

**EXPRESSION OF BREASTMILK: QUALITATIVE  
EXPLORATION ON CHALLENGES AND  
EXPERIENCE OF WORKING WOMEN IN  
MALAYSIA**

**NOR KAMARIAH BINTI MOHAMAD ALWI**

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**by**

**NOR KAMARIAH BINTI MOHAMAD ALWI**

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**PEMERAHAN SUSU IBU: PENEROKAAN KUALITATIF TENTANG  
PENGALAMAN DAN CABARAN DALAM KALANGAN WANITA  
BEKERJA DI MALAYSIA**

**ABSTRAK**

Pemerahan susu ibu adalah amalan mengeluarkan susu ibu untuk disimpan dan diberikan kepada bayi. Wanita di seluruh dunia telah mengamalkan pemerahan susu ibu atas pelbagai sebab menggunakan pelbagai kaedah dan peralatan. Walau bagaimanapun, rujukan mengenai amalan pemerahan susu dalam kalangan wanita bekerja di Malaysia masih kurang. Kajian ini meneroka pandangan dan pengalaman wanita bekerja di Malaysia dalam amalan ini terutamanya tentang tujuan pemerahan susu, faktor pengaruh dalam memilih kaedah pemerahan susu dan pengalaman mereka dalam amalan ini. Peserta awalan kajian ini telah dipilih secara khusus menerusi kumpulan sokongan penyusuan susu ibu daripada tiga lokasi di Malaysia iaitu Pulau Pinang, Kuala Lumpur dan Kelantan. Peserta berikutnya dipilih berdasarkan cadangan daripada peserta terdahulu menggunakan teknik 'snowballing'. Temuramah secara bersemuka menggunakan panduan menemuramah separa berstruktur dengan peserta yang telah memberi keizinan dan memenuhi syarat kelayakan iaitu ibu kepada bayi berusia tiga ke dua belas bulan dan masih mengamalkan pemerahan susu ibu. Temuramah diteruskan dengan peserta seterusnya sehingga mencapai ketepuan. Kesemua sesi temuramah dirakam dan ditranskrip perkataan demi perkataan. Sejumlah 19 peserta berumur antara 28 hingga 41 dalam kalangan kaum Melayu dan Cina telah ditemuramah. Semua peserta mempunyai pekerjaan dalam pelbagai sektor dengan status pekerjaan separa masa, masa anjal, sepenuh masa, bekerja sendiri dan dalam tempoh cuti. Setiap peserta mengamalkan pemerahan susu dan masih menyusukan bayi mereka yang berumur antara empat hingga sebelas bulan. Kaedah

pemerahan susu yang digunakan adalah pemerahan tangan, pam susu dan cawan pelekap. Analisa tema daripada dapatan kajian dipecahkan kepada tiga bahagian iaitu tujuan memerah susu, faktor yang mempengaruhi pemilihan kaedah memerah susu dan pengalaman memerah susu. Empat tema daripada tujuan memerah susu adalah pemisahan antara ibu dan bayi, kebimbangan tentang penghasilan dan bekalan susu, halangan penyusuan secara langsung dan tujuan yang berkaitan bayi. Dua tema daripada faktor yang mempengaruhi pemilihan kaedah memerah susu adalah pengaruh dalaman dan luaran. Empat tema daripada pengalaman memerah susu pula adalah amalan pemerahan susu, motivasi dalam memerah susu, cabaran memerah susu dan kaedah mengatasi cabaran penyusuan. Daripada dapatan kajian mengenai tujuan memerah susu, didapati ibu bekerja di Malaysia menunjukkan kesungguhan yang tinggi dalam amalan memerah susu walaupun menghadapi pelbagai cabaran. Dapatan mengenai faktor pengaruh dalam pemilihan kaedah pemerahan susu dapat memberikan maklumat terperinci kepada pengamal perubatan untuk memberi panduan kepada ibu menyusu dalam memilih kaedah pemerahan susu yang sesuai. Kajian lanjut yang melibatkan pelbagai pihak berkepentingan patut dipertimbangkan untuk mewujudkan panduan menyeluruh dalam menyokong amalan pemerahan susu.

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**ABSTRACT**

Breastmilk expression is a practice of extracting breastmilk to be stored and used for feeding infants. Women around the world has been practicing it for different reasons and using different methods and tools. However, there was lack of reference on milk expression among Malaysian working women. This study explored Malaysian working women views and experiences of on the expression of breastmilk, specifically on the reasons of practicing, influencing factors in choosing breastmilk expression method and their experiences in the practice. The initial participants were recruited through breastfeeding support groups from three locations in Malaysia which were Pulau Pinang, Kuala Lumpur and Kelantan. The subsequent participants were recommended by the earlier participants using snowballing technique. Face-to-face interviews were conducted using a semi structured interview guide with consented mothers of an infant age between three to twelve months old and were practicing any method of milk expression. All interviews' sessions were audio recorded and transcribed verbatim. A total of 19 participants aged between 28 to 41 among Malay and Chinese were interviewed. All participants were working in various sectors with status of employment ranging from part time, flexible hours, full time workers, self-employed and on leave. Each participant was practicing milk expression while continuing breastfeeding an infant aged between four to eleven months. The methods of breastmilk expression used were hand expression, breast pump and suction cup. Thematic analysis of the findings was presented into three sections which are reasons for practicing milk expression, influencing factors of milk expression method and

experiences of milk expression. Four themes emerged from reasons for practicing milk expression were separation between mother and infant, milk production and supply concerns, direct feeding barriers and infant related reasons. Two themes emerged from the influencing factors in choosing milk expression method were internal influences and external influences. Four main themes emerged from the experiences of milk expression were milk expression practices, motivation in milk expressing, challenges in milk expressing and coping mechanism while facing challenges in milk expression. From the findings of reasons that emerged in this study, it showed that high determination of working mothers in Malaysia to continue providing breastmilk despite various challenges they were facing. The influencing factors in choosing milk expression method could provide descriptive information for practitioners to guide breastfeeding mothers in choosing their method. Further study involving multiple stakeholders should be considered to develop a comprehensive guide in supporting women in milk expression practices.

## CHAPTER 1

### INTRODUCTION

#### 1.1 Background

Expressing breastmilk refers to a process of squeezing milk out of the breast so that it can be stored and used to feed a thriving infant (The Breast feeding Network, 2009). Breastmilk expression has been commonly practiced by women around the world for different reasons using various tools and techniques. Many mothers are still in search for tools or equipment that were efficient for them to provide adequate amount of milk for their infants (Yamada et al., 2019).

In early 20<sup>th</sup> century, lactating women in North America were encouraged to express their milk to help premature and ill infants when wet nurse services were hard to secure and maintained. The idea of collecting human milk has contributed to the establishment of milk banks in supporting premature and ill infants (Jones, 2003). In the recent years, mothers who delivered premature infants found that providing expressed breastmilk as one of the ways to connect to their infants while being cared separately (Bernaix et al., 2006).

Initially, expressing breastmilk was known to be as a method to provide breastmilk to infants when they were separated from their mothers (Ismail et al., 2012). Women who have to return to workforce continued to express their breastmilk at work to sustain milk supply to their infants (Hawkes et al., 2004). However, there were mothers who express their milk even when they were not separated from the infants (Geraghty et al., 2013).

There were elective and non-elective reasons for expressing breastmilk stated by mothers (Felice et al., 2017a). The elective reasons were characterised by mothers who

had a feasible alternative to pumping at that time while non-elective reasons were when no other choice allowed them to provide their milk. Among the elective reasons were to have somebody to feed their infants while the mothers could sleep or to allow fathers or other family members to bond with the infant, while the non-elective reasons are to supplement a feed at the breast or to bottle train their infants using expressed milk.

In a study involving 1564 breastfeeding mothers, 85% of the mothers had expressed milk at some point since their infants were born (Labiner-Wolfe et al., 2008). In a comparison between Perth Infant Feeding Study I (PIFS I) in 1992-93 and PIFS II in 2002-03, the proportion of mothers expressing breastmilk in the first six weeks had almost doubled in a decade (Binns et al., 2006). While the trend of milk expression was increasing, mothers were not well informed on what was the suitable method to express their milk (McInnes et al., 2015). They were continuously finding solution for effective and practical way to express breastmilk (Clemons & Amir, 2010).

As breastmilk expression practices increased, it became more known to and practised by more mothers. It has eventually turned into a new trend to express breastmilk (Geraghty et al., 2013). The ability to express and store breastmilk was seen as a sense of security knowing that their milk supply was enough for their infant (Felice et al., 2017a). Many mothers felt assured by looking at the volume of milk expressed as a method to quantify how much milk they could provide to their infants (O'Sullivan et al., 2017).

In Malaysia, one of the earliest references on caring for mothers with young infants, recommended milk expression to increase milk supply by expressing milk using hand after a breastfeeding session (Kitab Dunya Ibu, 1947). Milk expression was further

recognized as an important aspect to be taught to mothers to maintain lactation when separated from their infants in the implementation of Baby Friendly Hospital Initiative since 1993 (Kementerian Kesihatan Malaysia, 2022). In a study involving 300 full-time employed mothers who delivered at tertiary hospital in Kuala Lumpur, Malaysia, 73% of them had positive attitude towards breastmilk expression, storage and usage but only 57% scored as having good knowledge which was significantly associated with Malay ethnicity, tertiary education, multiparity status and prior breastfeeding experience (Shabbir et al., 2020).

## **1.2 Hand expression method acceptance**

Becker (2008) listed among the reasons to recommend hand expression over breast pump, the method has no economic barrier as it is free, always accessible and less time consuming in terms of preparation time. In 2010, a study recommended hand expression for the first 48 hours after delivery because it resulted better yield (Ohyama et al., 2010). In Russia, hand expression is recommended as part of a therapeutic approach to manage milk stasis, engorgement and plugged ducts (Bolman et al., 2013).

Despite the recommendations and suggestions for hand expression usage, information available to mothers on this technique was limited and inconsistent. A UK study on internet content found that information on hand expression was only available from non-commercial websites (McInnes et al., 2015). In a study comparing guidelines on expression, storage and transport of breastmilk used by neonatal units in Melbourne, Australia, National Health Service UK, guidelines and training manuals of the Human Milk Banking Association of North America, the World Health Organization and an information leaflet from Family Health Bureau, Sri Lanka, it was found that the description given on hand expression for each key points were all different (Rodrigo



et al., 2018). Out of these guidelines, only the Sri Lanka guideline recommending hand expression as the only preferred method. The other guidelines suggesting that hand expression as the initial method and subsequently breast pump as the preferred method.

Not all mothers who were taught on hand expression during their hospital stay, would be using the method at home. A study on assessing self-management of engorgement found that out of 62% mothers reported being taught hand expression in the hospital, only 14% were using the method to relieve their engorgement (Witt et al., 2016). However, after reemphasizing on the method using written instruction, there was an increase of 10% mothers using hand expression as part of the approach to manage engorgement and 96% valued the information given.

### **1.3 Breast pump invention, technology advancement and marketing**

The first breast pump patent was documented in 1854 by Orwell H. Needham (Needham, 1854). Over 200 years, the breast pump designs were advancing their products in terms of design and practicality of the apparatus (Bologna, 2016). While breast pump designs was continuously improved, leading companies were focusing on how to increase the efficiency of the pump (Prime et al., 2012).

From an anthropology and feminist perspective, breast pump is seen as men's invention that freed women from close contact with their infants (Esterik & C, 2017). In contrast, a mother-centred evaluation of breast pumps suggested that it is vital to redesign breast pumps to improve mothers' experience which can play a key role in prolonging the beneficial mother-infant breastfeeding relationship (Bartels et al., 2020).

A rise in women employment rate has increase consumer demands to have product that can effectively stimulate breast and increase milk production and output (Grand

View Research, 2019). Hospital-grade pump was gaining popularity not only because it can fulfil the consumer demands but also due to its ability to be used by multiple users and it was more durable and stronger. The market research reveals that working mothers generally preferred lighter breast pump that produced lesser noise. There has also been interest to design the breast pump based on infant's natural suction and suckling on the breast (Medela et al., 2017).

Global breast pump market was valued at USD891.5 million and USD2.51 billion in 2016 and 2020 respectively with North America held the largest market share (Grand View Research, 2019; Research, 2021). It is expected to continue growing due to multiple factors. Supportive government initiatives such as breastfeeding initiatives by United Nations Children's Fund (UNICEF) in the United Kingdom has led to increase in breastfeeding rate and simultaneously resulting in rise in demand for breast pump in Europe countries. Among the breastfeeding initiatives in the USA that require insurance companies to cover breastfeeding services and equipment has significantly increased demand for breast pump and USA is currently the largest regional market globally.

Improvement in consumer awareness on benefits of breastfeeding, increasing number of women employments and desire among consumer to adopt advance medical technology has been seen as influencing factors for expansion of breast pump global market (Research, 2021). Breastfeeding products marketing like breast pump has been noted as influencing factor for mothers to buy the breast pumps due to the slogans that the equipment was as near to breastfeeding as possible (Taylor et al., 2020). However, Mannel (2018) argued that breast pumps are useful for mothers who need to express milk regularly. Getting access to safe breast pumps is a public health and economic

issue. Mothers who had painful experience with breast pumps were more like to turn to highly marketed formula milk products.

While there were many choices of breastmilk expression tools in the market, many mothers were clueless on which one to choose (Meier et al., 2016). Most of them relied on internet searches to find solution when any problem arose (Taylor et al., 2020). Increasingly, breast pump companies were actively promoting their products through online marketing, mother and infant fairs, retail outlets, and many other venues that could reach out to mothers including health facilities. Some researches on effectiveness of breast pump usage were sponsored by breast pump companies (Becker et al., 2016). The outcome of these research is considered bias as the result may turn to be favourable to the funders.

#### **1.4 Problem statement**

A systematic review that examined 22 literatures related to breastmilk expression among healthy term infants revealed that there was limited evidence that milk expression prevalence was associated to success and duration of breastfeeding (Johns et al., 2013). However, the practice of milk expression was increased along with the commercial availability of a range of infant feeding equipment. It was underscored that breastmilk expression practices was associated with the motivation to provide human milk to their infants (Felice et al., 2017b). Further exploration among mothers in the USA found that the reasons for mothers to express their milk were complex and changing over the time (Felice et al., 2017a). The understanding of mother's reasons expressing breastmilk provide better perspective on how to support mothers in this practice. However, there is lack of reference on why working mothers in Malaysia

practicing milk expression. Hence, it is important to further investigate on the reasons of women practicing milk expression in the local context.

It has been an increased trend among mothers to express their breastmilk as early as right after birth using various methods. Despite hand expression is free and cost effective, it remains unpopular among breastfeeding mothers. In a commentary review, Morton (2012) addressed the concern of hand expression was underused due to her findings that medical staff were not comfortable to put hands on breast in the process of teaching milk expression method to mothers but seemed preferred to use breast pump. In the updated Cochrane review (Becker et al., 2015) on methods of milk expression for lactating women, most studies were categorized as unclear on what had influenced the decision of breastmilk expression method. In the same review, out of 25 studies that analyzed pump usage, 15 were supported by manufacturers. In developed countries like US however, breast pump has been recommended nationally by the Health and Human Services Department (Services, 2009). Further exploration besides the healthcare factor is needed to understand on why hand expression was not the first choice among mothers and what is the implication of recommendations to use breast pump.

Although there are literatures on breast pump and milk expression, research that focus on the factors influencing the decision, choice, and methods of providing breastmilk feeding is limited. The extent to which the role of marketing a breast pump has an impact on the phenomenon is yet to be explored.

## **1.5 Rationale of the study**

It has become a common knowledge that mothers sometimes would ask for opinions and advices on how to choose the best method of milk expression. A review on

guidelines of breastmilk expression, storage and transport for infants in hospital, found that most guidelines recommend hand expression as the initial method for expressing of breastmilk, followed by breast pump use (Rodrigo et al., 2018). In Malaysia, there is no clear recommendation on which method of milk expression to be used by mothers. However, hand expression was described as the only method of milk expression in the manual for breastfeeding peer supporters (Kementerian Kesihatan Malaysia, 2019, p. 34).

Mothers' views of effective methods is yet to be researched (Becker et al., 2016). There is no available recommendation on how to choose the best method of milk expression based on mother's needs. Many advices were given either by the advisor's personal experience or possibly influenced by marketing activities done by the breast pump's companies (McInnes et al., 2015). Thus, this study will provide and suggest factors to be considered in milk expression method decision based on the experience of current practices.

World Health Organization (WHO) has continuously encouraging policy makers to give more attention on how to support breastfeeding mothers (WHO, 2017). In Malaysia, tax relief is given for purchasing breastfeeding equipment to address these needs (Lembaga Hasil Dalam Negeri Malaysia, 2017). However, without a proper guideline on how to choose the right method for a mother's needs, this incentive can be abused by breast pump companies through their marketing activities. By conducting this study, the outcome can be used by stakeholders in breastfeeding field in providing appropriate support for breastfeeding mothers.

## **1.6 Research questions**

This study proposed to address the following research questions:

1. Why working women in Malaysia practice milk expression?
2. What influence their decision to choose milk expression method?
3. What are their experiences and challenges in expressing milk?

## **1.7 Objectives of the study**

The current study aims to explore the views and experience of Malaysian working women on the expression of breastmilk and their challenges in maintaining breastmilk or breastfeeding practices.

### **1.7.1 Specific objectives**

- 1) To understand the **reasons** for milk expression among Malaysian working women.
- 2) To determine the **influencing factors** in choosing the milk expression method.
- 3) To explore the **experiences and challenges** of using the various milk expression method.

## **1.8 Structure of the thesis**

The thesis comprises of six chapters, a reference lists and appendixes in the following manner. Chapter one is an introduction to this study. The introduction included background of milk expression, the significance of having milk expression research in Malaysia, research question and objective of this study.

Chapter 2 covers literature review that describe the practice of milk expression, exploration of milk expression experience and examine the perception of milk expression among mothers in various settings and populations. The literature included

provide in depth understanding of the state of milk expression practices, experience and perception and gap of the literature in Malaysian context.

Chapter 3 describes the research design and methodology of this study. The rational of choosing qualitative method, research design, data collection research procedure and data analysis is described. This chapter also includes approach in gathering the data, determination of sample selected and ethical considerations issues in this study.

Analysis of data and finding of the study is presented in Chapter 4. Discussion on the result is further elaborated in Chapter 5. Finally, Chapter 6 contains the summary, conclusion and recommendation of the study. The study is concluded with a reference list and appendixes.

## **CHAPTER 2**

### **LITERATURE REVIEW**

#### **2.1 Introduction**

Milk expression practices, experiences and perceptions among mothers have evolved over the years. Researchers have been exploring the richness of complexity of mothers' practices, experiences and perceptions in milk expression in different setting and population. Two reviews that have been conducted by earlier researchers on milk expression practices with specific focuses which were method of milk expression and antenatal milk expression have been identified.

A systematic review on milk expression practices, focusing on methods (Becker et al., 2016) included only randomized and quasi-randomized trials at any time after birth. The review tabled the maternal acceptability and satisfaction, adverse outcome, effectiveness, effect on milk composition and maternal physiological and economic implication of the milk expression method but was not able to assess safety and achievement of maternal goals for expressing milk.

Another Cochrane review on antenatal milk expression among women with diabetes (East et al., 2014) found that there were no published or unpublished randomized controlled trials comparing antenatal expressing with not expressing. It further suggested that there was no high-level systematic evidence to inform the safety and efficacy of the practice of expressing and storing breastmilk during antenatal. A qualitative review of mothers' perception on breastmilk expression for premature infant in neonatal care intensive unit (Abu Bakar et al., 2019) has synthesized three main themes: maternal changes, pumping challenges and motivation.



For this study, a literature search which excluding the previous reviews mentioned above, was conducted on four electronic databases (Krisalis Discovery, Scopus, CINAHL and PubMed). Search terms included the following: (“milk expression” OR “expressing milk” OR “expressing breastmilk” OR “breastmilk expression” OR “milk pumping” OR “pumping milk” OR “breast pump”) AND (practice OR experience OR challenge OR perception OR attitude OR feeling OR view) NOT (cow OR animal).

The search targeted peer-reviewed articles that included research about mothers’ practices, experiences and perceptions on milk expression published between January 2010 and August 2020. Only full-text available and English-language articles were included. Review article, policy statement, studies about instrument development, and non-human studies were excluded.

This literature review aimed to (a) describe the practice of milk expression, (b) explore the experience of milk expression and (c) examine the perception of milk expression among mothers in various settings and populations.

The major findings for each study were categorized by each theme’s description (Table 2.1). Each study has at least one of the themes. While the focus of the included studies was not looking at the association of the themes, this review has highlighted some association between experiences or perceptions and practices of milk expression among mothers.

Table 2.1 Themes identified in included articles (n=34)

<b>Author, year</b>	<b>Practice</b>	<b>Experience</b>	<b>Perception</b>	<b>Practices Associated with Experience or Perception</b>
Clemons & Amir, 2010	x	x		
de Alencar & Seidl, 2010	x	x		x

Table 2.1 Continued

Author, year	Practice	Experience	Perception	Practices Associated with Experience or Perception
Sisk et al., 2010		x	x	
Flaherman et al., 2012	x		x	
Geraghty S et al., 2012	x			
Ismail et al., 2012	x		x	x
Welborn, 2012	x	x	x	x
Geraghty SR. et al., 2013	x			
Hurst et al., 2013		x	x	
Johns HM et al., 2013		x		
Johnson et al., 2013			x	
Rossmann et al., 2013	x	x	x	x
Qi et al., 2014	x	x		
Brisbane & Giglia, 2015	x		x	x
Dinour et al., 2015	x		x	x
Froh et al., 2015		x		
Bai et al., 2016	x		x	x
Felice et al., 2016	x	x		
Flaherman et al., 2016		x		
Ikonen et al., 2016		x		
Johns et al., 2016	x	x		
Bower et al., 2017			x	
Felice et., 2017	x	x	x	x
Forster et al., 2017	x			
Keim et al., 2017	x			
Loewenberg et al., 2017	x	x		
O'Sullivan et al., 2017	x	x	x	
Bujold et al., 2018		x	x	
Fair et al., 2018	x		x	x
Ikonen et al., 2018	x	x		
Demirci et al., 2019	x	x	x	x
Jardine, 2019		x	x	
McCue & Stulberger, 2019	x		x	x
Mörelus et al., 2020		x	x	

The practices will be describing the method and the process of the practices in different setting or condition of mothers and infants. The experience will explore the reasons, challenges, coping strategies and motivations in milk expression practices. In

examining mothers' perception on milk expression, the positive and negative perceptions that influence the experiences and practices will be discussed.

## **2.2 Milk expression practices**

Among 25 studies that have practices as the primary outcome of this review, 12 studies were about methods and 18 studies were about processes, which includes studies discussing about the frequency, the duration, and the location of milk expression practices (Table 2.2). Of all these studies, 15 were from USA, five from Australia, one from each of Brazil, Malaysia, UK, and Finland and one study involved more than seven countries. Among the studied population were working mothers, mothers of premature or ill infant, mothers who donor milk and mothers with term newborn.

Table 2.2 Twenty-five studies describing practices of milk expression

<b>Author Year Location</b>	<b>Method (n = 12)</b>	<b>Process (n = 18)</b>
Clemons & Amir 2010 Australia	60% (507 out of 843) women expressed by hand, 64% (538 out of 843) using manual pump, 66% (556 out of 843) using electric pump and 10% (86 out of 843) using battery-operated pump. 54% (454 out of 839) women preferred electric pump, 28% (237 out of 839) manual pump, 9% (79 out of 839) hand expression, 4% (30 out of 839) “all of them”, and 5% (40 out of 839) “none of them”.	Frequency of expression varied over the time. The highest frequency was “several times a day” in weeks zero to four: 36.2%.
de Alencar & Seidl 2010 Brazil	61% (22 out of 36) using hand expression, 31% (11 out of 36) using breast shells, and 8% (3 out of 36) using breast pumps.	72% (26 out of 36) expressed more than once a day; 8% (3 out of 36) expressed once a day; and 19% (7 out of 36) frequency was variable. 83% (30 out of 36) mothers feels the frequency was related to more than one influencing factors.
Flaherman et al. 2012 USA	The median volume of expressed milk was 0.5 ml (0–1) for hand expressing, and 1 ml (0–3) for pumping mothers (p=0.07). Milk volume did not differ by intervention.	

Table 2.2 Continued

<b>Author Year Location</b>	<b>Method (n = 12)</b>	<b>Process (n = 18)</b>
Geraghty S et al. 2012 USA		63% (37 out of 59) of the mothers had expressed their milk by four weeks and 27% (22 out of 59) were feeding at breast.
Ismail et al. 2012 Malaysia		For exclusive breastfeeding mothers, they commonly practiced expressing milk regularly at workplace, twice a day for < one hour for each session.
Welborn 2012 USA		29% (6 out of 21) mothers who experience still birth or death in utero, express their milk after the loss. 71% (15 out of 21) mothers started pumping their milk when their babies were in the NICU and unable to breastfeed.
Geraghty SR .et al. 2013 USA		All 40 mothers expressed their milk at some point and all 40 infants were fed expressed milk. The most frequent combination of milk production methods by 28% (11 out of 40) mothers was feeding the infant at the breast at the second day and then including at least some milk expression until at least six months.

Table 2.2 Continued

<b>Author Year Location</b>	<b>Method (n = 12)</b>	<b>Process (n = 18)</b>
Johns HM et al. 2013 Australia	60% (605 out of 1003) mothers already had a breast pump prior to giving birth; 48% (239 out of 499) of the primiparas and 73% (366 out of 504) of the multiparous mothers. Most of the multiparous women had a breast pump from their previous infant. Possession of breast pump among primiparas were by: 44% (106 out of 239) buying themselves; 34% (80 out of 239) borrowing one; 23% (54 out of 239) receiving as a gift; <1% (3 out of 239) renting.	
Rossman et al. 2013 USA		57% (13 out of 23) mothers were able to maintain adequate milk volume for their infants. 43% (10 out of 23) mothers maintained a regular pumping schedule despite not being able to maintain adequate milk volume for their infants. Mothers were maintaining regular pumping schedule regardless they could maintain adequate milk volume for their infants or not.
Qi et al. 2014 USA	75% (1379 out of 1844) of mothers used new pumps. 60% (1102 out of 1844) purchased themselves	

Table 2.2 Continued

<b>Author Year Location</b>	<b>Method (n = 12)</b>	<b>Process (n = 18)</b>
Brisbane & Giglia 2015 Australia		9 out of 12 of mothers attempted to express colostrum antenatally after 37 weeks' gestation. Average number of syringes collected was six (range ¼ to 12). 4 out of 12 of those who collected colostrum used it to supplement their newborn.
Dinour et al. 2015 USA		Only 36% (4 out of 11) students expressing milk on campus as compared to 75% (6 out of 8) of staff and 69% (9 out of 13) of faculty could express milk on campus. All students expressed their milk in bathroom as compared to staff and faculty, most of them expressed milk in private room.
Bai et al. 2016 USA		58% (36 out of 62) of employees and 36% (57 out of 156) of students had pumped breastmilk on campus.
Felice et al. 2016 USA		<p>Mothers who pumped between 1.5 and 4.5 months postpartum as compared to mothers who fed HM but did not pump in this time period:</p> <ul style="list-style-type: none"> <li>- had a higher income and education</li> <li>- were less likely to have had a previous experience feeding HM</li> <li>- intended to feed HM longer</li> <li>- returned to work earlier and at more hours per week.</li> </ul>

Table 2.2 Continued

<b>Author Year Location</b>	<b>Method (n = 12)</b>	<b>Process (n = 18)</b>
Johns et al. 2016 Australia.	65% (501 out of 772) mothers chose electric breast pump. For first time mothers, 73% (306 out of 417) had used electric breast and 58% (241 out of 417) had used hand expression. 60% (605 out of 1003) of mothers already had breast pump immediately at postpartum. At six months, only 2% (18 out of 772) expressed by hand only and 66% (496 out of 754) had an electric pump and 56% (425 out of 754) a manual pump.	40% (186 out of 466) of mothers expressing milk several times a day at zero to two weeks >7% continue expressing several times a day at six to seven months. 40% (288/715) of mother continue expressing at five to six months occasionally Common in first two weeks postpartum and (290/466;62%) had expressed some milk at three months.
Felice et al. 2017 USA	Mothers used all types of milk expression methods: single manual, single electric, double electric and hand expression.	
Forster et al. 2017 Australia		42% (134 out of 316) mothers from antenatal expressing group practice > 20 times expressing during antenatal. 15% (46 out of 316) of infants from antenatal expressing group admitted to NICU. 14% (44 out of 316) of infants from standard care group admitted to NICU.
Keim et al. 2017 USA	7% (33 out of 478) exclusively pumping and not feeding at the breast. 93% (445 out of 478) were both feeding at breast and pumping but 9% (39 out of 445) of them providing milk to their infant exclusively at breast.	



Table 2.2 Continued

<b>Author Year Location</b>	<b>Method (n = 12)</b>	<b>Process (n = 18)</b>
Loewenberg et al. 2017 USA	98% (98 out of 100) intended to use a breast pump to express milk for their infant.	69% (68 out of 98) of those, intended to start within weeks of delivery. 29% (28 out of 98) had already initiated pumping or intended to initiate within the subsequent few days.
O'Sullivan et al. 2017 USA		Duration of milk expression ranged from a few days to 17 months and duration of feeding expressed breastmilk ranged from a few days to 16 months.
Fair et al. 2018 UK		64% (442 out of 688) of the respondents had heard of ABE, 8% (56 out of 688) reported that they had been advised to express breastmilk during pregnancy, and 14% (97 out of 688) reported that they had practiced milk expression during pregnancy. Mothers who were advised to express milk during pregnancy were more likely to practice it 68% (38 out of 56) as compared to not receiving advice, only 9.3% were practicing it during pregnancy.
Ikonen et al. 2018 Finland		35% (45 out of 125) of mothers initiated milk expression within six hours from birth. 33% (43 out of 129) of mothers expressed more than six times per day.
Demirci et al. 2019 USA	Hand expression method was used in AME practice.	Mothers were practicing AME once or twice a day during antenatal

Table 2.2 Continued

<b>Author Year Location</b>	<b>Method (n = 12)</b>	<b>Process (n = 18)</b>
Jardine 2019 USA, Canada, UK, Australia, Singapore, India, Malaysia and a few other countries.	Exclusively pumping.	
McCue & Stulberger 2019 USA	Using breast pump on one breast while simultaneously nurse a infant on the other breast.	

### **2.2.1 Methods of milk expression**

Among twelve studies reporting on method, five studies described method of milk expression of both hand expression and breast pump, six studies reported on use of breast pump and only one study solely on hand expression.

Only one study was looking at the milk volume as a comparison between both method with the outcome of no significant difference (Flaherman et al., 2012). Two studies from Australia (Clemons & Amir, 2010; Johns et al., 2016) reported preference of using breast pump over hand expression with only 2% of mothers (Johns et al. 2016) reported using hand expression at infants' age of six months. The participants were amongst a group of mothers of healthy term infants in Melbourne, Australia, between birth and six months postpartum. However, a Brazilian study among milk donors reported that 61% of the participants were using hand expression (de Alencar & Seidl, 2010) and less than 10% were using breast pumps.

Of six studies on the use of breast pump, one study in USA reported that 98% of the mothers intended to use breast pump at some point of their breastfeeding period (Loewenberg Weisband et al., 2017). Two studies related to breast pump use reported on the exclusively pumping practices and another study reported on the use of breast pump in parallel to breastfeeding on the other side of the breast. Only one study on antenatal milk expression reported hand expression as a sole method of expression (Demirci et al., 2019).

The trend of exclusively expressing milk and providing the milk to their infants using another apparatus like bottles and teats has been increasingly popular among mothers (Geraghty et al., 2013). Providing human milk or a mother's own milk has been the ultimate goal for many of these mothers (Bower et al., 2017). Some mothers were

struggling to get evidence-based information and support on exclusively expressing milk while trying to practice it (Jardine, 2019).

While it is not clear why a particular method was chosen over the other, breast pump was a common method of milk expression in most studies with three studies (Keim et al., 2017; Jardine, 2019; McCue & Stulberger, 2019) were using “pumping” as a term of reference of human milk expression method.

### **2.2.2 Process of milk expression practices**

Eighteen studies reporting on the process were about frequency, duration, time of initiation and the setting of milk expression (Table 2.2).

The five studies reporting on frequency of milk expression, found the frequency of milk expression ranged from twice a day to six times a day. Two studies reported on mothers maintaining regular expressing schedule (Ismail et al.,2012; Rossman et al.,2013) and one of them found that 43% of the mothers in the study maintain the regularity even if they could not provide adequate milk for their infants (Rossman et al.,2013).

For milk expression duration, a study reported some mothers were at least expressed some milk until for at least 6 months (Geraghty et al.,2013; Johns et al., 2016). The longest duration of milk expression period reported in one study was 17 months (O’Sullivan et al.,2017). Mothers who experienced perinatal loss were also reported to continue expressing milk as part of the grieving process until few weeks or months (Welborn, 2012).

Although majority of the studies were about milk expression after delivery and commonly began in a few weeks after delivery (Johns et al., 2016; Loewenberg et al., 2017), four studies were about milk expression during antenatal beginning at 37<sup>th</sup> week

of pregnancy (Brisbane & Giglia, 2015; Forster et al.,2017; Fair et al., 2018; Demirci et al., 2019). It was reported in one study as no adverse effect to be practiced (Forster et al.,2017). Mothers will most likely to practice antenatal milk expression if they have heard about it (Fair et al.,2018).

Three studies reported milk expression in workplace setting (Ismail et al.,2012; Dinour et al.,2015; Bai et al.,2016) with two specifically in campus comparing practices between students and employees (Dinour et al.,2015; Bai et al.,2016). Both studies found that percentage of students practicing milk expression is lesser than the employees. The students were reported expressing milk in bathroom as compared to the employees who were mostly expressing milk in a private room.

### **2.3 Milk Expression Experiences**

The experiences reported in this review were about observation and the struggle of milk expression experience. The observation theme was focusing on reasons, coping strategies and motivation observed in milk expression experience described in the studies. All the twenty-one studies on experiences were about observations but eleven of them were also reporting on struggles (Table 2.3).