infant was not satisfied after breastfeeds.
- Supplementary infant formula was used by 66% of the mothers before their first visit to a lactation consultant.
- Maternal perception of insufficient milk supply improved after targeted advice from a lactation consultant.

than the caesarean delivery *per se* (Zhang, Cheng, Yan, Wu, & Bai, 2019). Previous studies on breastfeeding after caesarean section delivery have also shown an increased incidence of PIMS (Chapman & Perez-Escamilla, 1999) and a decreased rate of exclusive breastfeeding at 1 week and 3 months (Torvaldsen et al., 2006; Zanardo et al., 2010), but have not distinguished between nonelective lower uterine segment caesarean section (NELUSCS) and elective lower uterine segment caesarean section (ELUSCS). The proportion of mothers who were exclusively breastfeeding at 6 weeks after NELUSCS (41%) has been shown to be similar to the proportion of mothers exclusively breastfeeding after instrumental delivery (48%), but these groups were not compared with mothers who had a spontaneous vaginal delivery (SVD) (Patel, Liebling, & Murphy, 2003). In China, the rates of exclusive breastfeeding at 1 month for vaginal and caesarean delivery were 65% and 40%, respectively, and 4 months 47% and 32%, respectively (Zhang et al., 2019).

PIMS and the associated lack of confidence may be physiological or psychological. However, the relative contribution of the above physiological factors and mothers' perceptions of their infants' behaviour to PIMS are not known. One study found that PIMS (assessed using the Breastfeeding Self-Efficacy Scale-Short Form) was not related to actual insufficient milk supply (Galipeau, Dumas, & Lepage, 2017). However, actual milk supply is not normally measured. Further investigation is required to determine the relative contributions of physiological and psychological factors, and if perceptions can change after targeted advice from lactation consultants. Lactation education and support using lactation consultants has shown an improvement in breastfeeding initiation, duration and exclusive breastfeeding rates (Patel & Patel, 2016 and Thurman & Allen, 2008), but there are no previous studies on mothers' change in perception of their milk supply following advice from a lactation consultant.

1.1 | Aims

We aimed to survey mothers in Perth, Western Australia, who sought professional advice for PIMS or other breastfeeding problems to determine the proportion of mothers that had PIMS and to determine if there are differences between the two groups

in demographics, physiological factors that affect initiation of milk production (maternal health, delivery of the infant) and lactation events postpartum. We also aimed to elucidate the reasons for the PIMS and if the mothers' perceptions changed after advice from a lactation consultant.

2 | METHODS

Women who deliver their infants at the major public hospital for women in Perth, Western Australia (King Edward Memorial Hospital for Women, KEMH) are offered free consultations at the Breastfeeding Centre of WA for advice for any breastfeeding difficulties, and about 20% of the women take advantage of this service. This percentage is consistent with the findings that 29% of mothers are still experiencing problems after 2 weeks (Binns & Scott, 2002). All the participants were asked to complete a written perception questionnaire and background questionnaire before their first consultation, and a subset were asked to complete a second perception questionnaire after their second consultation 2–4 weeks later. For this cross-sectional study, a convenience sample was used. For 7 months, between August 2017 and April 2018, if time permitted before the lactation consultant was available, the chief investigator approached mothers of singleton infants, born at term or >33 weeks gestational age at delivery, who attended the Centre for their first appointment to complete the questionnaires. Women were not approached if they were known to be severely stressed or they or their support person were not fluent in English.

The perception questionnaire asked participants to choose between *strongly agree*, *agree*, *unsure*, *disagree* or *strongly disagree* in response to the statements:

1. I think I produce enough breast milk for my baby.
2. My baby is growing well.
3. My baby has enough wet nappies (diapers).
4. My baby has enough soiled nappies (diapers).
5. My baby is normally alert.
6. My baby is well attached during breastfeeding.
7. My baby sucks well during breastfeeding.
8. My baby appears satisfied after breastfeeds.
9. My baby feeds too often.
10. My baby feeds too quickly.
11. My baby needs supplementary infant formula.
12. My breasts feel full before feeds.
13. My breasts feel soft after feeds.
14. My breasts feel empty in the afternoon or evening.

Participants who responded to the first statement 'I think I produce enough breast milk for my baby' with *unsure*, *disagree* or *strongly disagree*, indicating they were not confident in their milk supply, were classified as having PIMS. All questionnaire responses were grouped into positive (consistent with a perception of adequate milk supply) or negative (consistent with PIMS). For statements 1–8, 12 and 13 responses of *agree* or *strongly agree* were classified as positive, and

responses of *unsure*, *disagree* or *strongly disagree* were classified as negative. For statements 9–11 and 14, responses of *disagree* and *strongly disagree* were classified as positive, and responses of *unsure*, *disagree* or *strongly disagree* were classified as negative. All participants were requested to complete a background questionnaire covering demographics, maternal and infant variables.

During the first consultation, the lactation consultant used a standard assessment form to record the mothers' concerns about maternal and infant aspects of their breastfeeding.

For the last 5 months of the study period, mothers with PIMS who returned to the Breastfeeding Centre for a second consultation 2–4 weeks after the first consultation were invited to complete the same questionnaire again, and responses were again recorded.

The participants provided written, informed consent for the study, which was approved by the ethics committees of the Women and Newborn Health Service (HREC 2016055EW) and The University of Western Australia (HREO RA/4/1/8352).

2.1 | Statistics

All survey responses were grouped into positive and negative as defined above. Some demographic responses were also grouped when there were some categories of response that were uncommon.

A comparison of the mothers with PIMS and those with other breastfeeding problems was carried out for demographic, maternal and infant variables. Categorical variables were analysed using a Chi-squared test or Fisher's exact test, whereas continuous variables were analysed with a *t* test.

Logistic regression was carried out with PIMS as an outcome. Univariate modelling considered only the one questionnaire response at a time, whereas multivariate modelling also accounted for parity (primiparous or multiparous), ethnicity (Caucasian or other), BMI category (normal, overweight or obese), mode of delivery (indicator variables for induced onset of labour and instrumental), use of drugs during delivery (indicator variables for none, gas, morphine and epidural), expressing before discharge, the day the milk came in, current feeding category (exclusive breastfeeding, breastfeeding and expressed breast milk, breastfeeding and formula, breastfeeding with expressed breast milk and formula), presenting challenges (slow weight gain and formula use) and whether supplementary formula was being used. Raw data percentages and modelling output *p* values are reported.

Within the PIMS group Chi-squared or Fishers exact tests were used to investigate associations between the response to all the perceptions questions with respect to the use of supplementary infant formula.

Changes in the questionnaire responses from first to second consultation were analysed with a paired *t* test. The significance level was set at 0.05, and *R* was used for all analysis (R Development Core Team, 2017).

2.2 | Ethical statement

The participants provided written, informed consent for the study, which was approved by the ethics committees of the Women and

Newborn Health Service (HREC 2016055EW) and The University of Western Australia (HREO RA/4/1/8352).

3 | RESULTS

During the 7 months of recruitment, 438 clients of the Breastfeeding Centre were approached to participate, 10 declined, two had twins and were therefore ineligible, 426 completed the perception questionnaire, but three of those did not complete the background questionnaire, leaving 423 who completed both questionnaires. Of these, 36 questionnaires were incomplete; therefore, analysis of perceptions included 387 participants. There were 171 participants (44%) who were classified as having PIMS, and 216 participants who agreed or strongly agreed that they produced enough breast milk for their baby and were seeking a consultation for other breastfeeding problems, commonly infant attachment during breastfeeding, infant sleepy at the breast, nipple pain, use of a nipple shield and tongue tie. The first consultation for the mothers was early in lactation (IQR PIMS 1.2, 3.2 weeks after birth, IQR other breastfeeding problems 1.3, 3.0 weeks after birth).

3.1 | Demographics

Demographic data for mothers with PIMS and mothers with other breastfeeding problems are shown in Table 1. Analysis of PIMS by demographic, maternal and infant variables showed some differences from mothers with other breastfeeding problems, namely, a higher proportion of PIMS among: mothers of firstborns; mothers who are not Caucasian (mostly Asian, 15% or Indian, 6%); mothers whose infants were delivered via NELUSCS; those presenting with slow weight gain or with formula use. Differences were also seen with the day the milk came in (typically later for those reporting PIMS) and the current feeding with those reporting PIMS also reporting higher rates of supplementing breastfeeding with EBM and formula. For mothers with PIMS and those with other problems, there were 50 and 52, respectively, whose infants were delivered by caesarean section, all of whom received anaesthesia during birth. Among the mothers whose infants were not delivered by caesarean section there were fewer mothers with PIMS who had no drugs during delivery.

3.2 | Perceptions

The perceptions of mothers with PIMS and mothers with other breastfeeding problems are shown in Table 2. The most marked differences between mothers with PIMS and mothers with other breastfeeding problems were in the perceptions of infant growth, soiled nappies, satisfaction after breastfeeds and need for supplementary infant formula and for feeling of breast fullness before feeds and feeling empty in the afternoon or evening.

It is shown in Table 1 that 66% of mothers with PIMS were already using formula supplements. Between mothers who were or were not giving supplementary formula, there were no significant differences in their perceptions of their infant's growth ($p = 0.60$) or wet

nappies ($p = 0.35$), but mothers who used supplementary formula were less likely to agree that their infants had enough soiled nappies ($p = 0.015$), and those who did not use supplementary formula were marginally more likely to agree that their infants were usually alert ($p = 0.045$).

Overall, significantly more primiparous mothers (45%) were offering their infants supplementary formula than multiparous mothers (31%) ($p = 0.017$).

3.3 | Changes in perception after advice from lactation consultant

All mothers were given targeted advice by the lactation consultant. Advice to mothers with PIMS included correction of positioning and attachment, advice to feed from both breasts on demand eight to 12 times a day, use of breast compression during breastfeeding and expressing the breasts after or between breastfeeds. If the mother was anxious but otherwise breastfeeding well, the lactation consultant provided reassurance. Fifty-two mothers with PIMS did not attend the Breastfeeding Centre for a follow-up appointment and received subsequent care (if required) from their child health nurse or general practitioner. Eighty-three of the mothers who reported PIMS and returned to the Breastfeeding Centre for a second consultation were requested to complete a second written perception questionnaire 2–4 weeks after following the advice from the initial consultation. Sixty-six of these mothers provided partial data, and 57 provided complete data for both questionnaires. The initial perceptions of these mothers were not significantly different from the mothers with PIMS who only completed one questionnaire. The results of the two questionnaires are shown in Table 3.

The follow-up questionnaire showed that at the second consultation 26 of the 57 mothers who completed both questionnaires thought they produced enough breast milk for their baby. On average, these mothers were more likely to agree with the statements: my baby is growing well; my baby has enough wet nappies; my baby is normally alert, my baby is well attached during breastfeeding; my baby sucks well during breastfeeding and my breasts feel soft after feeds. There were no changes in the mothers' perceptions of the number of soiled nappies, infant satisfaction after breastfeeding, frequency and duration of breastfeeds or the need for supplementary infant formula. Nor were there significant changes in the mothers' perceptions of the fullness of their breasts before breastfeeding or the breasts feeling empty in the afternoon or evening.

4 | DISCUSSION

This study confirms that PIMS is a significant problem among mothers who seek consultation at the Breastfeeding Centre of WA, with 44% of the study population classified as having PIMS. Most of these mothers attended the Breastfeeding Centre within 3 weeks of birth.

TABLE 1 Demographics of participants with PIMS ($n = 171$) and those with other breastfeeding problems ($n = 216$)

	PIMS	Other problems	<i>p</i> value
Maternal characteristics			
Married or de-facto	94.6	96.6	0.45
Parity 1	75.0	58.0	<0.001
Ethnic group Caucasian	67.6	78.1	0.021
BMI	25.9 (5.0)	27.0 (6.4)	0.054
Breast growth during pregnancy	90.0	94.9	0.10
Breast surgery/piercing	8.6	5.6	0.30
Smoked during pregnancy	1.1	0.4	0.59
Smoking during lactation	0.5	0.9	1
Education			
Completed year 12	91.2	90.9	1
Further education	92.3	94.8	0.32
Maternal problems during pregnancy or after birth			
High blood pressure	9.7	10.5	0.92
Gestational diabetes	10.3	10.1	1
Type 1 diabetes	1.6	2.1	1
Postpartum haemorrhage	8.6	8.0	0.95
Depression	7.0	6.7	1
Infection	4.9	3.8	0.76
Hypothyroidism	3.8	5.9	0.45
Hyperthyroidism	1.1	2.5	0.48
Mastitis	3.8	5.5	0.57
Birth			
Mode of delivery			
IOL	27.6	24.4	0.53
SVD	50.3	57.6	0.16
Instrumental	15.1	10.5	0.20
ELUSCS	16.2	20.2	0.36
NELUSCS	13.5	6.3	0.02
Augmented	1	1	0.86
Drugs during delivery (excluding ELUSCS and NELUSCS) PIMS $n = 120$, other problems $n = 165$			
None	18.5	30.3	0.026
Gas (nitrous oxide)	53.8	47.6	0.17
Morphine	9.2	6.3	0.46
Pethidine	1.5	0.0	0.18
Epidural	46.2	36.0	0.09
Infant			
Gestational age at delivery, weeks	38.9 (2.1)	38.9 (2.1)	0.99
Weight at birth, g	3,314 (577)	3,266 (567)	0.40
Length at birth, cm	50.3 (3.1)	50.1 (3.1)	0.47
Admitted to special care nursery	26.6	27.4	0.95
Lactation			
Infant skin-to-skin within 1 h of birth	80.4	84.3	0.36
First breastfeed within 1 h of birth	60.7	64.8	0.45
≥3 feeds first day	63.2	71.8	0.10
≥3 expressions first day	31.1	28.1	0.60

(Continues)

TABLE 1 (Continued)

	PIMS	Other problems	p value
≥6 feeds + expressions first day	31	29	0.84
Express before discharge	63.0	58.8	0.46
Express after discharge	86.3	84.1	0.65
Day milk came in	4.1 (2.1)	3.4 (1.7)	<0.001
<i>At first consultation</i>			
Exclusively breastfeeding	10.3	32.6	<0.001
Breastfeeding intended duration >6 months	85.4	88.2	0.29
Nipple pain (sometimes or usually)	82.2	82.4	0.50
Dummy usage (sometimes or usually)	43.8	35.3	0.14
Mother age, y	32.5 (4.4)	32.6 (4.4)	0.84
Baby sex (% female)	53.5	47.1	0.31
Baby age, weeks	3.1 (3.1)	3.0 (2.9)	0.92
Presenting challenges			
Maternal milk supply	50	5	<0.001
Infant slow weight gain	23.8	12.6	0.004
Formula use	42.2	7.6	<0.001
Actually used formula	66	8	<0.001
Infant attachment	71.4	76.5	0.28
Infant sleepy at breast	16.2	14.7	0.77
Infant weight loss >10%	9.2	6.3	0.35
Nipple shield use	9.2	6.3	0.35
Infant unsettled	7.6	6.7	0.89

Note: Values are percentage or mean (SD).

Abbreviations: BMI, body mass index; IOL, induction of labour; SVD, spontaneous vaginal delivery; ELUSCS, elective lower uterine segment caesarean section; NELUSCS, non-elective lower uterine segment caesarean section.

4.1 | Perceptions

The most marked differences between mothers with PIMS and mothers with other breastfeeding problems were the perceptions of infants' satisfaction after breastfeeds and their need for supplementary infant formula. This is consistent with the common indicator of insufficient milk supply reported by mothers as their infant's unsettled behaviour (crying) (Lou et al., 2014; McCann & Bender, 2006).

The mothers with PIMS were also less likely than the mothers with other breastfeeding problems to agree that their breasts were full before breastfeeds and more likely to agree that the breasts felt empty during the afternoon or evening. These perceptions would reinforce a lack of confidence in the mothers' milk supply.

Considering the accepted clinical indications of sufficient breast milk intake, there were significant differences between the two groups in their perception of their infant's growth and elimination. However, these were concerns recorded by less than 28% of the mothers with PIMS. Indeed, there has been only one study that reports that mothers used frequency of elimination and infant weight gain as signs of sufficient milk (McCarter-Spaulling & Kearney, 2001). There were relatively few concerns among PIMS

mothers about wet and soiled nappies, infant alertness and infant growth. Indeed, lactation consultants and mothers expressed concerns about infant growth for only 24% to 27% of the infants (Tables 1 and 2). The infants were probably adequately nourished because 66% of the mothers with PIMS used supplementary formula. This is consistent with the overall exclusive breastfeeding rate in public hospitals in Western Australia of 73% (Hauck et al., 2011). KEMH is a Baby Friendly Health Initiative accredited hospital; therefore, the use of formula prior to discharge was not promoted unless medically indicated, for example, infants of mothers with insulin-dependent diabetes, who are more susceptible to hypoglycaemia. One study found that 41% of infants had received supplementary infant formula prior to discharge, and this was associated with decreased exclusive breastfeeding at 4 months (Alikasifoglu et al., 2001), and another study found that 77% of infants had been given formula prior to discharge (Chan, Nelson, Leung, & Li, 2000). These reports indicated that the main reason given for the introduction of formula was PIMS. Unfortunately, the verification of actual milk supply that would confirm or alleviate PIMS is extremely rare (Alikasifoglu et al., 2001). We did not establish when supplementary infant formula was introduced, nor the reason for its early

TABLE 2 Number of participants with PIMS ($n = 171$) and those with other breastfeeding problems ($n = 216$) with positive or negative responses to each statement

	Response	PIMS	Other problems	Univariate modelling			Multivariate modelling		
				Coefficient	SE	<i>p</i> value	Coefficient	SE	<i>p</i> value
My baby:									
Is growing well	Positive	114	175	-0.429	0.120	<0.001	-1.871	2.097	0.37
	Negative	42	29	0.799	0.270	0.003	1.075	0.398	0.007
Has enough wet nappies	Positive	141	195	-0.324	0.111	0.003	-1.372	1.98	0.49
	Negative	15	9	0.835	0.440	0.06	0.665	0.563	0.24
Has enough soiled nappies	Positive	124	191	-0.432	0.115	<0.001	-1.288	1.958	0.51
	Negative	32	13	1.333	0.349	<0.001	1.358	0.494	0.006
Is normally alert	Positive	134	185	-0.323	0.113	0.004	-1.723	1.897	0.36
	Negative	22	19	0.469	0.333	0.16	1.077	0.438	0.014
Is well attached during breastfeeding	Positive	26	50	-0.654	0.242	0.007	-1.872	2.081	0.37
	Negative	130	154	0.485	0.270	0.07	0.645	0.400	0.11
Sucks well during breastfeeding	Positive	49	100	-0.713	0.174	<0.001	-1.949	2.177	0.37
	Negative	107	104	0.742	0.222	0.001	0.939	0.327	0.004
Appears satisfied after breastfeeds	Positive	40	125	-1.139	0.182	<0.001	-2.771	2.348	0.238
	Negative	116	79	1.524	0.233	<0.001	1.336	0.349	<0.001
Feeds too often	Positive	60	99	-0.501	0.164	0.002	-1.740	2.156	0.42
	Negative	96	105	0.411	0.216	0.057	0.637	0.323	0.049
Feeds too quickly	Positive	78	110	-0.344	0.148	0.020	-1.755	2.151	0.41
	Negative	78	94	0.157	0.213	0.46	0.505	0.309	0.10
Needs supplementary infant formula	Positive	33	173	-1.657	0.190	<0.001	-1.691	2.214	0.445
	Negative	123	31	3.035	0.277	<0.001	2.228	0.434	<0.001
My breasts:									
Feel full before feeds	Positive	93	179	-0.655	0.128	<0.001	-1.098	2.09	0.60
	Negative	63	25	1.579	0.269	<0.001	2.044	0.400	<0.001
Feel soft after feeds	Positive	107	142	-0.283	0.128	0.027	-1.353	2.01	0.50
	Negative	49	62	0.048	0.230	0.836	-0.020	0.329	0.95
Feel empty in the afternoon or evening	Positive	38	104	-1.007	0.190	<0.001	-2.525	1.964	0.198
	Negative	118	100	1.172	0.233	<0.001	1.793	0.366	<0.001

introduction. Considering the possible effects on milk production, this should be investigated in future studies. It is possible that better communication of evidence-based information with obstetricians, midwives and expectant mothers is required.

Common concerns among all the participants in both groups were the attachment of the infant during breastfeeding and how well the infant was sucking during breastfeeding. An incorrect sucking technique has been associated with breastfeeding problems and discontinuation of breastfeeding (Cernadas, Noceda, Barrera, Martinez, & Garsd, 2003); therefore, it is understandable that this was a concern for most of the mothers in the study population.

Mothers with PIMS were marginally more concerned than those with other breastfeeding problems that their infants were feeding too often. Measurement of a 24-h breastfeeding milk profile and

comparison of the results with the wide range of normal, particularly for the number of breastfeeds per day (Kent et al., 2006) may reassure mothers and their health professionals that frequent breastfeeds are not necessarily a problem. The objective measurement would inform the mothers and their health professionals if the infants were requiring frequent breastfeeds to obtain a satisfactory daily milk intake (Kent et al., 2006). If the milk intake was shown to be inadequate, this would help to guide the advice provided by the lactation consultant.

4.2 | Demographics

There are many demographics of breastfeeding mothers that have been associated with breastfeeding problems, and we investigated

TABLE 3 Percentage of participants with PIMS who completed questionnaires before the first consultation (first) and during the second (second) consultation responding to each statement with *strongly agree or agree* ($n = 57$)

	First	Second	p value
I think I produce enough breast milk for my baby	0%	46%	<0.001
My baby			
Is growing well	73%	94%	<0.001
Has enough wet nappies	90%	97%	<0.001
Has enough soiled nappies	77%	80%	0.13
Is normally alert	79%	96%	0.011
Is well attached during breastfeeding	19%	60%	<0.001
Sucks well during breastfeeding	31%	67%	<0.001
Appears satisfied after breastfeeds	30%	50%	0.14
Feeds too often	33%	29%	0.40
Feeds too quickly	14%	23%	0.91
Needs supplementary infant formula	70%	49%	0.09
My breasts:			
Feel full before feeds	53%	59%	0.28
Feel soft after feeds	64%	79%	0.006
Feel empty in the afternoon or evening	51%	49%	0.75

which factors may predispose mothers to PIMS as opposed to other breastfeeding problems.

It is not surprising that mothers with PIMS were more likely to be primiparous than mothers with other breastfeeding problems and that primiparous mothers were more likely to be offering their infants supplementary infant formula, because primiparity and PIMS are risk factors for early cessation of exclusive breastfeeding (Hauck et al., 2011; Torvaldsen et al., 2006). Although Asian women in Perth, Western Australia have been shown to be less likely to initiate breastfeeding (Forde & Miller, 2010), the participants in this study had all initiated breastfeeding, but the non-Caucasian women were more likely to be immigrants and less likely to have support from an extended family, which is a contributing factor to continuation of breastfeeding (Lavender et al., 2005). In addition, there was a tendency for the BMI of the PIMS mothers to be higher than that of the mothers with other breastfeeding problems and obesity is also associated with delayed secretory activation (Rasmussen, Hilson, & Kjolhede, 2001) and early cessation of breastfeeding (Binns & Scott, 2002).

We assessed many of the physiological factors that affect initiation of milk production or actual milk supply. However, the following conditions occurred infrequently or there were no significant differences between the mothers with PIMS and those with other breastfeeding problems: lack of breast development during pregnancy, breast surgery, smoking, high blood pressure, gestational or type 1 diabetes, postpartum haemorrhage, depression, infection, hypothyroidism and hyperthyroidism and mastitis, and therefore PIMS could not be attributed to these factors.

4.3 | Birth

Infant characteristics at birth (gestational age, weight and length) were not significantly different between the two groups and were also not specifically associated with PIMS.

Mothers with PIMS and whose infants were not delivered by caesarean section were less likely to have given birth without intrapartum anaesthesia. Whilst gas (nitrous oxide) and instrumental delivery have not been shown to have an effect on full breastfeeding (Torvaldsen et al., 2006), pethidine administration during labour can affect the delay of the infant's first breastfeed after birth and their sucking technique (Righard & Alada, 1990); however, none of the participants whose infants were not delivered by caesarean section received pethidine. Although epidural anaesthesia is associated with an increased rate of nonexclusive breastfeeding in the first week, this applied only when there was a vaginal delivery (Torvaldsen et al., 2006). We found no significant difference in the use of epidural anaesthesia between women who had an SVD compared with other modes of delivery, nor between the mothers with PIMS and the mothers with other breastfeeding problems. However, further studies are required on the effects of epidural anaesthesia and short and long-term breastfeeding success (Mauri et al., 2015).

NELUSCS was significantly more common in mothers with PIMS than in mothers with other breastfeeding problems, in contrast with ELUSCS. Previous studies on breastfeeding after caesarean section delivery have not distinguished between NELUSCS and ELUSCS but have found that caesarean section delivery is associated with an increased incidence of PIMS (Chapman & Perez-Escamilla, 1999) and a decreased rate of exclusive breastfeeding at 1 week and 3 months (Torvaldsen et al., 2006; Zanardo et al., 2010). Therefore, the current data indicate that NELUSCS could be a contributing factor to PIMS.

4.4 | Initiation of lactation

Most mothers in both groups held their infants skin-to-skin, breastfed their infants within an hour of birth and intended to breastfeed for more than 6 months, and there were no significant differences between mothers with PIMS and mothers with other breastfeeding problems in early milk removal. Most mothers expressed milk after discharge from hospital and that would contribute to milk removal to support continued milk production. The fact that the majority of mothers in both groups expressed before and after discharge from hospital could indicate that there was concern either that the infant was not removing milk adequately during breastfeeds or the mothers were wanting to ensure an adequate milk supply. The delay in milk coming in for PIMS mothers compared with mothers with other breastfeeding problems may be associated with the higher prevalence of primiparous mothers in the PIMS group (Dewey, Nommsen-Rivers, Heinig, & Cohen, 2003).

The concern regarding infant attachment during breastfeeding was extremely prevalent, with more than 70% of all mothers being

concerned before the consultation with the lactation consultant. The importance of correct positioning and attachment to successful breastfeeding is largely experience-based, but one study has shown that infants using a correct breastfeeding technique or an incorrect breastfeeding technique that had been corrected by instruction within 6 days or birth, reported significantly fewer breastfeeding problems and longer breastfeeding duration than infants using an incorrect breastfeeding technique (Righard, 1998).

4.5 | Changes in perception after advice from the lactation consultant

Almost half of the mothers who initially thought they did not produce enough breast milk for their baby changed their perception when they completed the second questionnaire. The positive changes in their perceptions of their infants' growth, wet nappies, alertness, attachment and sucking during breastfeeding, along with a greater sensation of breast softness after breastfeeds, could be attributed to the benefits of the advice of the lactation consultant. Although some mothers indicated an improved perception of infant satisfaction after breastfeeds and reduction in need for supplementary infant formula, these did not reach statistical significance. This may indicate that it may take some time to restore the confidence of mothers who have had difficulties early in their lactation. Reviews by Thurman and Allen (2008) and Patel and Patel (2016) found some positive correlations between lactation consultant use and breastfeeding initiation, duration, and exclusive breastfeeding rates, but there are no previous studies on mothers' change in perception of their milk following advice from a lactation consultant.

4.6 | Limitations

After the first consultation with the lactation consultant, objective measurement of milk production by lending the mother sensitive, integrating baby weighing scales to measure each breastfeed for 24 h would have provided more certainty regarding actual milk supply. A second measurement after following advice from the lactation consultant for 2 or more weeks would have informed the mothers' changes in perceptions. The study would have been strengthened by a larger number of follow-up questionnaires, and an assessment of the mothers' compliance with the targeted advice from the lactation consultants.

5 | CONCLUSION

By 3 weeks after birth, 44% of the mothers who sought a consultation with the Breastfeeding Centre of Western Australia for breastfeeding problems had PIMS. Seventy-four percent of these mothers were concerned that their infants did not appear satisfied after breastfeeds, confirming previous findings. The mothers with PIMS did not

commonly cite concerns about other clinical signs of sufficient milk intake (growth, elimination, alertness and breast changes). This is not surprising considering 66% of the infants were already receiving supplementary infant formula and were probably adequately nourished.

The positive changes in perceptions after targeted advice from lactation consultants underline the value of professional guidance soon after birth.

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CONFLICTS OF INTEREST

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CONTRIBUTIONS

JK, EA, CH and DG designed the research study, JK performed the research, AR and KM analysed the data. The paper was written by JK and edited and approved by all coauthors.

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