

**Artikel Asli/Original Article**

**Comparison of Breastfeeding Practice Using Deuterium Oxide Dose to Mother Technique with Maternal Recall Breastfeeding Practice Among Mothers in Klang Valley**

(Perbandingan Amalan Penyusuan Susu Ibu dengan Kaedah Deuterium Oksida Dos kepada Ibu dan Kaedah Ingatan Semula Amalan Penyusuan Susu Ibu dalam Kalangan Ibu di Lembah Klang)

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ABSTRACT

*The assessment of exclusive breastfeeding is important to invest the efforts to promote and support breastfeeding practices. Hence this study was carried out to compare breastfeeding practices among mothers using deuterium dose to mother technique with maternal recall breastfeeding practice. A total of 30 mother-infant pairs from a university hospital and government health clinics in Klang Valley participated and completed the study. Mother-infant pairs were recruited into the study when infants were aged 3 months  $\pm$  1 week. Anthropometric measurements (height, weight, waist circumference for mother; length and weight for infant) were carried out. Socio-demographic questionnaire was self-administered while breastfeeding practices were interview administered using maternal recall breastfeeding practice questionnaire (MRBF). This was followed by baseline saliva collection of mother-infant pairs before dose and 6 days after mothers were given  $30 \pm 0.01$  g of  $D_2O$ . The post dose saliva sample of mother-infant pairs were collected 6 times at day 1,2,3,4,13 and 14. The results showed that majority of mothers (57%) were university graduates but majority were stay at home mothers. Meanwhile, mothers had BMI with mean  $25 \pm 4$  kg/m<sup>2</sup>. The results from MRBF questionnaire showed that all mothers were practicing exclusive breastfeeding and their infant never received any water sources other than their breast milk. However, the deuterium dose to mother technique revealed only 3% of mothers were actually practicing exclusive breastfeeding. From the isotopic data, the calculated mean intake of milk was  $721 \pm 243$  g/day while the mean non-milk oral intake of  $122 \pm 22$  g/day. In contrast exclusive breastfeeding infants received only 10 g/day non milk oral intake, demonstrating exclusive breastfeeding practice of mothers. There were different breastfeeding practice reported from mother using deuterium oxide dose to mother technique with maternal recall breastfeeding practice.*

*Keywords: Exclusive breastfeeding; breastfeeding practice; deuterium oxide technique; Klang Valley; maternal recall*

ABSTRAK

*Penilaian penyusuan eksklusif adalah penting supaya dapat mempromosikan dan menyokong amalan penyusuan ibu. Dengan itu, kajian ini dijalankan untuk membanding amalan penyusuan susu ibu di kalangan ibu dengan menggunakan kaedah deuterium oksida dos kepada ibu dan kaedah ingatan semula amalan penyusuan susu. Seramai 30 pasangan ibu dan bayi dari hospital Universiti dan klinik kesihatan kerajaan di Lembah Klang telah menyertai dan menyelesaikan kajian ini. Pasangan ibu dan bayi telah direkrut dalam kajian semasa bayi berumur 3 bulan  $\pm$  1 minggu. Pengukuran antropometri (ketinggian, berat badan dan ukur lilit pinggang untuk ibu; panjang dan berat untuk bayi) telah dijalankan. Borang soal selidik sosio-demografi diisi oleh ibu sementara amalan penyusuan susu ditemu duga oleh penyelidik dengan borang soal selidik ingatan semula amalan penyusuan susu. Ini diikuti dengan pengumpulan air liur asas dari pasangan ibu dan bayi sebelum dos diberi kepada ibu dan 6 hari selepas ibu diberi  $30 \pm 0.01$  g  $D_2O$ . Sampel air liur dari pasangan ibu dan bayi dikumpul pada hari pertama, ke-2, 3, 4, 13 dan 14 selepas dos  $D_2O$  diberi. Hasil menunjukkan majoriti ibu (57%) belajar sehingga universiti dan majoriti ibu tinggal di rumah. Ibu mempunyai BMI dengan purata  $25 \pm 4$  kg/m<sup>2</sup>. Hasil dari borang soal selidik amalan penyusuan susu menunjukkan semua ibu mengamalkan penyusuan susu ibu secara eksklusif dan bayi mereka tidak pernah menerima sebarang sumber air selain susu ibu. Walau bagaimanapun, kaedah deuterium oksida dos kepada ibu menunjukkan hanya 3% ibu sebenarnya mengamalkan penyusuan susu ibu secara eksklusif. Dari data isotop, purata pengambilan susu adalah  $721 \pm 243$  g/hari manakala pengambilan air selain sumber susu ibu sebanyak  $122 \pm 22$  g/hari. Sebaliknya kumpulan penyusuan susu ibu hanya menerima 10 g/hari air selain sumber susu ibu sahaja dan ini memenuhi syarat amalan penyusuan susu. Amalan penyusuan susu yang dilaporkan oleh ibu didapati berbeza jika berbanding kaedah deuterium oksida dos kepada ibu dengan kaedah ingatan semula amalan penyusuan susu.*

*Kata kunci: Penyusuan susu ibu secara eksklusif; amalan penyusuan susu ibu; teknik deuterium oksida; Lembah Klang; ingatan semula maternal*

## INTRODUCTION

Breastfeeding is a global policy established by WHO and UNICEF to ensure that optimum nutritional status is achieved among infants from birth until 2 years old (WHO & UNICEF 1989). WHO (2001) recommends exclusive breastfeeding up to six months and to be continued until two years, with the introduction of complementary foods in infant's life. Exclusive breastfeeding is defined as infants receiving breast milk only without any additional liquids or solid except medication under prescription of doctor (Noel-Weiss et al. 2012). Previous studies demonstrated that exclusive breastfeeding assured the essential nutrients for infants below 6 months and protected infants from diarrhea and respiratory infection (Horta & Victora 2013; Victora et al. 2016). The Malaysian government supports National Breastfeeding Policy and plays a vital role in the promotion of exclusive breastfeeding practices among Malaysian mothers (NCCFN 2013). Despite the intensive promotion of exclusive breastfeeding, some mothers discontinued breastfeeding due to several barriers, such as not enough milk, tiredness due to work and infant had trouble suckling or latching on (NHMS 2016). Despite the global increase trend of exclusive breastfeeding from 33% in 1995 to 39% in 2010 in developing country as reported by Cai et al. (2012), the National Health Morbidity Survey IV (NHMS IV) showed that 47.5% of Malaysian mothers practiced exclusive breastfeeding up to 6 month (NHMS 2016). Continuous education and promotion are required to further increase the awareness of the mothers towards the exclusive breastfeeding in Malaysia.

The tool used to identify breast milk intake included test weighing. Test weighing is a convenient instrument to assess human breast milk intake of infant through measured body weight before and after each feeding (WHO 2002). Haase et al. (2009) established the test weighing technique with controlled several confounding variables such as minimizing infant movement, eliminating clothes or blanket from draping over the side of scale and maintaining the consistent position to obtain a more accurate measurement of breast milk during breastfeeding in clinical setting. Savenije & Brand (2006), however reported the imprecise test-weighing due to the insensitivity of the weighing scale to differentiate the small changes before and after each feeding. Savenije & Brand (2006) reported that the presence of wire and splints, vomiting or regurgitation did not influence the imprecision of test weighing. However, the milk spill slightly affect the imprecision of test weighing. 95 % of test weighing showed 14 ml difference after excluding the milk spill cases and showed that adjusting for insensible water loss did not improved the precision of test-weighing (Savenije & Brand 2006).

Deuterium oxide dose-to-mother technique had been introduced by Coward et al. (1982) to differentiate the water sources intake by infants other than breast milk. The theory of deuterium oxide dose-to-mother technique assessed breast milk flow from mother to baby, based on

two compartment model, where the first compartment was mother's body water and the second compartment was baby's body water (IAEA 2010). Based on 6 assumptions, water input is equal to water output in the steady state and the adjustment of model for water turnover in the mother and baby (IAEA 2010). The breast milk and water sources intake determine by curve fitted using "Solver" function in Microsoft Excel (IAEA 2010). To date, no study had been carried out to determine exclusive breastfeeding practice using deuterium oxide among Malaysian mothers. Hence, this study was carried out to compare breastfeeding practices among mothers using deuterium dose to mother technique with maternal recall breastfeeding practice in Klang Valley, Malaysia.

## MATERIALS AND METHODS

The present study is a cross-sectional study (purposive sampling) of 32 mother-infant pairs who were recruited at 1 to 2 months postnatal during their visit to the hospital and government health clinics in Klang Valley. A sample size of 32 mother-infant pairs was calculated by formula  $N = t_{\alpha}^2 s^2 / \epsilon^2$  reported from Singh & Masuku (2014). "s" is the standard deviation of human milk intake at 3 months (135 g/day) as reported by Agne-djigo et al. (2013).  $\epsilon$  referred to the permissible in the estimation of mean whereas  $t_{\alpha}$  is the value of at 5% level of significance (Singh & Masuku 2014). 10% dropout rate was calculated from the total sample size. After initial interview by the researcher to review the inclusion and exclusion criteria of subjects using screening questionnaire, 30 mothers aged between 18 until 40 years old who were planning to exclusive breastfeed until 6 months were eligible to participate in this study. Subjects were excluded from continuing the study due to the changes of exclusive breastfeeding practices to other type of practice through questionnaire, unable to commit their time during data collection and personal issues. Mothers who were healthy without any fluid retention disease, non-smoker, non-alcohol drinker and had less than 4 children were selected. Meanwhile, full term infants (37 to 40 weeks) with normal weight for height z-score ( $> -2$ ) and normal birth weight ( $\geq 2.5$  kg) were included. Twins infants and those infants with edema problems were excluded in this study. The ethical approval was obtained from Research Ethics Committee of National University Kebangsaan Malaysia (NN-173-2014) and Medical Research & Ethics Committee (NMRR-15-445-25253) before study commencement.

## ANTHROPOMETRY MEASUREMENTS

Height of mothers were measured using measuring board (portable height-length measuring board, US) to the nearest to 0.1 cm. Weighing scale (Tanita HD-309 Weight Scale, Tokyo, Japan) was used to measure the weight of mothers. Meanwhile, infant's weight were measured by baby

weighing scale (Seca 354, Digital Baby Scale, CN), scales accurate to 0.01kg. The weight of infants were measured before deuterium dose was given and at post dose day 14 to obtain their weight changes. All measurement techniques followed the instruction from IAEA (2010).

#### MATERNAL RECALL BREASTFEEDING PRACTICE QUESTIONNAIRE

The researcher visited mothers at home when infant was aged 3 month  $\pm$  1 week. Socio-demographic information of mothers and infant's details were collected using a self-administered questionnaire. The practice questionnaire which was interview administered, was adopted from IYCF practice assessment form (exclusive breastfeeding under 6 months) (WHO 2008). It consisted of 29 items regarding current breastfeeding status, water sources intake other than breast milk of infants, whether breastfeed first and second children, type of delivery methods, initiation of breastfeeding and their planned duration to breastfeed were interviewed administered. 17 items were selected from IYCF practice assessment form and additional 12 items were included to obtain breastfeeding practice from subject. The maternal recall breastfeeding practice questionnaire was tested among pregnant mother to determine the whether the subject understand questionnaire. The question of current breastfeeding status, food or drink intake by infants since birth until now, water sources intake other than breast milk of infants and anything received by infants within 24 hours beside breast milk were those questions to determine the type of breastfeeding practice through administered interview. The definition of exclusive breastfeeding by WHO (2008) recommendation was infants receiving breast milk only without any additional liquids or solid except medication under prescription of doctor. Predominant breastfeeding define as infant receiving breast milk plus other liquid such as water, tea or juice (WHO 2008). Those infants received other foods or milk in addition to breast milk classified as partial breastfeeding (WHO 2008).

#### SAMPLE COLLECTION

Each saliva sample (1 ml) of infant was collected at least 15 minute since infant was last fed to avoid the residue of foods and milk left in the saliva samples and the sample was duplicated (IAEA 2010). A baseline saliva sample (2 ml) was collected from mothers at least 30 minutes post meal during 3 months postpartum. This was followed by  $30 \pm 0.01$  g deuterium oxide dose given to the mother. Only mothers were given the deuterium dose but not to the infants.  $50 \pm 0.01$  g drinking water added and rinsed the bottle contained deuterium dose, followed by drank by mothers. Saliva was collected from mother and infant pairs at baseline, day 1, 2, 3, 4, 13 and 14 after given the deuterium dose (IAEA 2010).

During saliva collection of mothers, they were given sterile cotton wool ball to soak up the saliva for 5 minute.

The researcher collected the cotton wool ball using forceps from mothers and push the wool ball with the saliva sample into a 20ml disposable syringe (IAEA 2010). The saliva sample was collected in storage vials and labeled (IAEA 2010). The labelled saliva sample was put in small zip lock bag and the step was repeated with duplicate sample (IAEA 2010). The saliva sample collection of infants almost same with the procedure of mother except the saliva sample of infants were collected through swap the cotton wool ball in the infants mouth until 1 ml saliva sample collected using sterile hand glove. The saliva sample was placed in a cool box with ice pack and transferred to a freezer with temperature  $-20^{\circ}\text{C}$  for storage until analysis (IAEA 2010).

All saliva samples were analyzed by Fourier transform infrared spectrophotometer (Agilent® 4500t). The absorption wavelength for deuterium oxide was within  $2300\text{ cm}^{-1}$  and  $2800\text{ cm}^{-1}$  (IAEA 2010). The results were calculated by water turnover in mother and infant using algorithm (2015 excel® spreadsheet portable FTIR) which was developed by Medical Research Council Collaborative Centre for Human Nutrition Research, Cambridge, UK (IAEA 2010). All samples were analyzed at least twice when both readings were different by 3.0 mg/kg. Mothers were categorized as practicing exclusive breastfeeding if the mean non-milk oral intake was  $\leq 25$  g/day and non-exclusive breastfeeding when non-milk oral intake was more than 25 g/day (Moore et al. 2007). Mothers were classified as predominant breastfeeding if their mean non-milk oral intake was between 25 and 220 g/day meanwhile categorized as partially breastfeeding if mean non-milk oral intake was more than 220 g/day (Moore et al. 2007).

#### STATISTICAL ANALYSIS

All data were analyzed using Statistical Product and Service Solution version 22. Descriptive test was used to analyze the socio-demographic data and maternal recall data among subjects. Meanwhile, ANOVA test was used for comparisons among group means. Statistical descriptive analysis test was used to compare maternal recall method against intake by deuterium oxide dose to mother technique.

#### RESULTS

Mean age of mothers was  $30 \pm 4$  years old and majority (57%) were university graduates and the remaining (43%) studied up to secondary or college level (Table 1). 47% of mothers were working, 43% were housewives and most of them had household income RM3000 and above.

Table 2 shows that mother had body mass index (BMI) of  $25 \pm 4\text{ kg/cm}^2$  at 3 months postpartum. Majority of mother had normal BMI (43%). 41% were overweight while 13% were obesity at 3 months postpartum. However, mother had central obesity problem as their waist circumference were  $82 \pm 10\text{ cm}$ .

TABLE 1. Socio-demographic characteristics of mother-infant pairs

Maternal Characteristics (n = 30)	n/%	Mean ± SD
Age/years		30 ± 4
20-30	19 (64)	
31-40	11 (36)	
Race		
Malay	29 (97)	
Chinese	1 (3)	
Infants		
First	13 (44)	
Second	7 (23)	
Third	10 (33)	
Education Level		
Secondary School	3 (10)	
STPM/College	10 (33)	
University	17 (57)	
Employment Status		
Employed	14 (47)	
Student	3 (10)	
Housewife	13(43)	
Household Income/RM		
Low (<1000)	3(10)	
Moderate (1001-3000)	8(27)	
High (>3000)	19 (63)	

TABLE 2. Anthropometry measurement of mothers

Maternal Characteristics (n = 30)	Mean ± SD	n/%
Weight/kg	61 ± 12	
Height/cm	156 ± 5	
Body mass index/kgm <sup>-2</sup>	25 ± 4	
Underweight		1(3)
Normal		13(43)
Overweight		12(41)
Obese		4(13)
Waist circumference/cm	82 ± 10	
Hip circumference/cm	99 ± 10	

From the maternal recall method (Table 3), majority of mothers (70%) had normal delivery, and majority (67%) initiated breastfeeding within 1 hour after delivery. Mothers who were exclusive breastfeeding initiated breastfeeding after 1 hour, while those who were partially breastfeeding initiated breastfeeding within 1 hour. Nevertheless, all mothers reported practicing exclusive breastfeeding and that their infants never received any water source other than breast milk since birth until 3 months and still practicing exclusive breastfeeding. 87% mothers received exclusive breastfeeding information before delivery.

TABLE 3. Breastfeeding practices using maternal recall method and deuterium dose to mother technique from birth to 3 months

Breastfeeding Practice (n = 30) n (%)	Maternal recall (n = 30)	D <sub>2</sub> O Method		
		Exclusive	Predominant	Partial
Initiate breastfeeding				
Within 1 hour	20 (67)	0 (0)	17(65)	3 (100)
After 1 hour	10 (33)	1 (100)	9 (35)	0 (0)
Currently practice exclusive breastfeeding at 3 months	30 (100)	1 (100)	26 (100)	3 (100)
Infant never received any water source other than breast milk since birth at 3 months	30 (100)	1 (100)	26 (100)	3 (100)
Infant received any water sources other than breast milk since birth at 3 months				
Plain Water	0 (0)	0 (0)	0 (0)	0 (0)
Water with Sugar	0 (0)	0 (0)	0 (0)	0 (0)
Milk Formula	0 (0)	0 (0)	0 (0)	0 (0)
Cow's milk or any other animal's milk	0 (0)	0 (0)	0 (0)	0 (0)
Juice	0 (0)	0 (0)	0 (0)	0 (0)
Broth or soup	0 (0)	0 (0)	0 (0)	0 (0)
The Herbs	0 (0)	0 (0)	0 (0)	0 (0)
Other	0 (0)	0 (0)	0 (0)	0 (0)
Medicine/Vitamin/ Syrup	0 (0)	0 (0)	0 (0)	0 (0)
Never	100 (30)	100 (30)	100 (30)	100 (30)
Type of delivery				
Normal	21 (70)	0 (0)	19 (73)	2 (67)
Caesarean	9 (30)	1 (100)	7 (27)	1 (33)
Period received exclusive breastfeeding information				
Before delivery	26 (87)	0 (0)	25 (97)	2 (67)
After delivery	5 (13)	1 (100)	1 (3)	1 (33)

Table 4 shows that mean breast milk intake of all infants was  $721 \pm 243$  g/day at 3 months postpartum. The mean non-milk oral intake for exclusive breastfeeding infants was 10 g/day and predominant infants was  $94 \pm 51$

g/day. Meanwhile, partially infants had mean non-milk oral intake  $402 \pm 223$  g/day. There were significant differences in breast milk intake and non-milk oral intake between exclusive, predominant and partially group respectively.

TABLE 4. Breast milk, non-milk oral intake and total body water from deuterium dose-to-mother technique at 3 months postpartum

Results	Overall	Exclusive	Predominant	Partially	P value	CI Value
Breast Milk Intake (BM)	$721 \pm 243$	670	$685 \pm 203$	$1051 \pm 400$	0.04*	630-812
Non-milk oral Intake (Fs)/gday <sup>-1</sup>	$122 \pm 22$	10	$94 \pm 51$	$402 \pm 223$	0.001**	76-168
Total Body Water (TBW)/kgday <sup>-1</sup>	$24 \pm 4$	27	$24 \pm 4$	$27 \pm 0$	0.295	23-26

\* significant different between group at  $p < 0.05$

\*\* significant different between group at  $p < 0.001$

In Table 5, the prevalence of exclusive breastfeeding practice by mothers using the exclusive breastfeeding questionnaire from maternal recall was 100%. However, deuterium dose to mother technique revealed that only 3% of mothers was actually practicing exclusive breastfeeding at 3 months. This was so much lower than the self-reporting of mothers from maternal recall which showed all mothers claimed to be practicing exclusive breastfeeding at 3 months. In reality, using the deuterium dose to mother technique, the majority of mothers (87%) were predominantly breastfeeding while 10% were partially breastfeeding.

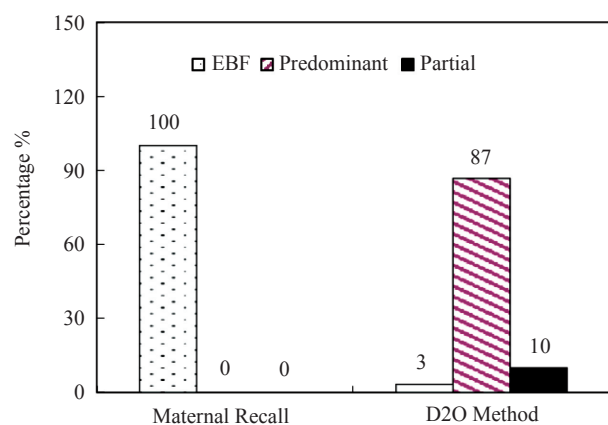


FIGURE 1. Prevalence of types of breastfeeding practices using maternal recall method and using deuterium dose to mother technique

## DISCUSSION

In the present study, three categories of breastfeeding practices were noted using deuterium dose to mother technique, (Figure 1) ie exclusive, predominant and partial breastfeeding. Deuterium dose to mother technique is a method which assumes exclusive breastfeeding infants received only breast milk from mothers within the period of 14 days (IAEA 2010). In other words, deuterium dose to

mother technique is a direct method to determine exclusive breastfeeding practices through the water flow from mother to infants (IAEA 2010). If infants received water sources other than breast milk, it will be determined by the flow of water and the non-oral milk intake will be above 25 g/day (Moore et al. 2007), which is categorized as non-exclusive breastfeeding infants.

On the other hand, the maternal recall method was the recall indicator using closed ended questionnaire with certain recall period for subjects. According to Aarts et al. (2000), a single recall indicator was not adequate to determine breastfeeding practice especially exclusive breastfeeding because of the wide discrepancy between the results obtained from current status indicators based on 24 hour period. Therefore, Aarts et al. (2000) suggested the recall period should include 24 hour period and since birth to avoid error found. Motswagole et al. (2015) showed that all Botswana mothers reported practising exclusive breastfeeding by maternal recall method, however only 61.2% were actually exclusive breastfeeding using isotopic data of D<sub>2</sub>O at 3 months. A similar result was also shown by Samuel et al. (2012) in India, in which 90% mothers was classified as exclusive breastfeeding using maternal recall method, when only 23% was exclusive breastfeeding using isotopic data of D<sub>2</sub>O. In our study, 100% mothers were classified as exclusive breastfeeding by maternal recall method, however only 3% mothers were actually exclusive breastfeeding using deuterium dose to mother technique. In this study, the discrepancies in the prevalence of exclusive breastfeeding between these two methods were due to mothers giving water to the infants occasionally due to haze or hot weather in Malaysia. Many mothers did not know that for exclusive breastfeeding practice, water and other water sources was reported by mother should not be given to infants. For working mothers, while they asked the caregivers to give expressed breast milk to the infants, the caregivers or nannies gave mixed water and other water sources to the infants without the mother's knowledge. These feedbacks were personal communication with subject when they interviewed.

Using the deuterium dose to mother technique, our study showed that there was significant difference in breast milk intake and non-milk oral intake between exclusive breastfeeding and non-exclusive breastfeeding group (predominant and partially) respectively. Overall the mean breast milk intake by all infants were  $721.3 \pm 243$  g/day at 3 months postpartum. By breastfeeding practice, the partially breastfed infants had the highest intake of breast milk in comparison with predominant breastfed infants or exclusive breastfeeding infants. There were uncertain amount of human milk intake reported by WHO (2001) due to difficulty to assess the human milk intake accurately whether using test-weighing or maternal human milk expression methods (Costa et al. 2010). However, deuterium oxide dose to mother technique resolved the weakness of both methods and directly measure the milk flow through estimation of deuterium enrichment (Costa et al. 2010). Costa et al. (2010) reported mean of human milk intake from 12 countries were 780 g/day during first 3 to 4 months when measured using direct method (deuterium oxide dose to mother technique). The mean of human milk intake from Costa et al. (2010) was almost similar with our current result. However in this study, predominant and partially breastfed infants had more non-milk oral intake (an indicator of non exclusive breastfeeding) than exclusive breastfeeding infants. Hence based on our results, it should not be interpreted that exclusive breastfeeding infants in Malaysia received less breast milk than predominant and partially breastfed infants, as only one infant was categorized as being breastfed exclusively.

In our study, none of the mothers reported giving any syrup, herbal tea, juice, formula milk, water, sweet water or other water source to their infants as shown in maternal recall breastfeeding practice at 3 months postpartum in each breastfeeding group. The maternal recall reflected the definition of exclusive breastfeeding as defined by WHO (2008), where infants received only breast milk and might include ORS, syrup and drops (vitamins, minerals and medicine). Breastfeeding practice was low among Malaysian mothers both in the urban area with end with rural area with 89% population (NHMS 2016). Exclusive breastfeeding was difficult to practise especially among working mothers, due to not enough milk, feel of tiredness after work and the technique of infant sucking and latching (NHMS 2016). However, 46.6% of working mothers were able to practice exclusive breastfeeding based on the current findings. Among those working mothers, they reported that they expressed and stored their breast milk to be given to their infants by the nannies or the caregivers (through personal communication). Maternal education level and household income did not affect their exclusive breastfeeding practice in current study in contrast to the findings of another study by NHMS (2016).

WHO (2003) recommended the initiation of breastfeeding within 1 hour of delivery, as a way of promoting breastfeeding practices longitudinally. This is because early initiation of breastfeeding may stimulate the

function of breast to increase breast milk supply and thus maintain or sustain their breastfeeding practices until 6 months (WHO 2002). However, our study showed that the only exclusive breastfeeding infants was breastfed after 1 hour of delivery as she was delivered by caesarean. Despite majority of the infants were delivered normally, their mothers were practising predominant breastfeeding at 3 months postpartum. Although mothers received exclusive breastfeeding information before delivery, hence have knowledge of the benefits of exclusive breastfeeding, it did not necessary translate into the practice of exclusive breastfeeding at 3 months postpartum. This was supported by Regan et al. (2013) who reported that the mode of delivery and timely initiation of breastfeeding were not the major reasons influencing the breastfeeding practices, however the decision of mothers were the main reason of breastfeeding practices.

This study is the first study in Malaysia to use deuterium dose-to-mother technique, which is a gold standard method as reference to determine the breastfeeding practices through estimation of breast milk intake by infants. Deuterium dose-to-mother technique is a direct method to measure the flow of deuterium mixed with breast milk and thus determine the total milk intake by adjusting for insensible and sensible water loss (Costa et al. 2010). It mimics the normal behavior feeding of both mother and infant during small and frequent feeding or nighttime feeding where test weighing and milk expression method could not (Costa et al. 2010). However, there is a precaution to avoid the loss of deuterium enrichment. The cross-contamination of saliva sample with breast milk left over in the mouth of infants should be centrifuged to obtain a clear sample and stable result.

Meanwhile, the limitation of this study was the small sample size and hence was unable to represent the mothers in Malaysia. This study was a part of a larger IAEA validation study that is participated by 8 different countries. Some precaution should be taken when mothers were working and gave expressed milk to the infant. The final reading of deuterium dose to mother technique affected if the mother gave expressed milk to infants without notifying the researcher was give expressed milk that did not contain deuterium dose during the 14 days post dose and this affected the deuterium oxide amount taken by infants.

## CONCLUSION

There are different breastfeeding practice reported from mother using deuterium oxide dose to mother technique with maternal recall breastfeeding practice. Deuterium oxide dose to mother technique is a more reliable method in determining exclusive breastfeeding practices as it is able to differentiate the types of breastfeeding practices among mothers.

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