ORIGINAL ARTICLE

Postpartum Body Weight and Body Mass Index (BMI) Changes among Exclusive Breastfeeding and Non-Exclusively Breastfeeding Mothers of 6-Months Postpartum

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ABSTRACT

Introduction: Failure to return to pre-pregnancy weight after pregnancy may be one of the contributing factors to obesity that might impact women's health in the long term. The main objective of this study was to observe and compare postpartum body weight and BMI changes between exclusive breastfeeding and non-exclusive breastfeeding mothers of 6-months postpartum. **Methods:** This was a cross-sectional study conducted online via Google form related to breastfeeding practises of mothers in Malaysia that were recruited via simple random sampling. Invitation to fill in the form was distributed via identified breastfeeding support group on the social media platform . The participants' pre-pregnancy and 6-months postpartum weight were self-reported, meanwhile the participants' 1-month postpartum weight were recorded based on antenatal book record. All variables were described using Descriptive analyses. Independent T-test was used to assess the difference in weight and BMI changes between exclusively and non-exclusively breastfed mothers. **Result:** A total of 116 mothers were included based on the selection criteria using simple random sampling across Malaysia. 70% of the participants in this study practised exclusive breastfeeding (n = 81). Exclusively breastfeeding mothers showed decreasing postpartum weight (-1.04 ± 4.66 kg) changes whilst non-exclusively breastfeeding mothers of 6-months postpartum showed an increasing pattern (0.32 ± 4.25 kg). However, there was no significant difference in postpartum weight and BMI changes between these two groups ($p > 0.05$). **Conclusion:** The study found no significant difference in postpartum body weight and BMI changes in exclusively breastfed and non-exclusively breastfeed mothers at 6-months postpartum.
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INTRODUCTION

World Health Organization (WHO) reported 13% of the worldwide adult population were obese in 2016 with 11% of the population being men and 15% being women. This statistic showed that the rate of obesity in the world's population was slightly higher among women compared to men. National Health and Morbidity Survey 2006 II (NHMS) reported that the prevalence of obesity in Malaysia was 14.5% continuously increased from NHMS III 2011 to NHMS 2015 with 15.1% and 17.7%, respectively (4). NHMS 2019 reported that 50.1% of the adults are overweight or obese with 30.4% being overweight and 19.7% being obese (52). Systematic global data analysis conducted by Ng et al (2014) showed that the prevalence of obese women in Malaysia was slightly higher than men with 16.7% and 11.5%, respectively (5). Pregnancy and postpartum are the key phases of obesity risk in women's lives (36, 53 - 54). Hence, it should be taken seriously by the mothers as this period greatly influence the mothers' health in later life.

Gestational weight gain is the overall weight gain during pregnancy that is important as it is linked with an increased obesity rate among women of childbearing age and might have a significant influence on the pregnancy outcomes. Maternal obesity is associated with a higher risk of pregnancy loss, congenital anomalies, gestational diabetes and foetal macrosomia (2). Greater postpartum weight retention accelerates the emergence of cardio-metabolic risk factors (42). On the other hand, excessive maternal weight also put the foetus at risk of metabolic impairment and obesity. Infants born to overweight and obese mothers have higher fat mass than those born to lean or average-weight mothers, and there is evidence that proved obese mothers' foetuses

develop insulin resistance while still in utero (2). Hence, weight gain during pregnancy should fall within the recommendation of the Institute of Medicine (1). This recommendation differs according to the pre-pregnancy BMI of the mothers. Furthermore, women should be advised to control their GWG, be physically active, decrease the energy consumption after childbirth and continue to breastfeed their infant up to 6 months to reduce postpartum weight retention (20).

Failure to return to pre-pregnancy weight is associated with an increased risk of the onset of obesity in childbearing age (43) and may increase the risk of excessive gestational weight gain and increased postpartum BMI in a subsequent pregnancy (7). Hence, this proved that postpartum weight retention would be one of the contributing factors to obesity that might give an impact on women's health in the long term. Excessive weight gain during pregnancy is caused by decreased exercise, increased consumption of healthy foods, and smoking cessation whilst increased physical activity and breastfeeding are associated with a reduction of postpartum weight retention (44). This study highlighted that breastfeeding is one of the contributing factors to losing weight in the postpartum period (44). Research shows that mothers who exclusively breastfed their infants lose more weight than those who did not exclusively breastfeed their infants (40). Plus, breastfeeding promotes weight loss by reducing the maternal adipose tissue particularly visceral fat (6, 21 – 22). A study stated that visceral fats deposition was greater among mothers who lactated in less than 3 months (32). In addition, studies have also found that breastfeeding may help in protecting the mothers from non-communicable diseases (NCDs) which include hypertension, diabetes mellitus, and cardiovascular diseases (8). Furthermore, breastfeeding also showed a negative association with rapid weight gain among infants (30) and protective effect against obesity in nine years of age of the infants' life (33).

However, the effect of breastfeeding on postpartum weight loss remains controversial as the outcome of breastfeeding on weight loss seems to differ according to population and geographical location (9). Therefore, a study was conducted on the difference in postpartum body weight and BMI changes in exclusive breastfeeding and non-exclusively breastfeeding mothers with the sample size across Malaysia. The main objective of this study is to compare postpartum body weight and BMI changes between breastfeeding and non-breastfeeding mothers of 6-months postpartum.

MATERTIALS AND METHODS

Design

This was a cross-sectional study conducted to retrieve retrospective data on weight gain and breastfeeding practices of mothers at 6 months postpartum. Data was collected using online platforms as it would be convenient for mothers to fill in the questionnaire according to their convenience. This data collection method was feasible to be conducted as the study was conducted in 2020, during the outbreak of the COVID-19 pandemic.

Participants

The inclusion criteria for the subjects were Malaysian citizens, six months postpartum mothers aged 18 – 40 years old and members of a breastfeeding support group on Facebook and Twitter. Exclusion factors include mothers who were pregnant in 6 months postpartum had any medical illness and did not breastfeed at all with a 6-month postpartum period.

The sample size was calculated using the PS Power and Sample Size Calculation software that use two mean formula to compare two independent means,

$$n = 2\left[\frac{(Z\alpha + Z\beta)^2\sigma^2}{\Delta^2}\right]$$

n = sample size
$z\alpha$ = value of the standard normal distribution cutting off probability α in one tail for a one-sided or a/2 in each tail for a two-sided alternative
$z\beta$ = value of the standard normal distribution cutting off probability β
σ = population standard deviation
Δ = overall change in value

The formula considers the type I error probability, α= 0.05, and the power of 80%. The percent margin of error of this study from the real population considered in this calculation is 5. Standard deviation used in this study is 5, which was adapted from S6mano et al (2013) that compare the effect of breastfeeding on weight loss and recovery of pre-gestational weight among mothers (40). The calculation also included 20% of dropouts. A total of 116 mothers were included in this study after excluding the participants who did not meet the inclusion criteria set.

Data collection

After ethical approval was obtained from the Research Ethics Committee of UiTM [600-TNCPI(5/1/6)], the recruitment of participants were advertised on social network platforms such as Facebook and Twitter. Mothers who met the inclusion criteria were recruited after they consented to the study. These mothers were given the link to the online questionnaire that was designed using Google form. The questionnaire consists of 3 parts. Part A; demography, Part B; anthropometry and Part C: Breastfeeding practices. Results were computed in SPSS software version 23.

Data was arranged accordingly and all the 6 months' postpartum mothers were grouped into two groups according to those who exclusively breastfed their child for 6 months and those who practised any kind of

breastfeeding for six months.

Instruments

Data collection was gathered using an online questionnaire adapted from S6mano et al., 2013. In Part A, demography information such as age, education level, occupation household income, marital status, partners' occupation and educational level and parity was collected. In part B, anthropometry information regarding height, pre–pregnancy weight and postnatal weight at 1 month and 6th month were obtained. These data can be retrieved from the prenatal record books that the mothers had to bring for their monthly check up in the health clinic and the weight on 6-months postpartum was self-reported by the participants. In part C, information regarding breastfeeding and exclusive breastfeeding were obtained.

A "Breastfeeding Assessment" questionnaire consists of 3 sections pertinent to the study being evaluated. Before answering the questionnaire and providing the information and data in the survey, participants were asked for their willingness to participate in this study. Section A composed of questions regarding the mothers' sociodemographic, whereas section B consists of the anthropometric measurements of the mothers who practised exclusive breastfeeding and those who were non-exclusively breastfeed their children. Anthropometric measurements include the mother's height, the weight of 1-month postpartum from the health record during their pregnancy check-up which is the "pink book". The participants uploaded the image of the record on their weight at 1st month postpartum from the antenatal check-up book in this section. Meanwhile, the weight during pre-pregnancy period and 6-month postpartum which were self-reported by the mothers.

BMI of the mothers was calculated using the table the formula of BMI, whereby the weight (in kilogram, kg) will be divided by square of height (in metre, m) and classified based on WHO BMI cut off (42). Mothers with BMI of <18.5 kg/m2 were categorized as underweight, whilst mothers with BMI of 18.5 – 24.9 kg/m2 were classified as normal. BMI of 25 – 29.9 kg/m2 was categorized as overweight and mothers who had BMI of more than 30 kg/m2 were classified as obese. WHO BMI cut off points were referred based on MDG (2010) that recommend the use of WHO BMI cut off points for adults (10).

Data analysis

Statistical analyses were performed using the SPSS statistical software version 23. All variables were described using Descriptive analyses. An Independent T-test was used to assess the difference in weight and BMI changes between exclusively and non-exclusively breastfed mothers.

Ethical Clearance

Ethical approval to carry out the survey was obtained by the Research Ethics Committee of UiTM (REC/12/2020 (UG/MR/237)). None of the funding sources had a role in this study . All procedures used in studies involving human subjects complied with the institutional and/or national research committee's ethical requirements, as well as the 1964 Helsinki Declaration and its subsequent revisions or comparable ethical standards.

RESULTS

Sociodemographic characteristics of exclusive and non-exclusive breastfed mothers at 6-months postpartum mothers based on the feeding practices

A total of 116 mothers voluntarily participated in this study. In table I, it can be observed that more than half of the participants breastfed their infants (70%, n = 81). The mean age of exclusively breastfeeding mothers were 28.35 ± 3.56 months and non-exclusively breastfeed mothers were 29.03 ± 4.96 months. Most of the participants were in the age group of 26 – 30 years old (58%, n = 51). Majority of the participants were Malays, 98.3% (n = 104) with more than half of the subjects having tertiary education (79%, n = 92). Nearly half of the exclusively breastfed mothers worked in the government or private sector whilst majority of the non-exclusively breastfed mothers were unemployed. More than half of the exclusively breastfed mothers' and non-exclusively mothers' partners were married (n = 60, n = 23) and, majority of them have tertiary education (n = 67, n = 33). More than a quarter of exclusively breastfed mothers were in upper middle-class family (n = 30), whilst nearly half of the non-exclusively breastfed mothers were in middle class family (n = 16). Moreover, majority of the exclusively and non-exclusively breastfed mothers had one child (n = 74) and only one exclusively breastfed participant had a history of smoking before pregnancy. From 116 subjects of this study, majority of the participants had no history of GDM during previous pregnancy (n = 82).

Comparison of maternal anthropometric data at pre-pregnancy, 1 month postpartum and 6 months postpartum between exclusively breastfed and non-exclusively breastfed mothers

The mothers' BMI changed throughout the pre-pregnancy period to 6-months postpartum period. It can be seen from Figure 1 the number of exclusively breastfed mothers who were underweight and had normal BMI during pre-pregnancy to 6-months postpartum period reduced from 12 % to 6.9% and 41% to 40.5%, respectively. The number of underweight mothers who were non-exclusively breastfed their infants also reduced from 5.2% to 3.4%. These patterns showed that mothers with underweight and normal BMI before pregnancy who were exclusively breastfed and underweight non-exclusively breastfed mothers retained some of their gestational weight or gained new weight in this period. In addition, the number of exclusively breastfeeding mothers who were overweight and obese

Table I: Sociodemographic characteristics of 6-months postpartum mothers according to their breastfeeding practice.

Characteristic	n (%)		P
	Exclusive breast-feeding (n = 81)	Non-exclusive breastfeeding (n = 35)	
Age (mean ± SD)	28.35 ± 3.56	29.03 ± 4.96	0.454
18 – 20	2 (2.5)	0 (0)	
21 – 25	10 (12.3)	8 (22.9)	
26 – 30	51 (63)	16 (45.7)	
31 – 35	14 (17.3)	7 (20.0)	
36 – 40	4 (4.9)	4 (11.4)	
Ethnic			0.055
Malay	80 (98.8)	34 (97.1)	
Chinese	0	0	
Indian	0	0	
Others	1 (1.2)	1 (2.9)	
Education			0.023
No formal education	0 (0)	0 (0)	
Primary school	1 (1.2)	0 (0)	
Secondary school	16 (19.8)	7 (20.0)	
Tertiary education	64 (79.0)	28 (80.0)	
Occupation			0.437
Government/privately employed	44 (54.3)	14 (40.0)	
Self-employed	11 (13.6)	6 (17.1)	
Unemployed	26 (32.1)	15 (42.9)	
Marital status			0.694
Married	79 (97.5)	34 (97.1)	
Never married	1 (1.2)	0 (0)	
Divorced	1 (1.2)	0 (0)	
Widowed	0 (0)	1 (2.9)	
Partner's education			0.161
No formal education	0 (0)	1 (2.9)	
Primary school	1 (1.2)	0 (0)	
Secondary school	20 (24.7)	11 (31.4)	
Tertiary education	60 (74.1)	23 (65.7)	
Partner's occupation			0.778
Government/privately employed	67 (82.7)	33 (94.3)	
Self-employed	13 (16.0)	2 (5.7)	
Unemployed	1 (1.2)	0 (0)	
Household income			0.005
RM 6000 and above (upper class)	20 (24.7)	7 (20.0)	
RM 3000 – RM 6000 (upper middle class)	30 (37.0)	11 (31.4)	
RM 1000 – RM 3000 (middle class)	26 (32.1)	16 (45.7)	
RM 900 – RM 1000 (lower middle class)	3 (3.7)	1 (2.9)	
less than RM 900 (lower class)	2 (2.5)	0 (0)	
Number of children			0.300
One	48 (59.3)	26 (74.3)	
More than one	33 (40.7)	9 (25.7)	
Smoking status			0.891
No	80 (98.8)	35 (100)	
Yes, before 1 pregnant	1 (1.2)		
Previous history of GDM			0.482
No	57 (70.4)	25 (71.4)	
Yes	24 (29.6)	10 (28.6)	
Pre-pregnancy weight (mean ± SD)	56.66 ± 12.51	60.64 ± 15.12	0.004*
Total gestational weight gain (mean ± SD)	12.08 ± 5.66	11.07 ± 5.29	0.003*

Descriptive analysis

*Chi-square test and t-test sig at p<0.05

before pregnancy had an increase in BMI from 12.9% to 16.3% and 3.4% to 6%, respectively which indicated that overweight and obese mothers who were exclusively breastfeeding might have retained their weight in the first 6-months postpartum period. The same pattern was seen among the proportion of non-exclusively breastfed mothers who were overweight with increment of 2.6 %. In contrast, the fraction of non-exclusively breastfed mothers who were obese decreased by 0.9 %.

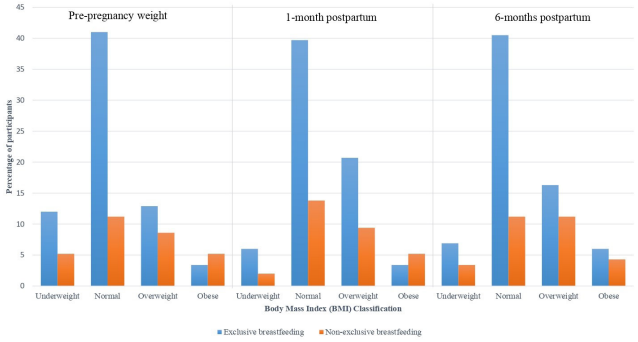

Figure 1: Numbers of exclusively and non-exclusively breast-feeding mothers based on their BMI status. The participants were classified into exclusive breastfeeding non-exclusive breastfeeding group and further categorized based on their BMI status during three period, pre-pregnancy, 1-month post-partum and 6-months postpartum.

Effect of exclusive breastfeeding on postpartum weight loss

The mean weight changes from first month postpartum to six months postpartum for exclusively breastfed mothers was -1.04 ± 4.66 kg and non-exclusively breastfed mothers was 0.32 ± 4.25 kg (Table II). Figure 2 shows that mothers who exclusively breastfed their infants showed a decreasing pattern of postpartum body weight changes while mothers who did not exclusively breastfed showed a slight increase in 6-months postpartum weight. However, there was no significant difference in weight changes from 1-month postpartum to six months postpartum between the two groups. The mean change of BMI were 0.34 ± 2.31 kg/m^2 and 0.32 ± 4.25 kg/m^2 from pre-pregnancy BMI of exclusively breastfeeding and non-breastfeeding mothers of 6-months postpartum, respectively. The BMI pattern for mothers who were exclusively breastfeeding and non-exclusively breastfeeding shows an increment trend (Fig. 2).

DISCUSSION

In this study, more than half of the participants exclusively breastfed their infants for the first 6-months (n = 81) which met the recommendation by WHO (2011), the American Academy of Paediatrics (AAP, 2012), and Malaysia's National Breastfeeding Policy. The guidelines were established to encourage breastfeeding among mothers, which is advantageous to both infants' and

Table II Comparison of Weight changes between exclusive breast-feeding and non-exclusively breastfeeding group

Measurements	Mean ± SD		P
	Exclusive breast-feeding (n = 81)	Non-exclusive breastfeeding (n = 35)	
Weight changes (kg)	-1.04 ± 4.66	0.32 ± 4.25	0.142

Independent t test

*p<0.05

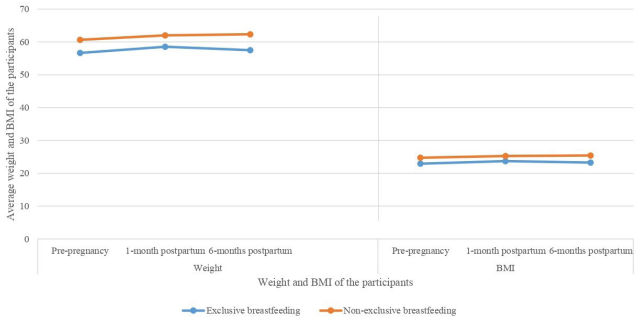

Figure 2: Comparison of Weight and BMI changes from pre-pregnancy to 6 months postpartum between exclusive breastfed and non-exclusive breastfed mothers. The weight and BMI of the mothers were compared using mean and were plotted in graph to observe the weight and BMI changes from pre-pregnancy to 6-months postpartum.

mothers' health in the long run . Studies showed that breastmilk helps to improve the cognitive development of the infants which include intellectual, psychomotor, neurological and social development as the breastmilk also composed of bioactive substances that contributes to the infant's growth (46, 47). Plus, breastmilk also helps to reduce the risk of being overweight or developing obesity in later life among infant (30, 33). The SWIFT cohort study determined whether higher breastfeeding intensity is associated with more favourable blood lipids, lipoprotein and adipokines among mothers who were diagnosed with gestational diabetes mellitus (GDM) after pregnancy (22). Plus, a systematic review and meta-analysis study by A study also found that breastfeeding has protective effect against breast carcinoma by the possible biological mechanisms that involves the regulation of circulation hormones that is associated with risk of breast cancer such as estradiol, prolactin and growth hormone (48).

Breastfeeding has been shown to reduce weight gain during postpartum period (19, 27, 40). This study found no significant difference in the weight changes between exclusively breastfed and non-exclusively breastfed mother. Overweight mothers (n = 15) and obese mothers (n = 4) in the study retained their weight during postpartum period , which in parallel with previous study conducted among overweight and obese mothers that found the same pattern of weight retention reduction among exclusively breastfeeding mothers. However, in our study, obese mothers who did not exclusively breastfeed their infants also had also experienced weight reduction in their postpartum as seen from the results of their BMI. This might be associated with pre-pregnancy BMI, physical activity, adequate weight gain during pregnancy, lower parity, appropriate or low calorie intake and absence of depression which contribute weight loss during postpartum period (45). In contrast, a previous study found that mothers who were exclusively breastfed had a greater tendency to return to their pre-pregnancy BMI as compared to mothers who were not exclusively breastfeeding their infants (27). This study reports the differences in body weight between mothers who exclusively breastfed and did breastfed their infant from birth to 6 months postpartum. Although the study shows there are differences in weight changes, but no statistical significance was found. Although there are studies that have reported a significance difference between this two groups (28, 41), however, many studies have also reported that there is no significant association between weight changes and breastfeeding practices . (35, 37 - 38). These studies discovered that exclusive breastfeeding have no effect on weight loss during postpartum period which may be contributed to other factors such as dietary intake (25, 31, 49), physical activity (25 - 26), gestational weight gain (35, 36, 45, 50, 51) and cultural practices (39).

A recent study conducted among breastfeeding mothers of multiple countries reported no significant impact on postpartum weight loss in these setting. The countries that were involved in this study were Brazil, Ghana, India, Norway, Oman and USA (39). The study explained that, lactation stimulates appetite, specifically among mothers in Ghana and Oman who are breastfeeding and may have led to mobilize fat stores accumulated during gestation which may lead to new weight gain in the postpartum period. Not only that, cultural practises in these countries such as special care for a newly delivered mother and her child, including celebration, religious ritual and feasting by the extended family and community may contribute to little weight loss (39). Despite having the highest reported frequency and overall duration of breastfeeding, mothers in Ghana and Oman reflected the same pattern as shown by previous studies found in Denmark and Brazil, where higher parity was positively associated with overweight and obesity and that attenuate weight loss caused by lactation (39).

The conflicting results from the previous report observed may be contributed by lower energy consumption and increased physical activity (25-26). Plus, there was also an imbalance numbers of mothers who were exclusive breastfeeding and non-exclusive breastfeeding to compare between these two groups which might contribute to the results due to simple random sampling techniques used in this study. Thus, the result of this study may not be able to determine the significant difference of weight changes among exclusively and non-exclusively breastfed mothers. Plus, the pre-pregnancy weight and 6-months postpartum reported by the mothers were self-measured which may be under- or over-reporting.

Our study highlighted the importance of gestational weight gain and postpartum weight reduction in women's lives as it may impact the mothers' health in long term . Although there was no significant difference found in the weight changes among exclusively and non-exclusively breastfed mothers, more weight reduction can be seen in exclusively breastfed mothers.

However, the unequal number of exclusively breastfed and non-exclusively breastfed mothers may impact the results of this study in comparing the effect of exclusive breastfeeding on the postpartum weight and BMI. Plus, the result for this study may have under-reporting of the pre-pregnancy weight and 6-months postpartum weight as both weight were self-reported by the mothers.

CONCLUSION

This cross-sectional study showed no significant difference in postpartum body weight and BMI changes between exclusive and non-exclusive breastfeeding mothers at 6-months postpartum. We also found no significant association between breastfeeding and postpartum body weight and BMI changes. However, breastfeeding is still encouraged as it provides other health benefits to the mothers as well as their infants. The results did indicate weight loss in some participants who were exclusively breastfed their infants in the study period. Hence, we highly suggest for further studies to be conducted on a larger sample population to draw a more conclusive results.

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REFERENCES

1. Davis EM, Stange KC, Horwitz RI. Childbearing, Stress and Obesity Disparities in Women: A Public Health Perspective. Maternal and Child Health Journal. 2010;16:109–118. doi: 10.1007/s10995-010-0712-6.
2. Walsh JM, McGowan CA, Mahony RM, Foley ME, McAuliffe FM. Obstetric and metabolic implications of excessive gestational weight gain in pregnancy. Obesity. 2014;22:1594–1600. doi: 10.1002/oby.20753.
3. World Health Organization. Obesity and Overweight [Internet]. World Health Organisation. 2021. Available from: https://www.who.int/news-room/fact-sheets/detail/obesity-and-overweight.
4. Chan YY, Lim KK, Lim KH, Teh CH, Kee CC, Cheong SM, Khoo YY, Baharudin A, Ling MY, Omar MA, et al. Physical activity and overweight/obesity among Malaysian adults: findings from the 2015 National Health and morbidity survey (NHMS). BMC Public Health [Internet]. 2017 [cited 2019 Mar 12];17. doi: 10.1186/s12889-017-4772-z.
5. Ng M, Fleming T, Robinson M, Thomson B, Graetz N, Margono C, Mullany EC, Biryukov S, Abbafati C, Abera SF, et al. Global, regional, and National Prevalence of Overweight and Obesity in Children and Adults during 1980-2013: a Systematic Analysis for the Global Burden of Disease Study 2013. Lancet (London, England). 2014;384:766–781. doi: 10.1016/S0140-6736(14)60460-8.
6. McClure CK, Schwarz EB, Conroy MB, Tepper PG, Janssen I, Sutton-Tyrrell KC. Breastfeeding and Subsequent Maternal Visceral Adiposity. Obesity (Silver Spring, Md) [Internet]. 2011 [cited 2020 Apr 6];19:2205–2213. doi: 10.1038/oby.2011.185.
7. Gilmore LA, Klempel-Donchenko M, Redman LM. Pregnancy as a window to future health: Excessive gestational weight gain and obesity. Seminars in Perinatology [Internet]. 2015;39:296–303. doi: 10.1053/j.semperi.2015.05.009.
8. Kelishadi R, Farajian S. The protective effects of breastfeeding on chronic non-communicable diseases in adulthood: A review of evidence. Advanced Biomedical Research [Internet]. 2014 [cited 2019 Nov 14];3:3. doi: 10.4103/2277-9175.124629.
9. He X, Zhu M, Hu C, Tao X, Li Y, Wang Q, Liu Y. Breast-feeding and postpartum weight retention: a systematic review and meta-analysis. Public Health Nutrition. 2015;18:3308–3316. doi: 10.1017/s1368980015000828.
10. Ministry of Health. Malaysian Dietary Guidelines for Children and Adolescents National Coordinating Committee on Food and Nutrition Ministry of Health Malaysia 2013 [Internet]. 2010 [cited 2021 Sep 30]. Available from: https://nutrition.moh.gov.my/wp-content/uploads/penerbitan/buku/MDG_Children_adolescent_2014.pdf.
11. America Academy of Paediatrics. Home [Internet]. www.aap.org. 2012 [cited 2022 Jan 26]. Available from: https://www.aap.org/en-us/about-the-aap/aap-press-room/Pages/AAP-Reaffirms.
12. World Health Organization. Exclusive breastfeeding for six months best for babies everywhere [Internet]. www.who.int. [cited 2022 Jun 15]. Available from: https://www.who.int/mediacentre/news/statements/2011/breastfeeding_20110115/en/.
13. Ibrahim R. Promotion of Breastfeeding | Bahagian Pemakanan [Internet]. Bahagian Pemakanan. [cited 2022 Jan 26]. Available from: https://nutrition.moh.gov.my/en/promosi-penyusuan-susu-ibu/#:~:text=BREASTFEEDING%20PROMOTION&text=Malaysian%20Breastfeeding%20Policy%20states%20that.
14. Aldana-Parra F, Olaya G, Fewtrell M. Effectiveness of a new approach for exclusive breastfeeding counselling on breastfeeding prevalence, infant growth velocity and postpartum weight loss in overweight or obese women: protocol for a randomized controlled trial. International Breastfeeding Journal. 2020;15. doi: 10.1186/s13006-019-0249-2.
15. Alves M da S, Almeida MAM, Gomes C de B, Ferrari AP, Parada CMG de L, Carvalhaes MA de BL. Longer duration of exclusive breastfeeding reduces maternal weight retention: results from the CLaB study. Revista Brasileira de Saьde Materno Infantil. 2020;20:273–284. doi: 10.1590/1806-

93042020000100015.
16. Anderson AK, McDougald DM, Steiner-Asiedu M. Dietary trans fatty acid intake and maternal and infant adiposity. European Journal of Clinical Nutrition. 2010;64:1308–1315. doi: 10.1038/ejcn.2010.166.
17. Baker JL. Breastfeeding and weight in mothers and infants. Managing and Preventing Obesity. 2015;123–134. doi: 10.1533/9781782420996.2.123.
18. Brock EG, Long L. Breast feeding. Obstetrics, Gynaecology & Reproductive Medicine [Internet]. 2019 [cited 2019 Apr 18];29:136–140. doi: 10.1016/j.ogrm.2019.02.003.
19. da Silva M da CM, Oliveira Assis AM, Pinheiro SMC, de Oliveira LPM, da Cruz TRP. Breastfeeding and maternal weight changes during 24 months post-partum: a cohort study. Maternal & Child Nutrition. 2013;11:780–791. doi: 10.1111/mcn.12071.
20. Fadzil F, Shamsuddin K, Wan Puteh SE, Mohd Tamil A, Ahmad S, Abdul Hayi NS, Abdul Samad A, Ismail R, Ahmad Shauki NI. Predictors of postpartum weight retention among urban Malaysian mothers: A prospective cohort study. Obesity Research & Clinical Practice. 2018;12:493–499. doi: 10.1016/j.orcp.2018.06.003.
21. Gunderson EP, Kim C, Quesenberry CP, Marcovina S, Walton D, Azevedo RA, Fox G, Elmasian C, Young S, Salvador N, et al. Lactation intensity and fasting plasma lipids, lipoproteins, non-esterified free fatty acids, leptin and adiponectin in postpartum women with recent gestational diabetes mellitus: The SWIFT cohort. Metabolism [Internet]. 2014 [cited 2019 Sep 21];63:941–950. doi: 10.1016/j.metabol.2014.04.006.
22. Gunderson EP. Impact of Breastfeeding on Maternal Metabolism: Implications for Women with Gestational Diabetes. Current Diabetes Reports [Internet]. 2014;14. doi: 10.1007/s11892-013-0460-2.
23. Cohen SS, Alexander DD, Krebs NF, Young BE, Cabana MD, Erdmann P, Hays NP, Bezold CP, Levin-Sparenberg E, Turini M, et al. Factors Associated with Breastfeeding Initiation and Continuation: A Meta-Analysis. The Journal of Pediatrics [Internet]. 2018;203:190-196.e21. doi: 10.1016/j.jpeds.2018.08.008.
24. Oliveira DS de, Boccolini CS, Faerstein E, Verly-Jr E. Breastfeeding duration and associated factors between 1960 and 2000. Jornal de Pediatria. 2017;93:130–135. doi: 10.1016/j.jped.2016.05.005.
25. Huang T, Yeh C-Y, Tsai Y-C. A diet and physical activity intervention for preventing weight retention among Taiwanese childbearing women: a randomised controlled trial. Midwifery. 2011;27:257–264. doi: 10.1016/j.midw.2009.06.009.
26. Ha AVV, Zhao Y, Binns CW, Pham NM, Nguyen PTH, Nguyen CL, Chu TK, Lee AH. Postpartum Physical Activity and Weight Retention within One Year: A Prospective Cohort Study in Vietnam. International Journal of Environmental Research and Public Health. 2020;17:1105. doi: 10.3390/ijerph17031105.
27. Jarlenski MP, Bennett WL, Bleich SN, Barry CL, Stuart EA. Effects of breastfeeding on postpartum weight loss among U.S. women. Preventive Medicine. 2014;69:146–150. doi: 10.1016/j.ypmed.2014.09.018.
28. Krause KM, Lovelady CA, Peterson BL, Chowdhury N, Шstbye T. Effect of breast-feeding on weight retention at 3 and 6 months postpartum: data from the North Carolina WIC Programme. Public Health Nutrition [Internet]. 2010 [cited 2019 Sep 3];13:2019–2026. doi: 10.1017/s1368980010001503.
29. Krause KM, Lovelady CA, Шstbye T. Predictors of Breastfeeding in Overweight and Obese Women: Data From Active Mothers Postpartum (AMP). Maternal and Child Health Journal. 2010;15:367–375. doi: 10.1007/s10995-010-0667-7.
30. Lindholm A, Bergman S, Alm B, Bremander A, Dahlgren J, Roswall J, Staland-Nyman C, Almquist-Tangen G. Nutrition- and feeding practice-related risk factors for rapid weight gain during the first year of life: a population-based birth cohort study. BMC Pediatrics. 2020;20. doi: 10.1186/s12887-020-02391-4.
31. Ma D, Szeto IMY, Yu K, Ning Y, Li W, Wang J, Zheng Y, Zhang Y, Wang P. Association between gestational weight gain according to prepregnancy body mass index and short postpartum weight retention in postpartum women. Clinical Nutrition. 2015;34:291–295. doi: 10.1016/j.clnu.2014.04.010.
32. McClure CK, Catov J, Ness R, Schwarz EB. Maternal Visceral Adiposity by Consistency of Lactation. Maternal and Child Health Journal. 2011;16:316–321. doi: 10.1007/s10995-011-0758-0.
33. McCrory C, Layte R. Breastfeeding and risk of overweight and obesity at nine-years of age. Social Science & Medicine. 2012;75:323–330. doi: 10.1016/j.socscimed.2012.02.048.
34. Melzer K, Schutz Y. Pre-pregnancy and pregnancy predictors of obesity. International Journal of Obesity. 2010;34:S44–S52. doi: 10.1038/ijo.2010.239.
35. Montgomery KS, Best M, Aniello TB, Phillips JD, Hatmaker-Flanigan E. Postpartum Weight Loss. Journal of Holistic Nursing [Internet]. 2012;31:129–138. doi: 10.1177/0898010112464120.
36. Nartea R, Mitoiu BI, Nica AS. Correlation between Pregnancy Related Weight Gain, Postpartum Weight loss and Obesity: a Prospective Study. Journal of Medicine and Life [Internet]. 2019 [cited 2020 Jul 10];12:178–183. doi: 10.25122/jml-

2019-0015.
37. Neville CE, McKinley MC, Holmes VA, Spence D, Woodside JV. The relationship between breastfeeding and postpartum weight change—a systematic review and critical evaluation. International Journal of Obesity [Internet]. 2013 [cited 2019 Aug 23];38:577–590. doi: 10.1038/ijo.2013.132.
38. Østbye T, Peterson BL, Krause KM, Swamy GK, Lovelady CA. Predictors of Postpartum Weight Change Among Overweight and Obese Women: Results from the Active Mothers Postpartum Study. Journal of Women's Health [Internet]. 2012 [cited 2019 Mar 28];21:215–222. doi: 10.1089/jwh.2011.2947.
39. Onyango AW, Nommsen-Rivers L, Siyam A, Borghi E, de Onis M, Garza C, Lartey A, Baerug A, Bhandari N, Dewey KG, et al. Post-partum weight change patterns in the WHO Multicentre Growth Reference Study. Maternal & Child Nutrition. 2011;7:228–240. doi: 10.1111/j.1740-8709.2010.00295.x.
40. Sámano R, Martínez-Rojano H, Martínez EG, Jiménez BS, Rodríguez GPV, Zamora JP, Casanueva E. Effects of Breastfeeding on Weight Loss and Recovery of Pregestational Weight in Adolescent and Adult Mothers. Food and Nutrition Bulletin. 2013;34:123–130. doi: 10.1177/156482651303400201.
41. Wahabi HA, Fayed AA, Tharkar S, Esmaeil SA, Bakhsh H. Postpartum Weight Retention and Cardiometabolic Risk among Saudi Women: A Follow-Up Study of RAHMA Subcohort. BioMed Research International. 2019;2019:1–8. doi: 10.1155/2019/2957429.
42. World Health Organization. WHO :: Global Database on Body Mass Index [Internet]. Who. int. 2020. Available from: http://apps.who.int/bmi/index.jsp?introPage=intro_3.html.
43. Ketterl TG, Dundas NJ, Roncaioli SA, Littman AJ, Phipps AI. Association of Pre-pregnancy BMI and Postpartum Weight Retention Before Second Pregnancy, Washington State, 2003–2013. Maternal and Child Health Journal. 2018;22:1339–1344. doi: 10.1007/s10995-018-2514-1.
44. Suliga E, Rokita W, Adamczyk-Gruszka O, Pazera G, Cieśla E, Głuszek S. Factors associated with gestational weight gain: a cross-sectional survey. BMC Pregnancy and Childbirth. 2018;18. doi: 10.1186/s12884-018-2112-7.
45. Zanotti J, Capp E, Wender MCO. Factors associated with postpartum weight retention in a Brazilian cohort. Revista Brasileira de Ginecologia e Obstetrнcia [Internet]. 2015 [cited 2019 Sep 22];37:164–171. doi: 10.1590/so100-720320150005186.
46. Lee H, Park H, Ha E, Hong Y-C, Ha M, Park H, Kim B-N, Lee B, Lee S-J, Lee KY, et al. Effect of Breastfeeding Duration on Cognitive Development in Infants: 3-Year Follow-up Study. Journal of Korean Medical Science [Internet]. 2016;31:579. doi: 10.3346/jkms.2016.31.4.579.
47. Zielinska M, Hamulka J, Grabowicz-Chądrzyńska I, Bryś J, Wesolowska A. Association between Breastmilk LC PUFA, Carotenoids and Psychomotor Development of Exclusively Breastfed Infants. International Journal of Environmental Research and Public Health. 2019;16:1144. doi: 10.3390/ijerph16071144.
48. Chowdhury R, Sinha B, Sankar MJ, Taneja S, Bhandari N, Rollins N, Bahl R, Martines J. Breastfeeding and maternal health outcomes: a systematic review and meta-analysis. Acta Paediatrica. 2015;104:96–113. doi: 10.1111/apa.13102.
49. Bertz F, Brekke HK, Ellegerd L, Rasmussen KM, Wennergren M, Winkvist A. Diet and exercise weight-loss trial in lactating overweight and obese women. The American Journal of Clinical Nutrition. 2012;96:698–705. doi: 10.3945/ajcn.112.040196.
50. Rong K, Yu K, Han X, Szeto IMY, Qin X, Wang J, Ning Y, Wang P, Ma D. Pre-pregnancy BMI, gestational weight gain and postpartum weight retention: a meta-analysis of observational studies. Public Health Nutrition [Internet]. 2015;18:2172–2182. doi: 10.1017/S1368980014002523.
51. Sha T, Cheng G, Li C, Gao X, Li L, Chen C, Yan Y. Patterns of Women's Postpartum Weight Retention and Its Associations with Maternal Obesity-Related Factors and Parity. International Journal of Environmental Research and Public Health [Internet]. 2019 [cited 2021 Aug 20];16. doi: 10.3390/ijerph16224510.
52. Institute for Public Health (IPH), National Institute of Health, Ministry of Health. Non-Communicable Diseases: Risk Factors and other Health Problems [Internet]. 2020. Available from: https://iku.moh.gov.my/images/IKU/Document/REPORT/NHMS2019/Report_NHMS2019-NCD_v2.pdf.
53. Gaillard R, Durmuş B, Hofman A, Mackenbach JP, Steegers EAP, Jaddoe VWV. Risk factors and outcomes of maternal obesity and excessive weight gain during pregnancy. Obesity. 2013;21:1046–1055. doi: 10.1002/oby.20088.
54. Moore AP, Flynn AC, Adegboye ARA, Goff LM, Rivas CA. Factors Influencing Pregnancy and Postpartum Weight Management in Women of African and Caribbean Ancestry Living in High Income Countries: Systematic Review and Evidence Synthesis Using a Behavioral Change Theoretical Model. Frontiers in Public Health. 2021;9. doi: 10.3389/fpubh.2021.637800.