



# Maternal depression and child feeding practices: Determinants to malnutrition among young children in Malaysian rural area

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Maizatul Azlina Chee Din<sup>1,2</sup>, Nur Islami Mohd Fahmi Teng<sup>1</sup>   
and Zahara Abdul Manaf<sup>3</sup>

## Abstract

**Background:** Maternal depression may affect child feeding practices and growth.

**Objective:** The objective of this study is to determine the relationship between child feeding practices and current maternal depression with malnutrition among young children in a rural community.

**Methods:** This is a case–control study consisting of 52 Malay mothers of malnourished children (case) and 50 Malay mothers of well-nourished children (control) in Kuala Langat, Selangor, Malaysia. Structured questionnaires on child feeding practices and Beck Depression Inventory: Second Edition questionnaire were distributed to mothers.

**Results:** Depressed mothers stopped exclusive breastfeeding ( $2.8 \pm 2.1$  months) earlier than non-depressed mothers ( $3.7 \pm 2.0$  months;  $p=0.045$ ). Binary logistic regression analysis showed current maternal depression was a primary contributor associated with risk of malnutrition in children (adjusted odds ratio: 2.5, 95% confidence interval: 1.08–6.09), and followed by the number of children (adjusted odds ratio: 1.3, 95% confidence interval: 1.02–1.77).

**Conclusion:** Mothers who experienced depression were twice as likely to have malnourished children. Each additional child in the family will increase the risk of malnutrition by 1.3 times. Maternal depression is associated with child feeding practices and malnutrition among young children in the studied population. Preliminary screening to identify depression symptoms should be conducted to all mothers as early as the first trimester to prevent the incidence of malnutrition in children.

## Keywords

child feeding practices, malnutrition, maternal depression, undernutrition, young children

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## Introduction

Insufficient nutrient intake is one of the immediate determinants of malnutrition.<sup>1</sup> Approximately, 10.9 million children under 5 died in developing countries each year, and 60% of the deaths were directly or indirectly due to malnutrition.<sup>2</sup> More than two-thirds of these deaths are mainly related to inappropriate feeding practices during the first year of life. Malnutrition enormously contributes to the worldwide burden of numerous diseases. Globally, undernutrition is responsible for more than half of all the deaths annually in children under 5.<sup>3</sup> In 2016, according to

<sup>1</sup>Centre for Dietetics Studies, Maternal, Infant and Young Child (MiCHILD) Research Group, Faculty of Health Sciences, Universiti Teknologi MARA, Puncak Alam, Selangor, Malaysia

<sup>2</sup>Non-Communicable Disease Section, Disease Control Division, Ministry of Health Malaysia, Putrajaya, Malaysia

<sup>3</sup>Dietetic Programme, Centre for Healthy Aging and Wellness, Faculty of Health Sciences, Universiti Kebangsaan Malaysia, Kuala Lumpur, Malaysia

### Corresponding author:

Nur Islami Mohd Fahmi Teng, Centre for Dietetics Studies, Maternal, Infant and Young Child (MiCHILD) Research Group, Faculty of Health Sciences, Universiti Teknologi MARA, Cawangan Selangor, Kampus Puncak Alam, Bandar Puncak Alam, Selangor 42300, Malaysia.  
Email: nurislami@uitm.edu.my



UNICEF,<sup>4</sup> at least 155, 52 and 99 million children under the age of 5 years were stunted, wasted and underweight worldwide, respectively. Malnutrition is congregated in developing countries, specifically in Africa and South Asia.<sup>5,6</sup> On the contrary, Headey et al.<sup>7</sup> reported that India, Pakistan and Bangladesh specifically displayed high prevalence of malnutrition. The rising trend in malnutrition is also seen in Turkey, India and China.<sup>8–10</sup>

In Malaysia, malnutrition in young children has declined in the past two decades.<sup>11,12</sup> However, despite a rapid economic growth in Malaysia, malnutrition among children is still prevalent. According to the National Health and Morbidity Survey (NHMS) conducted in 2006, the prevalence of underweight, wasting and stunting in children aged 1–3 years were 19.8%, 15.1%, and 17.2%, respectively.<sup>13</sup> The higher percentage of malnutrition was commonly found to be clustered among children aged 1–3 years. This probably due to early weaning, late initiation of complementary foods, a low-protein diet and severe or repeated infections.<sup>14</sup> Latest findings in NHMS 2019 shockingly revealed the increment of malnutrition specifically in stunting among children below 5 years old from 17.7% (2015) to 21.8% (2019).<sup>15</sup>

Appropriate child feeding practices were fundamental element, where frequency, amount, energy-density and diversity of food play an important role to combat malnutrition.<sup>16</sup> Optimum nutrition is important for children in order to reach their maximum potential growth which can be achieved by proper feeding practice. Feeding is a form of interaction between mother and her child. During feeding, children begin to develop the mother–child relationship.<sup>17</sup> However, when mothers are depressed during the first few years of the children's life, there is a disturbance in mother–child interaction pattern.<sup>18–21</sup> This disturbance may discourage the mother to give proper attention to her child especially when her child becomes choosy during feedings<sup>22</sup> or when her child refuses to eat.<sup>23</sup> The poor feeding practices give irreparable impact on the children's life such as stunting, poor cognitive development, and significant increase on the risk of infectious diseases such as diarrhoea and acute respiratory infection.<sup>24–26</sup>

In order to facilitate a smooth feeding of the child, the stability of the mother's mental health is paramount. Some research has connected maternal depression to potentially harmful feeding behaviours, such as being less likely to establish boundaries or restrict child intake.<sup>27</sup> In Western population, based on a study done by Clarke and his team in Portland, Oregon, among 472 adults, females are highly linked with depression in adolescents and adults.<sup>28</sup> A review paper compared the prevalence of depression particularly maternal depression across 64 studies involving 17 countries from different settings which displayed maternal depression in Asian countries ranging from 3.5% to 63.3%.

In Malaysia, the prevalence of postpartum depression was at the lowest percentage of 6.5%, while another study

showed the percentage was at a higher rate of 22.8%.<sup>29</sup> The study which involved Malay women from low socio-economic background reported the prevalence was as high as 34.5%.<sup>30</sup>

It is well documented that depression is an intensely disabling disorder.<sup>31</sup> Several tools are available for the purpose of screening current depression such as Beck Depression Inventory: Second Edition (BDI-II), Centre for Epidemiological Studies – Depression Scale (CES-D) and Patient Health Questionnaire 9 (PHQ-9).<sup>32,33</sup> In spite of the accessible tools to screen depression for general population, the condition continues to be frequently unrecognized and untreated<sup>34</sup> in low-income countries.<sup>35</sup> By sociodemographic groups, it was revealed that women reported higher percentage of depression (2.6%) as compared to men at 2.0%.<sup>15</sup> The similar findings were confirmed by previous researcher in his review paper that women with low socio-economic background experience depression higher than men.<sup>36</sup> However, identification of women experiencing depression remains difficult as women are often reluctant to unveil their feelings.<sup>37</sup> Maternal depression may affect the child's feeding practices. However, the relationship between maternal depression and child feeding practices reported from previous studies is inconsistent. Some studies reported that maternal depression is negatively correlated with child feeding practices.<sup>38–40</sup> In contrast, others reported maternal depression is not significantly associated with child feeding practices.<sup>41–43</sup> In addition, data on maternal depression and childhood malnutrition particularly in developing countries were very limited, and to the best of our knowledge, there were only two studies conducted with varying results.<sup>44,45</sup> In addition to that, significant association was found between maternal depression and malnutrition in children.<sup>46–48</sup> In contrast, several authors<sup>49–51</sup> failed to find the relationship between maternal depression and malnutrition. Furthermore, the study of prevalence of depression in subgroup population such as among mothers of malnourished children was insufficiently researched.<sup>52</sup> Data on maternal depression status and its possible relationship with child feeding practices would be of significant for health professionals to outline the best approach in battling malnutrition in the country. It can be seen that the rates of depression for Malaysian population demonstrated a wide range of percentage. Guan, in his review article, recommended that there is a need to examine the prevalence of depression in subgroup population.<sup>52</sup> Therefore, this study was conducted by focusing on subgroup population. In addition to that, there is no published data to look at the association of malnutrition with maternal factors concurrently with child feeding practices in Malaysia. As the study on the subgroup population such as among mothers of malnourished children and the linkage with maternal factors were insufficiently researched in Malaysia, hence, it leads this study to be conducted

with the aims (1) to determine the relationship between child feeding practices and current maternal depression in malnourished and well-nourished children and (2) to determine risk factors of malnutrition. We hypothesized that there is a relationship between maternal depression and child feeding practices in malnourished and well-nourished children.

## Methods

### Study population and design

A case-control study was conducted at eight health clinics in Kuala Langat, Southwest of Selangor, Peninsular Malaysia. This district was selected because it was reported to be among the highest prevalence of malnutrition in Selangor, with 2.4% of underweight and a leading of stunting rate at 2.5%.<sup>53</sup> A list of children who attended the clinic was obtained from all eight health clinics in Kuala Langat district, Selangor. The data have been collected throughout the year of 2021.

### Subjects of the study

According to Krejcie and Morgan's<sup>54</sup> method, the number of subjects (n) in the study was calculated. Allowing for 10% of dropouts, the calculated sample size required for this study was 62 for the case group and 62 for the control group (N=124). The expected effect size is 0.50 since this would provide the maximum sample size. A total of 124 mothers consisting of 62 mothers of malnourished children (case) and 62 mothers of well-nourished children (control) were chosen using a simple random sampling method from the list of children provided, who registered at the government health clinics in Kuala Langat district, Selangor, Malaysia. The child's age, gender and residential area in the case group were matched with the child in the control group. Anthropometric measurements such as current body weight, height, mid-upper arm circumference (MUAC) and head circumference (HC) of children were measured. The anthropometric status of the children was categorized based on the World Health Organization (WHO)<sup>55</sup> growth chart and classification.

### Classification of cases and controls

Following the guidelines for children's growth charts and classifications set out by the WHO, children with weight-for-age, height-for-age, and body mass index (BMI)-for-age below than  $-2SD$  were categorized as underweight, stunted and wasted, respectively. Children who were underweight, stunted or wasted as well as those that fall into any of these categories in any combination were grouped as the case group, while children in the control group were those with weight-for-age, height-for-age, BMI-for-age between  $>-2SD$  to  $<+2SD$  of WHO Child

Standard. Mothers of both case and control group were recruited following the study protocols.

### Inclusion and exclusion criteria

The inclusion criteria for the cases were Malaysian mothers aged  $\geq 18$  years, Malay, literate and able to understand Malay language, having at least one diagnosed undernourished child (aged 6 months to 5 years), mother with a child born with a birth weight  $\geq 2.5$  kg, mothers with no co-morbid mental and physical disabilities as well as medical illnesses or having a history of experiencing such conditions.

Meanwhile, the inclusion criteria for the controls were as follows: healthy well-nourished children (aged 6 months to 5 years).

The exclusion criteria for both cases and controls were illiterate Malay mothers, mothers diagnosed with hypertension and/or mental illnesses, mothers with a child with congenital disease and mothers with child's BMI-for-age more than  $+2SD$ . Considering that uncontrolled hypertension and depression were significantly associated,<sup>56</sup> mothers with hypertension and/or mental illnesses,<sup>57</sup> and/or having past history of suffering such conditions were excluded in this study.

### Assessment of child feeding practices

A structured questionnaire on child feeding practices specifically designed for children under the age of five comprised of exclusive breastfeeding practice duration, duration of breastfeeding, duration of formula feeding and children's age initiated with complementary foods was obtained through one-to-one interview session. This questionnaire used was obtained from a national survey. It has been validated<sup>58</sup> locally through face validity, pre-tested and available in two languages (Bahasa Melayu or Malay and English).

### Assessment of maternal depression

The BDI-II<sup>59</sup> was used to determine maternal depression status. The questionnaire was translated and validated locally with 0.89 internal consistencies.<sup>60</sup> It is a 4-point options scored ranging from 0 to 3 consistent with accelerated severity of the symptoms. It encompasses 21 items, a self-reporting instrument intended to evaluate the existence and severity of depression symptoms. These items include changes in appetite, sleep patterns, body image, work, energy loss, self-esteem, suicidal ideation, focus on daily work, weight, physical activity level and sexual preference. Mothers were asked to respond to each statement in accordance with their emotional state for the past 2 weeks. Each item corresponds to a symptom of depression and is summed to give a single score for BDI-II. A BDI-II score of 14 and above indicates depression, while a score of less than 14 indicates non-depression.

## Statistical analysis

Data analysis was performed using SPSS (Statistical Package for Social Science) version 20.0 for Windows (SPSS Chicago, IL, USA). Kolmogorov–Smirnov test was used to assess the normality of the continuous data. The difference in each variable of both case and control groups were analysed using t-test for continuous variables (age, birth weight, current weight, current height, MUAC and HC), while chi-square test was used for categorical variables. The variables involved were gender, number of children, duration of mother's education, marital status, mother's working status, father's occupational status, household income, initiated complementary foods at 6 months, introduced mixed rice porridge as the first complementary foods and maternal depression status. Maternal depression status and child feeding practices were tested whether there was significantly different using independent t-test for variables as follows: duration of exclusive breastfeeding, duration of breastfeeding and age of children initiated with complementary foods. Meanwhile, chi-square test was used to compare the exclusive breastfeeding practised among depressed and non-depressed mothers. Each potential risk factor associated with malnutrition was entered individually into binary logistic regression. For this analysis, adjusted odds ratios (AORs) with their corresponding 95% confidence intervals (95% CI) were reported. Significance was set at a p value less than 0.05. The association has been adjusted for birth weight.

## Results

Out of 124 eligible mothers, a total of 102 mothers with 52 cases and 50 controls with their children agreed to enrol in this study giving a positive response rate of 82.3%. Table 1 demonstrates the demographic profiles, anthropometric measurements and factors associated with malnutrition in the case and control group. All maternal subjects had mean ages of 102 subjects. In terms of gender, the majority of subjects were mothers to girls for both cases (57.7%) and controls (56.0%). By comparison, anthropometric measurements show birth weight ( $3.2 \pm 0.4$  kg), current weight ( $11.1 \pm 1.4$  kg), MUAC ( $15.3 \pm 1.4$  cm) and HC measurement ( $46.9 \pm 1.4$  cm) in control subjects were higher as compared to case subjects. Independent t-test showed significant differences for all these parameters ( $p < 0.001$ ). Significantly, mothers in the case group had more children compared to the control group ( $p = 0.036$ ). More than three-quarters of mothers in the case (80.8%) and control groups (80.0%) experienced schooling up to secondary level. All fathers were working in both groups. Nearly all mothers in the cases (98.1%) and controls (98.0%) were married. A huge percentage of mothers who are not working were seen in both case (65.4%) and control (70.1%) groups which had a monthly household income of more than US\$500. Significantly, more mothers (44.2%) in the

case group were categorized as depressed compared to mothers in the control group (24.0%),  $p = 0.033$ . After adjustment using binary logistic regression model, the significant risk factors remain statistically significant with maternal depression (AOR = 2.6, 95% CI: 1.08–6.09) and the number of children (AOR = 1.3, 95% CI: 1.02–1.77). The results indicated that mothers who experienced depression were twice as likely to have malnourished children. In addition, each additional child in the family increased the risk of malnutrition by 1.3 times (Table 1).

More than half of non-depressed mothers (68.7%) and majority (82.9%) of depressed mothers did not practice exclusive breastfeeding up to 6 months to their child. Depressed mothers stopped exclusive breastfeeding ( $2.8 \pm 2.1$  months) earlier than non-depressed mothers ( $3.7 \pm 2.0$  months;  $p = 0.045$ ). Duration of breastfeeding and children's age initiated with complementary foods were not statistically significant between both groups ( $p > 0.05$ ; Table 2).

## Discussion

The aim of this study was to determine the relationship between child feeding practices and current maternal depression in malnourished and well-nourished children and also the risk factor of malnutrition. This article has provided further evidence that maternal depression is prevalent in the studied population, and depressed mothers were associated with child feeding practices. This matches well with the latest findings of NHMS 2019 which demonstrated that depression was higher in rural area (3.6%) as compared to urban area (1.9%).<sup>15</sup> This finding significantly differs from the previous national survey of NHMS IV (Institute of Public Health, 2011<sup>12</sup>) in which depression was high in urban area as compared to the recent data. Our study also found that 44.2% of mothers in the case group and 24.0% in the control group were depressed. This could be caused by mothers who were less likely to engage with positive parenting behaviours including care giving practices. Depression among mothers of childbearing age is common due to routine demands of parenting.<sup>38</sup> Meta-analysis of small observation studies found a positive association between depressed mothers and impaired parenting.<sup>61</sup> Clinically depressed mothers, when compared with non-depressed mothers, were less sensitive to their infants during feeding.<sup>62</sup> Previous study demonstrated that the effect of maternal depression at the age of 2 years appeared to be more important than any other times and continuous exposure to depression in mothers influenced inner behaviour of children.<sup>63</sup> In addition, children who were malnourished in the first year of life and put on weight rapidly later in childhood and beyond were also at high risk of chronic diseases related to nutrition.<sup>64</sup> The cognitive model hypothesizes that depressed women have pessimistic views of themselves, the world and their future.<sup>65</sup> A qualitative study among 39 Indian women

**Table 1.** Demographic profiles, anthropometric measurements and factors associated with malnutrition in the case and control groups.

Factors	Cases (n=52)	Control (n=50)	P value	AOR (95% CI)
Age, mean (year) <sup>a</sup>	25.6 ± 7.8	24.2 ± 6.9	0.342	NA
Gender <sup>b</sup>				
Boys	22 (42.3)	22 (44.0)	0.863	NA
Girls	30 (57.7)	28 (56.0)		
Birth weight (kg) <sup>a</sup>	2.9 ± 0.3	3.2 ± 0.4	<0.001**	NA
Current weight (kg) <sup>a</sup>	9.3 ± 1.4	11.1 ± 1.4	<0.001**	NA
Current height (cm) <sup>a</sup>	83.4 ± 7.8	85.3 ± 5.9	0.164	NA
Mid-upper arm circumference (MUAC) (cm) <sup>a</sup>	14.0 ± 1.4	15.3 ± 1.4	<0.001**	NA
Head circumference (HC) (cm) <sup>a</sup>	45.75 ± 1.95	46.9 ± 1.4	0.001*	NA
Number of children <sup>c</sup>	3.0 (2.0–4.0)	2.0 (1.0–3.0)	0.036*	1.3 (1.02–1.77)
Duration of mother's education (years)				
<11	42 (80.8)	40 (80.0)	0.922	1.1 (0.40–2.8)
≥12	10 (19.2)	10 (20.0)		
Marital status				
Married	51 (98.1)	49 (98.0)	0.978	0.961 (0.058–15.79)
Divorce	1 (1.9)	1 (2.0)		
Working status (mother)				
Not working	34 (65.4)	35 (70.0)	0.618	1.2 (0.54–2.84)
Working	18 (34.6)	15 (30.0)		
Occupational status (father)				
Working	52 (100.0)	50 (100.0)	0.843	1.04
Not working	0	0		
Household income (US\$)				
<500	25 (48.1)	18 (36.0)	0.218	1.7 (0.75–3.64)
≥500	27 (51.9)	32 (64.0)		
Initiated complementary foods at 6 months				
Yes	34 (65.4)	33 (66.0)	0.948	1.0 (0.45–2.33)
No	18 (34.6)	17 (34.0)		
Introduced mixed rice porridge as the first complementary foods				
Yes	13 (25.0)	19 (38.0)	0.160	1.8 (0.79–4.30)
No	39 (75.0)	31 (62.0)		
Maternal depression status				
Non-depressed	29 (55.8)	38 (76.0)	0.033*	2.5 (1.08–6.09)
Depressed	23 (44.2)	12 (24.0)		

AOR: adjusted odds ratio; CI: confidence interval.

<sup>a</sup>Independent t-test.<sup>b</sup>Chi-square test.<sup>c</sup>IQR–interquartile range.

\*p &lt; 0.05; \*\*p &lt; 0.001.

The association has been adjusted for birth weight.

**Table 2.** Child feeding practices according to maternal depression status.

Factors	Maternal depression status		
	Depressed (n=35)	Non-depressed (n=67)	p value
Exclusive breastfeeding <sup>a</sup>			
Yes	6 (17.1)	21 (31.3)	0.123
No	29 (82.9)	46 (68.7)	
Duration of exclusive breastfeeding (months) <sup>b</sup>	2.8 ± 2.1	3.7 ± 2.0	0.045*
Duration of breastfeeding (months) <sup>b</sup>	13.3 ± 9.6	13.2 ± 8.7	0.817
Age of children initiated with complementary foods (months) <sup>b</sup>	5.7 ± 1.1	6.2 ± 1.6	0.183

\*p &lt; 0.05, Independent t-test.

<sup>a</sup>Chi-square test.<sup>b</sup>Independent t-test.

pointed out that maternal depression negatively affected their relationship with family members and performance of household tasks.<sup>66</sup> These ramifications give a better insight on how maternal depression contributed to dreadful impact to the entire family. A study by Rahman et al.<sup>48</sup> among 632 Pakistani women proposed that child growth retardation could be cut down to 35% by reducing the prevalence of maternal depression. These findings imply that optimizing maternal mental health would reduce the chances of having malnourished children.

Notably, depressed mothers ( $2.8 \pm 2.1$  months) ceased exclusive breastfeeding earlier than non-depressed mother ( $3.7 \pm 2.1$  months). These figures when viewed did not meet the WHO's<sup>67</sup> recommendation where exclusive breastfeeding should be applied up to the first 6 months of an infant's life. This finding was similar with the study done by Hellin and Waller.<sup>68</sup> Studies in the developed countries also reported the same findings where it showed that a shorter duration of breastfeeding was observed in depressed mothers as opposed to non-depressed mothers. A study among 200 Kenyan mothers exposed that non-depressed mothers had higher odds of giving exclusive breastfeeding compared to depressed mothers.<sup>47</sup> It was also confirmed that stress strongly interfered with milk production, making it difficult for a child to feed.<sup>69</sup> Worst case scenario, suboptimal breastfeeding was responsible for 1.4 million deaths of children aged less than 5 years (under-5 mortality).<sup>70</sup>

Our finding also revealed that each additional child in the family will increase the chances of malnutrition by 1.3 folds. This finding is similar with the previous study by Danaci et al.<sup>71</sup> This could be due to attention demand from each child for child care and food distribution in order to meet their nutritional needs. Larger family size with congestion and inadequate spacing has been linked to severe malnutrition in different studies as well.<sup>72,73</sup> These findings suggest that birth spacing of 2 years gap should be implemented due to demands for child care and nutritional aspects. In order to plan for a proper birth spacing, couples should consider family planning (FP) and seek for counselling services as these services may help reduce unplanned pregnancy.<sup>74</sup>

To the best of our knowledge, this study is the first of its kind in Malaysia. The magnitude of the risk imposed by maternal depression found in our study presented that depressed mothers were 2.5 times more likely to have malnourished children compared to non-depressed mothers. The same finding was obtained by a meta-analysis on 17 different studies done previously.<sup>75</sup> The vicious cycle relation between maternal depression and malnourished children could be continuously happening in the next generation. The direction of the relation may be that sick children may cause depression, or depressed mother are incapable to function effectively to maintain good nutrition of their children.

This study found that more than two-third of non-working mothers in case group and all mothers in the control group exclusively breastfeed their children up to 6 months. Our findings are consistent with a study done by Tan.<sup>76</sup> The study reported that non-working mothers were associated with exclusive breastfeeding. This finding does not necessarily mean that working leads to the failure of exclusive breastfeeding. Other factors such as household tasks, childcare demands, mental preparation to work and struggling to satisfy job tasks may interfere with mothers' effort to breastfeed exclusively. In parallel with exclusive breastfeeding promotion, working mothers should be well informed in term of mental and physical preparation to continue breastfeeding while working. Furthermore, a deep understanding on the benefits of breast milk is crucial towards successful breastfeeding.

It is interesting to point out that the proportion of mothers practicing exclusive breastfeeding was low in both the case (34.6%) and control groups (18.0%). Comparing the current percentage with NHMS 2016, the national figure of exclusive breastfeeding was far higher at 47.1%.<sup>58</sup> The lower rate of exclusive breastfeeding in this study may be due to the supplementation of plain water or formula feeding in early months. Due to this, promotion of exclusive breastfeeding should be done more aggressively to save children's lives.

From the perspective of policy makers and public health practitioners, in order to avert these effects on maternal and child health, crafting a cohesive policy response is incredibly important. In clinical settings, mental health screening should be incorporated into prenatal and perinatal care, and implemented regularly. Because earlier research revealed that mothers will have depression at various points throughout the postpartum period,<sup>77-80</sup> policy should also mandate routine screening for depression at 3, 6, 12, 18, and 24 months, particularly during childbearing age. Early identification of depression can lead to early treatment and referral, preventing the problem from worsening and substantially affect the mother's role.

Malaysia implemented a national breastfeeding policy in 1993, and the policy has since encouraged all mothers to breastfeed their children with breast milk from birth until 6 months old continuing until 2 years of age. Complementary foods should be given from 6 months old. Public health practitioners should practically advise mothers on breastfeeding and complementary feeding not only during monthly appointments, but also during home visit as well as ensuring that mothers have access to extra information and assistance when needed. Mothers will benefit from comprehensive support while their children's development is improved.

Currently available research indicates that FP can significantly affect obtaining important nutrition outcomes.<sup>81</sup> The advantages of appropriate birth spacing extend far into infancy, lowering the prevalence of a crucial indicator of

malnutrition, particularly stunting among children under the age of 5. Public health practitioners should consistently advocate mothers and advising the best options for birth spacing methods through consultation. Well-spaced deliveries allow women's bodies to restore necessary nutrients, resulting in improved nutritional results for their babies, such as a healthy birth weight as well as their responsibility to give her children nutritious meal. Studies have also shown that breastfeeding practices improve when pregnancies are planned, enhances nutrition and indirectly improved the quality of life.<sup>82</sup>

### *Strengths and limitations*

There are some potential limitations to be carefully considered when interpreting the findings. It is important to note that this study was conducted among children aged 6 months to 5 years; hence, some mothers may have difficulties to recall the exact time they terminated breastfeeding and started complementary feeding which may contribute to underreporting issue. The results of this research suggest that maternal depression is a determinant for malnutrition in the Malay children studied. As a result, generalization to all mothers cannot be made as it represents only to Malay communities in a clinic-based setting. Thus, generalization to other ethnics cannot be demonstrated. As we only include healthy and literate mothers in this study, it may introduce bias. However, this is the limitation and is applied in all purposive sampling study. This study only determines the factors contribute to malnutrition in children with no causal risk mechanism covered. Thus, the conclusion only highlighted which factors were the contributing factors to malnutrition. The strengths of this study include the sessions were conducted consistently by the trained interviewers which prevent interviewer bias. In terms of geographical area, only mothers from the rural area who registered in government health clinics were studied. The case and control subjects were strictly chosen from the same residential area to avert geographical bias.

Contributing factors to maternal depression are numerous. Studies done in Britain and North America highlighted a strong relationship between maternal depression and recent life events while Asian studies reported a non-significant relationship.<sup>83</sup> Literature reviews regarding risk factors for maternal depression were mostly conducted in western communities. Studies undertaken among Asian cultures were lacking and not succinctly elaborated,<sup>29</sup> especially the study related to the prevalence of depression in subgroup population.<sup>36</sup> In this study, these contributing factors were not measured. Hence, extensive studies on etiological factors associated with maternal depression should be further explored so that holistic approach can be implemented in sustaining mothers' mental health. Furthermore, there is a need to widen

the scope of the research in a larger sample size and to other ethnic groups where it would be valuable to formulate specific intervention in battling malnutrition in children particularly those residing in the rural areas.

### **Conclusion**

Evidence from this study confirms that promotion of maternal mental health and FP are important for child nutrition. Thus, screening and detection of maternal depression as early as the first trimester is the first step to determine the magnitude of the problem to reduce the burden and consequences of malnutrition. Depressed mothers should be referred to a psychiatrist for further treatment. It is a great importance to continuously promote maternal mental health for mothers to function effectively and to be able to apply proper child feeding practices for the improvement of the child's nutrition. This action is vital to hasten the fourth sustainable development goals (SDGs) outlined by the United Nation to improve mothers' mental health.

### **Declarations**

#### *Ethics approval and consent to participate*

This study has been approved by the Medical Research and Ethics Committee (MREC) (NMRR-20-8185), Ministry of Health Malaysia and conformed to the provisions of the Declaration of Helsinki. Informed consent has been signed by all subjects upon participation in the study. To ensure data confidentiality, the questionnaire was numbered anonymously based on registration.

#### *Consent for publication*

Not applicable.

#### *Author contribution(s)*

**Maizatul Azlina Chee Din:** Conceptualization; Data curation; Formal analysis; Investigation; Methodology; Project administration; Resources; Software; Writing – original draft; Writing – review & editing.

**Nur Islami Mohd Fahmi Teng:** Conceptualization; Formal analysis; Investigation; Methodology; Resources; Supervision; Validation; Writing – original draft; Writing – review & editing.

**Zahara Abdul Manaf:** Conceptualization; Formal analysis; Investigation; Methodology; Supervision; Validation; Writing – review & editing.

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### Competing interests

The author(s) declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

### Availability of data and materials

Not applicable.

### ORCID iD

Nur Islami Mohd Fahmi Teng  <https://orcid.org/0000-0002-6305-8416>

### Supplemental material

Supplemental material for this article is available online.

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