



**THE MATERNAL DIETARY STATUS AND  
NUTRITIONAL COMPOSITION OF HUMAN MILK  
DURING EXCLUSIVE BREASTFEEDING PERIOD**

**BY**

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**A thesis submitted in fulfilment of the requirement of the  
degree of Master of Health Sciences**

**Kulliyyah of Allied Health Sciences  
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**AUGUST 2018**

## ABSTRACT

The Malaysian Dietary Guidelines (2013) advocate exclusive breastfeeding for the first six months of babies' lives for multi-beneficial effects on both child and maternal health. In Islam, breastfeeding a child is encouraged up to the age of two years. Studies on nutritional composition of breast milk are majorly done in the Western countries. The human milk nutritional content of Malaysian mothers whose diets are typically different than their Western counterparts' due to traditional postpartum practices, has never been investigated. The objectives of this study were: 1) to analyze the nutritional composition of human milk among Malay mothers during exclusive breastfeeding period, 2) to assess the mothers' dietary intake during this period, and 3) to evaluate the association between maternal dietary intake and their human milk nutritional composition. A total of 32 mothers were recruited. Sociodemographic and anthropometry data were recorded during the 3rd trimester of pregnancy. After delivery, 10-30ml of human milk samples were collected once each during the colostrum and transitional milk phases (within the 1<sup>st</sup> month postpartum), and every 30 days during the mature milk phase (between 2<sup>nd</sup> and 6<sup>th</sup> months postpartum). The basic macronutrients (carbohydrates, protein, and total fat) and fatty acids contents of the human milk were determined using proximate analysis and gas chromatography methods, respectively. Maternal diet history was obtained on each day prior to human milk sampling. Dietary nutrient intakes were statistically adjusted using residual method to account for possibility of energy misreporting. Total energy and nutrient intakes were compared to the Recommended Nutrients Intakes (RNI) for Malaysia for pregnant and lactating women (2017). The findings of this study demonstrated that the total calorie, total fat, saturated fatty acids (SFA), polyunsaturated fatty acids (PUFA), and monounsaturated fatty acids (MUFA) consumption were the lowest, whereas protein intake was the highest during confinement period. In addition, the maternal nutritional intakes of total calorie, total fat, SFA, PUFA, MUFA, dietary fiber, calcium, and water, did not meet recommended values throughout the exclusive breastfeeding period. Compared to the standard reference, the total energy, total carbohydrate, SFA, and MUFA content of the human milk was lower, whereas protein was within the reference range. In contrast, total fat and PUFA were comparatively higher than the standard reference. Palmitic acid and oleic acid were identified to be the most represented fatty acids in the human milk samples. Even though the maternal dietary intake was found to be suboptimal in this study, this was not associated with human milk nutritional composition. In conclusion, mothers in this study failed to meet the nutritional requirement during exclusive breastfeeding period, and this may be likely influenced by the traditional postpartum dietary practices. Appropriate dietary action should be taken to improve maternal nutritional intake during this crucial time. Other than highlighting healthy and balanced nutrition, dietary advice for breastfeeding women should also address the cultural food taboos commonly practiced by local mothers during confinement. Further investigation is needed to determine the association between maternal diet and human milk quality of Malaysian mothers.

Keywords: exclusive breastfeeding, maternal dietary intake, human milk, nutritional composition, postpartum dietary practices

## خلاصه البحث

تنصح المبادئ التوجيهية المالميزية للتغذائية لعام (2013) بالرضاعة الطبيعية حصرياً خلال الأشهر الستة الأولى في حياة الأطفال لأجل الحصول على الآثار الايجابية المتعدد والفوائد الكثير للرضاعة الطبيعية على صحة الطفل والأم معاً. ولذلك يشجع الإسلام، على الرضاعة الطبيعية للطفل حتى سن عامين. لقد تم إجراء الدراسات بشكل رئيسي على التكوين الغذائي للحليب البشري في الدول الغربية، ولكن المحتوى الغذائي للحليب للأمهات المالميزيات، اللواتي قد يختلفن من نظيراتهن الغربيات بسبب الممارسات التقليدية في النظام الغذائي، لم يبحث بعد تسعى هذه الدراسة إلى تحقيق الأهداف التالية:

(1) تحليل التركيب الغذائي للحليب البشري بين الأمهات المالميزيات خلال فترة الرضاعة الطبيعية، (2) تقييم المتناول الغذائي للأمهات خلال هذه الفترة، و (3) تقييم العلاقة بين المحتوى الغذائي للأمهات المرضعات والتكوين الغذائي الحليب البشري. لتحقيق هذه الأهداف تم انتخاب 32 مرضعة إجمالاً، وتم تسجيل البيانات الاجتماعية في الديموغرافية والقياسات البشرية خلال الثلاثة الأشهر الأخيرة من الحمل. ثم تم جمع 10-30 مل من عينات اللبن البشري بعد الولادة، مرة واحدة خلال مراحل إنتقال اللبن (خلال الشهر الأول بعد الولادة)، وكل 30 يوم عند مرحلة اللبن الناضج (بين 2 و 6 أشهر بعد الولادة). وتم قياس محتوى المغذيات (الكربوهيدرات والبروتين والدهون الكلية) و محتويات الأحماض الدهنية في الحليب البشري باستخدام التحليل التقريبي وطرق الاستشراب الغازي، وذلك على وفق تاريخ النظام الغذائي للأمهات في كل يوم من قبل أخذ العينة الحليب البشري. تم ضبط المغذيات إحصائياً باستخدام طريقة المتبقية لحساب إمكانية وجود الطاقة. وتمت مقارنة إجمالي الطاقة والمغذيات مع الغذائية الموصى بها (RNI) لمالميزيا (2017). أظهرت نتائج هذه الدراسة أن استهلاك إجمالي السعرات الحرارية، والدهون الكلية، والأحماض الدهنية المشبعة (SFA)، والأحماض الدهنية المتعددة غير المشبعة (PUFA)، والأحماض الدهنية الأحادية غير المشبعة (MUFA) كانت هي الأدنى، في حين أن تناول البروتين كان الأعلى خلال فترة الحبس. وبالإضافة إلى ذلك، فإن مآخذ الغذائي للأمهات من إجمالي السعرات الحرارية، والدهون الكلية، و SFA، و PUFA، و MUFA، والألياف الغذائية، والكالسيوم، والماء، لم يستوف القيم الموصى طوال فترة الرضاعة الطبيعية الحصرية. مقارنة بالمعيار المرجعي، كانت الطاقة الكلية، الكربوهيدرات الكلية، SFA، وأقل محتوى MUFA للحليب البشري، بينما كان البروتين ضمن النطاق المرجعي. بالإضافة إلى ذلك، كانت الدهون الكلية و PUFA أعلى نسبياً من المعيار المرجعي. بالإضافة إلى ذلك، تم تحديد حمض البالميتيك و حامض الأوليك ليمثلان الأحماض الدهنية أكثر في عينات الحليب البشري. على الرغم من ذلك فقد وجدت

الدراسة أن المتناول الغذائي للأمهات كانت دون الأمثل في هذه الدراسة ، وهذا لا يرتبط بتكوين الغذائي الحليب البشري. في الختام ، الممارسات الغذائية التقليدية بعد الولادة تؤثر في قدرة الأمهات على تلبية المتطلبات الغذائية خلال فترة الرضاعة الطبيعية. ولذلك، ينبغي اتخاذ إجراءات غذائية مناسبة لتحسين المحتوى الغذائي للأمهات أثناء هذه الفترة الحاسمة. بخلاف الإهتمام على الظروف الصحية والتغذية المتوازنة، فإن ينبغي المشورة الغذائية للنساء المرضعات أن يجبرن عن المحظورات الغذائية الثقافية التي تمارسها عادة للأمهات المحليات أثناء الحبس. ينبغي يكون هناك تحقيق إضافي لتحديد الارتباط بين نظام غذائي للأمهات وجودة حليب الأم للأمهات الماليزيات.

الكلمات المفتاحية: الرضاعة الطبيعية الحصرية، المحتوى الغذائي للأمهات، الحليب البشري، التكوين الغذائي، الممارسات الغذائية التقليدية بعد الولادة.

## **APPROVAL PAGE**

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*This thesis is dedicated with love and affection to my*

*Baba & Mama*

*Whose love, encouragement, and prayers had kept me going and finally able to  
complete my thesis successfully.*

*Supervisors*

*Whose guidance and support had given me the courage and strength to face the  
challenges throughout this journey.*

*Siblings*

*Siti Najihah, Siti Nabilah, Muhammad Azri, Sarah Afifah, & Muhammad Adib*

*Dearest friend*

*Nur Nazrin Hadia Zakaria*

## ACKNOWLEDGEMENTS

All glory is due to Allah, the Almighty, whose Grace and Mercy have been with me throughout the duration of my study. Although it has been tasking, His Mercies and Blessings on me eased the journey of completing this thesis.

I am most indebted to my supervisor, Asst. Prof. Dr. Nor Azwani Mohd Shukri, whose kindness, thoroughness, and guidance, have facilitated the successful completion of my work. I put on record and appreciate her detailed comments, useful suggestions and inspiring queries, which have considerably improved this thesis. Despite her commitments, she took time to listen and attend to me whenever requested. The moral support she extended to me is in no doubt a boost that helped in completing this research work. I am also grateful to my co-supervisors, Assoc. Prof. Dr. Muhammad Ibrahim and Asst. Prof. Dr. Radiah Abdul Ghani, whose guidance, feedback, and support, contributed a lot to the outcome of this work. I would also like to thank all the participants who have participated in this research and made it possible for me to complete my Masters study.

I would like to also express my gratitude to my beloved parents (Abdul Basir Ahmad and Noryati Mohd Noor), siblings, and supportive friends; for their prayers, understanding and endurance while away. Lastly, thank you to IIUM Research Initiative Grants Scheme (RIGS) for funding this study.

Once again, we glorify Allah for His endless Mercy on us which has brought this thesis to its successful completion.

*Alhamdulillah.*

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## LIST OF ABBREVIATIONS

ARA	Arachidonic acid
BMI	Body mass index
DHA	Docosahexaenoic acid
EA	Elaidic acid
EFA	Essential fatty acids
GDM	Gestational diabetes mellitus
GI	Gastrointestinal
IOM	Institute of Medicine
IQ	Intelligence Quotient
LA	Linoleic acid
MANS	Malaysian Adult Nutrition Survey
MUFA	Monounsaturated fatty acids
NCCFN	National Coordinating Committee on Food and Nutrition
NEC	Necrotizing enterocolitis
NHMS	National Health and Morbidity Survey
OA	Oleic acid
PUFA	Polyunsaturated fatty acids
RNI	Recommended Nutrient Intakes for Malaysia
SFA	Saturated fatty acids
T2DM	Type 2 diabetes mellitus
TFA	Trans fatty acids
UNICEF	The United Nations Children's Fund
WHO	World Health Organization

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# CHAPTER I

## INTRODUCTION

Human milk is recognized as the normative standard for infant feeding (Moretti, 2012; WHO, 2011). It is a unique food that contains both nutrients and non-nutritive bio-active factors suited to human infants. These properties have been proven to help in promoting survival and healthier development of the infants (Ofstedal, 2012). Breastfeeding has been shown to reduce incidence of infection, sudden infant death syndrome, obesity, necrotising enterocolitis (NEC), childhood cancer, asthma, diabetes, and dermatitis. These show that breast milk is the best food for babies (Ip *et al.* (2007).

According to the World Health Organization (WHO), exclusive breastfeeding is the consumption of human milk without supplementation, except for vitamins, minerals, medicines, water, and drops of syrup (WHO, 1991). It includes breastfeeding both from a wet nurse and maternal feeding of expressed breast milk. WHO and United Nations Children's Fund (UNICEF) strongly advocate exclusive breastfeeding for the first six months after birth as the optimal way of feeding infants based on evidence which showed beneficial effects on child health, growth and development as well as positive implications on maternal wellbeing (WHO, 2009). The same recommendation is adopted by the Malaysian government as its Key Message 1 in its Malaysian Dietary Guidelines (MDG) for Children and Adolescents (Ministry of Health, 2013).

Besides duration, the nutritional quality of human milk is also an important aspect of breastfeeding. One of the factors that may influence this is the maternal diet.

Lactation comes with a higher nutritional demand and greater than that of pregnancy. In order to produce each litre of human milk, approximately 700kcal are required (Cervera & Ngo, 2001). On average, a lactating mother will produce 20 - 30 ounces (about 850 ml) of human milk each day. Thus, there is a need to optimize mother's food intake during lactation period in order to meet the elevated energy and micronutrients requirements. However, among Asian populations, maternal nutritional intake during this crucial period may be affected by the common traditional postpartum practices which involve dietary restrictions and prohibitions.

Postpartum confinement practices are normative among Asian communities. After delivery, mothers are advised to observe their food intake and adhere to traditional practices, such as hot compress or *bertungku* (applying heat on the body using heated stone wrapped in herbs) and roasting or *bertangas* (lying on a bed over a fire), which are believed to reduce their susceptibility to illness (Heh, 2004). The confinement duration varies between 30 - 100 days. The health beliefs and practices may be distinct across cultures, but they share a lot of similarities as well. The common ideas surrounding these practices are the importance of observing the 'hot and cold' elements, as well as the necessity of confinement within a specific period after giving birth (Kim-Godwin, 2003). There are some justifications for these practices. Among them are to: maintain close mother-infant contact, recuperate from birth, and protect the mother and her baby from harm such as postpartum haemorrhage and stomach problems (Piperata, 2008). Postpartum confinement practices commonly involve behavioural precautions, hygiene care, as well as dietary restrictions.

Inadequate dietary intake during lactation may compromise, the nutritional status of the mother, her recovery back to health, and her human milk production. Consequently, inadequate amounts of human milk may pose malnutrition risk for the

infant. Thus, it is crucial for the mother to maintain good nutritional intake especially during the confinement period in order to ensure optimal recovery, breastfeeding success, and satisfactory nutritional status of her baby.

### **1.1 Statement of Research Problem**

Human milk supplies the required nutrition to infants. Some of the nutrients in the milk are dependent on maternal dietary intakes. On the other hand, the mothers' food intake may be subjected to dietary restrictions commonly included as part of the traditional confinement practices after delivery. This practice may impact mothers' ability to meet the increased energy and nutrients needs during breastfeeding period. There is no existing study characterizing the dietary status of Malaysian mothers during confinement period. In addition, the human milk nutritional content of Malaysian mothers whose diets are different compared to diets of mothers from other countries due to cultural influences, has not been investigated thus far.

### **1.2 Rationales of Study**

Studies on human milk composition, and its relation to maternal dietary status among Malay women, are very limited. Food restrictions during postpartum period may lead to inadequate energy and nutrients intakes, and may affect human milk nutritional composition. Thus, this study will observe maternal dietary status of Malay mothers (who commonly practise postpartum dietary practices) and their human milk quality. In addition, this study may provide baseline information for future studies such as for the development of dietary guidelines during confinement period to improve maternal nutritional intake. Furthermore, this study would enable the determination of the local

mothers' human milk nutritional content and its comparison with those of mothers in other countries.

### **1.3 Objectives**

#### **1.3.1 General Objective**

To assess the dietary status and the human milk nutritional composition of lactating mothers during exclusive breastfeeding period in Kuantan, Pahang.

#### **1.3.2 Specific Objectives**

- i.** To assess the dietary intake of mothers during exclusive breastfeeding (including confinement) period.
- ii.** To compare the total energy and nutrients intakes with recommended nutritional intakes for breastfeeding mothers.
- iii.** To analyze the nutritional composition (energy, protein, carbohydrate, fat, and fatty acids) of human milk among Malaysian mothers during exclusive breastfeeding period and to compare these with reference standards.
- iv.** To determine potential association between the maternal dietary intake and their breast milk nutritional composition

#### **1.3.3 Research Hypotheses**

The hypotheses of this study are:

- i.** The dietary intake of some mothers during confinement and exclusive breastfeeding periods may not meet nutritional recommendations.

- ii.** The human milk nutritional composition of Malaysian mothers is unique and may differ from human milk of breastfeeding mothers from other countries due to the local practice of traditional postnatal food restrictions and prohibitions.
- iii.** The nutritional composition of human milk of Malaysian mothers reflects their unique dietary intake during traditional confinement period