

## Special Article - Breast Feeding

# Research Progress on Breastfeeding and Postpartum Weight Retention

Yuqi D, Zekun C, Xue Y and Defu M\*

Peking University Health Science Center, School of Public Health, China

\*Corresponding author: Ma Defu, School of Public Health, Peking University Health Science Center, 38 Xueyuan Road, Haidian District, Beijing 100191, China

Received: January 20, 2021; Accepted: February 26, 2021; Published: March 05, 2021

**Abstract**

Obesity is a major public health Problem and Postpartum Weight Retention (PPWR) may cause a vicious cycle of postpartum women's obesity and it is highly likely to increase the risk of adverse health outcomes. Breastfeeding is an unparalleled way to provide ideal food for the infants and an integral part of the reproductive process, which has an important impact on the health of mothers and infants. There may be an association between breastfeeding and PPWR and that effect may be affected by breastfeeding method and/or duration, but it still have controversies. In this review, we will discuss the association between breastfeeding and PPWR and explore the potential impact factors.

**Keywords:** Breastfeeding; Lactation; Postpartum weight retention; PPWR; Review

**Introduction**

Over the past 30 years, obesity has become increasingly popular worldwide, especially among women of childbearing age [1]. Obesity is a major public health problem and it is estimated that medical expenses due to obesity exceed 700 billion dollars per year [2]. For most women, pregnancy and childbearing will cause the weight changes, and that may change their weight of trajectory [3], which will have a profound impact on themselves and their offspring [4-7].

Postpartum Weight Retention (PPWR) is the difference between the weight at a certain time after delivery minus the weight before pregnancy [8]. 47% of American women gain too much weight during pregnancy and thus 13% of them cannot regain their pre-pregnancy weight after delivery, and their weight increases by about 5 kg at 6-18 months after delivery [9]. Longitudinal studies have shown that Gestational Weight Gain (GWG) and pre-pregnancy Body Mass Index (BMI) are related to postpartum weight retention [10-13]. Every increase of 1 unit of BMI before pregnancy will increase the weight of 0.51 kg after delivery [14] and every gain of 1 kilogram of body weight during pregnancy will be retained in the body by 35% at 9 months postpartum [15], which may cause a vicious cycle of postpartum women's obesity [16-18] and it is highly likely to increase the risk of adverse health outcomes, including insulin resistance, metabolic syndrome and cardiovascular disease [3]. Therefore, studies have proposed that maintaining pregnancy weight at 6 months after delivery can be used as a predictor of long-term obesity [19].

In addition to pre-pregnancy BMI and GMG, there are many other factors that affect the occurrence of PPWR, including parity, age, race/ethnicity, education, diet, physical activity, breastfeeding time and so on [20-24]. Among these factors, breastfeeding is particularly worthwhile attention because it is an unparalleled way to provide ideal food for the healthy growth and development of infants; it is also an integral part of the reproductive process and has an important impact on the health of mothers [25,26]. However, scholars still have controversies about the relationship between breastfeeding and

postpartum weight retention. Research includes but is not limited to the time, duration and method of breastfeeding. Therefore, in this review, we intend to summarize the current research results and conclusions, analyze the underlying mechanisms, and point out the direction for future research.

**The Effect of Breastfeeding on Postpartum Weight Retention****Breastfeeding improves postpartum weight retention**

Some studies have shown a significant correlation between breastfeeding and PPWR. Waits [27] et al. obtained a dose-response relationship between breastfeeding duration and PPWR in a cross-sectional study of 52, 367 women in Taiwan, China. The PPWR of women who exclusively breastfed for 1 month was significantly lower than those who did not breastfeed or partly breastfed during the same period, and PPWR decreased by an average of 0.1-0.2 kg per month. The PPWR of mothers who exclusively breastfed for 6 months was reduced by 0.7 kg compared with partial breastfeeding, and 1.3 kg less than those without breastfeeding.

However, not all studies have obtained or explored a dose-effect relationship. A prospective cohort study conducted by Tahir [28] et al. of 370 mothers in the United States found that the PPWR of mothers breastfeeding for more than 3 months decreased significantly than those who breastfed for only 1-3 months. However, there is no statistically significant between breastfeeding for 3 months and 6 months at 6 months postpartum. A retrospective cohort study conducted by Krause [29] et al. on 14, 330 women who breastfed for 3 months and 4, 922 women who breastfed for 6 months in the United States, and found that breastfeeding status had no effect on weight retention at 3 months postpartum, but it has a significant impact on weight retention at 6 months postpartum. The effectiveness of reducing postpartum weight are as follows: complete breastfeeding > mixed feeding > formula feeding, full breastfeeding has greater protective effects. Other previous studies [30-34] (different populations, different research methods) have come to the

same conclusion, that is, breastfeeding has a significant reduction in PPWR and that effect may be affected by breastfeeding method and/or duration.

### **Breastfeeding has nothing to do with postpartum weight retention**

There are also some evidences that breastfeeding has nothing to do with PPWR. Neville [35] conducted a systematic review of all observational studies (8 retrospective studies and 37 prospective studies) published before June 12, 2012 on breastfeeding and postpartum weight changes as well as body composition changes, then concluded: most studies reported little or no association between breastfeeding and changes in body weight ( $n=27$ , 63%) or changes in body composition ( $n=16$ , 89%). In studies that do show breastfeeding has a positive effect on weight loss, this association is often relatively weak and often confused by other factors such as GWG, age, and pre-pregnancy BMI. However, four of five studies with higher methodological quality in terms of weight measurement and adjustment of key covariates showed a positive correlation between breastfeeding and weight change. Nevertheless, the overall study findings emphasize that there is currently insufficient evidence to suggest a direct link between breastfeeding and postpartum weight changes.

Subsequent studies confirmed Neville's conclusions. A prospective cohort study of 1, 035 women in Ireland conducted by Mullaney [36] et al. showed that, there was no difference in the weight change of women who exclusively breastfed (+2 kg), mixed breastfed (+1.7 kg) and formula fed (+1.1 kg) at 4 months postpartum. Moreover, compared with formula fed women, breastfed women had a greater increase in body fat percentage at 4 months postpartum (-0.03% vs +1%,  $P=0.02$ ). And the results of a cluster randomized trial conducted by Oken [37] et al. on 17, 046 women in Belarus showed that the proportion of women in the intervention group (6, 321) who exclusively breastfed for greater than or equal to 3 months was 44.5%, and the control group (5, 546) was 7.1%. At 11.5 years postpartum, the average results of the intervention group mothers were lower than those of the control group mothers' BMI (-0.27kg/m<sup>2</sup>; 95% CI: -0.91, 0.37) and body fat (-0.49%; 95% CI: -1.25, 0.27). However, the effect is a million to one and the range of confidence interval is wide. Moreover, the results decays to zero after adjusting the baseline characteristics.

### **Current meta-analysis researches**

Meta-analysis is a method of combining different results from multiple studies to obtain a comprehensive effect value [38]. Currently, there are only two related articles. He [39] et al. made a systematic review and meta-analysis to reveal the relationship between breastfeeding and postpartum weight retention. The study included 11 articles (8 cohort studies and 3 Randomized Controlled Trials (RCT)) published before October 2014. The results showed that whether breastfeeding can reduce body weight is related to the duration of breastfeeding. Compared with formula feeding, breastfeeding for 3-6 months has a positive effect on weight change (0.87 kg 95% CI: 0.57-1.17); If breastfeeding lasts for more than 6 months, or less than/ equal to 3 months, it may have little or no effect on weight change. However, the problem with this article is that the two included RCT studies equate mixed feeding with formula feeding

[40,41], but in fact mixed feeding also includes breastfeeding; except that, another included RCT study compares the effects of early infant food supplementation on the mother's PPWR, breastfeeding time, and delivery interval [42]. It is not relevant to our research topic and relevant data cannot be extracted and used. The results of these three studies reduce the credibility of this study.

Jiang [43] et al. also did a meta-analysis to explore the relationship. A total of 14 original studies published before June 2016 were included. The results showed that: compared with mothers who used formula feeding, the postpartum weight of breastfed mothers can reduce 0.38 kg (95% CI: -0.64, -0.11). Subgroup analysis showed that breastfeeding duration is an important influencing factors for PPWR. The PPWR of the breastfeeding group showed a U-shaped trend compared with the formula feeding group and no dose-effect relationship was observed. Breastfeeding had the most significant effect on reducing PPWR at 6-12 months postpartum. In addition, breastfeeding can lower the PPWR of childbearing women with these conditions: developing countries, primiparas, age less than 30 years, and normal BMI before pregnancy. However, as the author said, this meta-analysis still has certain limitations. PPWR is the result of a combination of multiple factors [22], and the confounding factors can only be adjusted in the original study, hence, we cannot rule out the residual confounding of the original study. Whether these potential confounding factors are more related to PPWR is still unclear.

### **The possible mechanism of breastfeeding to reduce postpartum weight retention**

Excessive or abnormal accumulation of fat or adipose tissue in the body can lead to obesity [44]. As we all know, the way to lose weight is nothing more than reducing energy intake and increasing energy expenditure. There are two potential mechanisms that explain why breastfeeding may reduce PPWR. The first potential mechanism is that lactation itself is an energy-consuming process. Studies have shown that breastfeeding mothers need to spend 500 kcal per day to produce milk [45]. At the same time, lactation can helpfully mobilize the fat reserves in the body to achieve weight loss.

The second underlying mechanism is the changes in maternal hormone levels. The lactation process promotes the synthesis and releases the prolactin. Increased levels of prolactin in the body will reduce the level of estrogen, which in turn enhances the mobilization of adipose tissue; in addition, prolactin can also inhibit the production of fat and inhibit the uptake of glucose by adipose tissue [46]. But the release of prolactin is a double-edged sword. On the one hand, it increases the mobilization of adipose tissue and reduces the production of fat. On the other hand, it also stimulates the lactating mothers' appetite, leading to the increase of food intake [47]. Brewer [48] et al. conducted a study on the weight and body fat changes of 56 American women from the beginning of delivery to 6 months postpartum and showed that, lactating mothers consume more energy (exclusive breastfeeding, 2055±435 kcal; mixed breastfeeding, 2005±515 kcal) than non-lactating mothers (formula feeding, 1453±503 kcal) ( $P<0.01$ ).

Since the mobilization and metabolism of fat is a gradual process; and the prolactin level, which impacts the appetite and food intake, also shows a downward trend over time. Therefore, short-term breastfeeding may not have a significant effect on weight. McClure

[49] et al. explored the relationship between breastfeeding duration and visceral obesity in 89 American women and showed that, in the fully adjusted model, the visceral fat of mothers who had never breastfed is 36.96 cm larger than those who breastfed for 3 months after delivery (95% CI: 20.92, 53.01); The visceral fat is 20.38 cm higher in mothers who breastfed for less than 3 months than those who breastfed for 3 months or more (95% CI: 2.70, 38.06).

Maybe this is one of the reasons for the global public health recommendations. The WHO recommend that the infants should be fed by exclusive breastfeeding for the first 6 months after birth to achieve optimal growth, development as well as health should be continued feeding by breastfeeding with other nutritionally adequate and safe complementary foods until age 2 or order [25,50].

## Conclusion and Inspiration

The effect of breastfeeding may not be a real risk factor for PPWR, but a common cause of PPWR. However, many results and potential mechanisms indicate that breastfeeding may help reduce PPWR, and the potential beneficial effects of breastfeeding need to be weighed against other risks of PPWR.

Due to the inability to implement high-quality RCT researches, we suggest that a multi-center, large sample, cohort study instead of cross-sectional research (in order to obtain causal inference) should be conducted in the future. And we should try to avoid using self-reported height and weight to prevent information bias and try our best to record the detail measurement and the information on many all known and potential confounding factors. In addition, the follow-up time should be longer, in order to obtain the weight information at a longer time point after delivery and learn about the long term impact.

## References

- Sermondade N, Huberlant S, Bourhis-Lefebvre V, Arbo E, Gallot V, Colombani M, et al. Female obesity is negatively associated with live birth rate following IVF: a systematic review and meta-analysis. *Hum Reprod Update*. 2019; 25: 439-451.
- Harrison C, Brown W, Hayman M, Moran L, Redman L. The Role of Physical Activity in Preconception, Pregnancy and Postpartum Health. *Semin Reprod Med*. 2016; 34: e28-e37.
- Nasreddine L, Ayoub J, Abbas N, Abdul Malik M, Naja F. Postpartum Weight Retention and Its Determinants in Lebanon and Qatar: Results of the Mother and Infant Nutrition Assessment (MINA) Cohort. *Int J Env Res Pub He*. 2020;17:7851.
- Deng HY, Zheng XX, Gong YH, Shen JP, Fan J, Lu Y. Study on the relationship between body mass index before pregnancy and weight gain during pregnancy and puerperium. *Chinese Maternal Child Health Care*. 2007;861-863.
- Dutton H, Borengasser SJ, Gaudet LM, Barbour LA, Keely EJ. Obesity in Pregnancy. *Med Clin N Am*. 2018;102:87-106.
- Kominiarek MA, Peaceman AM. Gestational weight gain. *Am J Obstet Gynecol*. 2017;217:642-651.
- Catalano PM, Shankar K. Obesity and pregnancy: mechanisms of short term and long term adverse consequences for mother and child. *BMJ*. 2017;356:j1.
- Gao HE. Research progress on duration of breastfeeding and postpartum weight retention. *Journal of Hygiene Research*. 2015;44:1019-1022.
- Tahir MJ, Haapala JL, Foster LP, Duncan KM, Teague AM, Kharbanda EO, et al. Association of Full Breastfeeding Duration with Postpartum Weight Retention in a Cohort of Predominantly Breastfeeding Women. *Nutrients*. 2019;11:938.
- Rooney BL, Schauburger CW, Mathiason MA. Impact of Perinatal Weight Change on Long-Term Obesity and Obesity-Related Illnesses. *Obstetrics & Gynecology*. 2005;106:1349-1356.
- Martin J, MacDonald-Wicks L, Hure A, Smith R, Collins C. Reducing Postpartum Weight Retention and Improving Breastfeeding Outcomes in Overweight Women: A Pilot Randomised Controlled Trial. *Nutrients*. 2015;7:1464-1479.
- He X, Zhu M, Hu C, Tao X, Li Y, Wang Q, et al. Breast-feeding and postpartum weight retention: a systematic review and meta-analysis. *Public Health Nutr*. 2015;18:3308-3316.
- Sha T, Cheng G, Li C, Gao X, Li L, Chen C, et al. Patterns of Women's Postpartum Weight Retention and Its Associations with Maternal Obesity-Related Factors and Parity. *Int J Env Res Pub He*. 2019;16:4510.
- Kac G, Benício MHDA, Velásquez-Meléndez G, Valente JG, Struchiner CJ. Gestational Weight Gain and Prepregnancy Weight Influence Postpartum Weight Retention in a Cohort of Brazilian Women. *The Journal of Nutrition*. 2004;134:661-666.
- Pan LL, Lan JQ, Zeng G, Li ZN, Sun YW, Duan YF, et al. Analysis of weight retention and influencing factors in urban and rural postpartum women. *Journal of Hygiene Research*. 2012;41:504-507.
- Hoover EA, Louis JM. Optimizing Health. *Obstet Gyn Clin N Am*. 2019;46:431-440.
- Lim S, Liang X, Hill B, Teede H, Moran LJ, O'Reilly S. A systematic review and meta-analysis of intervention characteristics in postpartum weight management using the TiDieR framework: A summary of evidence to inform implementation. *Obes Rev*. 2019;20:1045-1056.
- Dalrymple KV, Flynn AC, Relph SA, O Keeffe M, Poston L. Lifestyle Interventions in Overweight and Obese Pregnant or Postpartum Women for Postpartum Weight Management: A Systematic Review of the Literature. *Nutrients*. 2018;10:1704.
- MACLEAN CC, THOMPSON IS. Postpartum Care and Contraception in Obese Women. *Clin Obstet Gynecol*. 2016;59:204-215.
- Hollis JL, Crozier SR, Inskip HM, Cooper C, Godfrey KM, Harvey NC, et al. Modifiable risk factors of maternal postpartum weight retention: an analysis of their combined impact and potential opportunities for prevention. *Int J Obesity*. 2017;41:1091-1098.
- Fadzil F, Shamsuddin K, Wan Puteh SE, Mohd Tamil A, Ahmad S, Abdul Hayi NS, et al. Predictors of postpartum weight retention among urban Malaysian mothers: A prospective cohort study. *Obes Res Clin Pract*. 2018;12:493-499.
- Shao H, Hwang L, Huang J, Hsu H. Postpartum Weight Retention Risk Factors in a Taiwanese Cohort Study. *Obesity Facts*. 2018;11:37-45.
- Archuleta J, Chao SM. Maternal Characteristics that Impact Postpartum Weight Retention: Results from the 2016 Los Angeles Mommy and Baby (LAMB) Follow-Up Study. *Matern Child Hlth J*. 2020;
- Zanotti J, Capp E, Wender MCO. Factors associated with postpartum weight retention in a Brazilian cohort. *Revista Brasileira de Ginecologia e Obstetrícia*. 2015;37:164-171.
- The World Health Organization's infant feeding recommendation.[hyperlinked with [http://www.who.int/nutrition/topics/infantfeeding\\_recommendation/en/](http://www.who.int/nutrition/topics/infantfeeding_recommendation/en/)]
- Abou-Dakn M. Gesundheitliche Auswirkungen des Stillens auf die Mutter. *Bundesgesundheitsblatt - Gesundheitsforschung - Gesundheitsschutz*. 2018;61:986-989.
- Waits A, Guo C, Chang Y, Chien L. Dose-Response Relationships between Breastfeeding and Postpartum Weight Retention Differ by Pre-Pregnancy Body-Mass Index in Taiwanese Women. *Nutrients*. 2020;12:1065.
- Tahir MJ, Haapala JL, Foster LP, Duncan KM, Teague AM, Kharbanda EO, et al. Association of Full Breastfeeding Duration with Postpartum Weight Retention in a Cohort of Predominantly Breastfeeding Women. *Nutrients*. 2019;11:938.

29. Krause KM, Lovelady CA, Peterson BL, Chowdhury N, Ostbye T. Effect of breast-feeding on weight retention at 3 and 6 months postpartum: data from the North Carolina WIC Programme. *Public Health Nutr.* 2010;13:2019-2026.
30. Chagas D, Silva A, Ribeiro C, Batista R, Alves M. [Effects of gestational weight gain and breastfeeding on postpartum weight retention among women in the BRISA cohort]. *Cad Saude Publica.* 2017;33:e7916.
31. Dujmovic M, Kresic G, Mandic ML, Kenjeric D, Cvijanovic O. Changes in dietary intake and body weight in lactating and non-lactating women: prospective study in northern coastal Croatia. *Coll Antropol.* 2014;38:179-187.
32. Martin JE, Hure AJ, Macdonald-Wicks L, Smith R, Collins CE. Predictors of post-partum weight retention in a prospective longitudinal study. *Maternal & Child Nutrition.* 2014;10:496-509.
33. Kac G, Benício MH, Velásquez-Meléndez G, Valente JG, Struchiner CJ. Breastfeeding and postpartum weight retention in a cohort of Brazilian women. *The American Journal of Clinical Nutrition.* 2004;79:487-493.
34. Martin J, MacDonald-Wicks L, Hure A, Smith R, Collins C. Reducing Postpartum Weight Retention and Improving Breastfeeding Outcomes in Overweight Women: A Pilot Randomised Controlled Trial. *Nutrients.* 2015;7:1464-1479.
35. Neville CE, McKinley MC, Holmes VA, Spence D, Woodside JV. The relationship between breastfeeding and postpartum weight change--a systematic review and critical evaluation. *Int J Obes (Lond).* 2014;38:577-590.
36. Mullaney L, O'Higgins AC, Cawley S, Kennedy R, McCartney D, Turner MJ. Breast-feeding and postpartum maternal weight trajectories. *Public Health Nutr.* 2016;19:1397-1404.
37. Oken E, Patel R, Guthrie LB, Vilchuck K, Bogdanovich N, Sergeichick N, et al. Effects of an intervention to promote breastfeeding on maternal adiposity and blood pressure at 11.5 y postpartum: results from the Promotion of Breastfeeding Intervention Trial, a cluster-randomized controlled trial. *The American Journal of Clinical Nutrition.* 2013;98:1048-1056.
38. Ma D, Szeto IM, Yu K, Ning Y, Li W, Wang J, et al. Association between gestational weight gain according to prepregnancy body mass index and short postpartum weight retention in postpartum women. *Clin Nutr.* 2015;34:291-295.
39. He X, Zhu M, Hu C, Tao X, Li Y, Wang Q, et al. Breast-feeding and postpartum weight retention: a systematic review and meta-analysis. *Public Health Nutr.* 2015;18:3308-3316.
40. Hatsu IE, McDougald DM, Anderson AK. Effect of infant feeding on maternal body composition. *Int Breastfeed J.* 2008;3:18.
41. Dewey KG, Cohen RJ, Brown KH, Rivera LL. Effects of Exclusive Breastfeeding for Four versus Six Months on Maternal Nutritional Status and Infant Motor Development: Results of Two Randomized Trials in Honduras. *The Journal of Nutrition.* 2001;131:262-267.
42. Ly CT, Diallo A, Simondon F, Simondon KB. Early short-term infant food supplementation, maternal weight loss and duration of breast-feeding: a randomised controlled trial in rural Senegal. *Eur J Clin Nutr.* 2006;60:265-271.
43. Jiang M, Gao H, Vinyes-Pares G, Yu K, Ma D, Qin X, et al. Association between breastfeeding duration and postpartum weight retention of lactating mothers: A meta-analysis of cohort studies. *Clin Nutr.* 2018;37:1224-1231.
44. Panuganti KK, Nguyen M, Kshirsagar RK. Obesity. 2020;
45. Melzer K, Schutz Y. Pre-pregnancy and pregnancy predictors of obesity. *Int J Obesity.* 2010;34:S44-S52.
46. PANSINI F, BONACCORSI G, GENOVESI F, FOLEGATTI MR, BAGNI B, BERGAMINI CM, et al. Influence of Estrogens on Serum Free Fatty Acid Levels in Women\*. *The Journal of Clinical Endocrinology & Metabolism.* 1990;71:1387-1389.
47. Lyu L, Lo C, Chen H, Wang C, Liu D. A prospective study of dietary intakes and influential factors from pregnancy to postpartum on maternal weight retention in Taipei, Taiwan. *Brit J Nutr.* 2009;102:1828-1837.
48. Brewer MM, Bates MR, Vannoy LP. Postpartum changes in maternal weight and body fat depots in lactating vs nonlactating women. *The American Journal of Clinical Nutrition.* 1989;49:259-265.
49. McClure CK, Catov J, Ness R, Schwarz EB. Maternal Visceral Adiposity by Consistency of Lactation. *Matern Child Hlth J.* 2012;16:316-321.
50. Binns C, Lee MK, Kagawa M, Low WY, Scott J, Lee A, et al. Infant Feeding Guidelines for the Asia Pacific Region. *Asia Pacific Journal of Public Health.* 2018;30:682-690.