ECRONICON OPEN ACCESS

EC NUTRITION
Review Article

Public Health Concern of Maternal Obesity and Exclusive Breastfeeding

Otitoju GTO[1]*, Ali CU[2] and Otitoju O[3]

[1]*Department of Hospitality and Management, Federal University Wukari Taraba State Nigeria*

[2]*Department of Nutrition and Dietetics, University of Nigeria Nsukka Enugu State Nigeria*

[3]*Department of Biochemistry, Federal University Wukari Taraba State Nigeria*

***Corresponding Author**: Otitoju GTO, Department of Hospitality and Management, Federal University Wukari Taraba State Nigeria.

Received: August 30, 2019; **Published:** September 30, 2019

Abstract

Introduction: Maternal obesity is emerging as a public health problem, recently highlighted together with maternal under- nutrition as a ''double burden'', especially in African countries undergoing social and economic transition. World Health Organization recommends that an infant should be put to breast within an hour after delivery and exclusively breastfeed for the first six months of life and continue until age of 24 months or more. There is an association between maternal obesity and low breastfeeding rates. Studies have shown that obese mothers are less likely to exclusively breastfeed their babies.

Methods: A systematic review was conducted, using the Studies carried out by eight (8) Authors on maternal obesity and exclusive breastfeeding in different countries of the world. This study examined maternal obesity and breastfeeding intention, initiation, duration and delayed onset of lactatogenesis.

Results: It was deduced from the studies that obese women breastfeed for a shorter period than normal weight women and are less likely to initiate breastfeeding. The studies reported a significant relationship between obesity and delayed lactogenesis. As a result of high level of progesterone in the adipose tissue which interferes with breastmilk let down. Obese women also have lower prolactin response to suckling than normal weight women.

Conclusion: Breastmilk is the best food for infant as it contains all the nutrient the infant needs for the first six (6) months of life. It confers numerous benefits on both the mother and her baby. Exclusive breast feeding is rarely practiced due to certain factors that militate against its success such as maternal obesity. Maternal obesity reduces breastfeeding success and lactation performance in women, therefore overweight/ obese women of child bearing age should be encouraged to lose weight before conception, as to reduce the level of progesterone in the adipose tissue and as well breastfeed successfully after delivery.

Keywords: *Maternal; Obesity; Exclusive Breastfeeding; Lactogenesis*

Introduction

The emergence of 'maternal obesity' as a significant health issue of concern. It is demonstrated by a large number of new medical scientific investigations, along with the sensational and extensive coverage of new research findings in the popular media. The coalescence of these forces result in changes to maternity care and public health policy. These changes are orientated towards the classification and management of 'maternal obesity' as a high risk phenomenon requiring surveillance and intervention [1]. 'Maternal obesity' being articulated as a key public health issue with significant implications for women, child and future adult health and as 'the biggest challenge for

maternity services today' (Heslehurst, Bell and Rankin 2011). In response, maternity care practice is changing to include the introduction of routine Body Mass Index (BMI) screening in primary maternity care and the classification and management of pregnant women considered obese (30 - >30 - 40 kg/m^2) as 'high risk'.

Obesity is a worldwide epidemic. Prevalence is higher in wealthy countries [2-4], but increasing in developing countries, with severe consequences [4,5].

Definition of terms

Obesity: Obesity is defined as an excessively high amount of body fat or adipose tissue in relation to lean body mass (Stunkard and Wadden 1993 in Laura, Rayburn and Alejandra 2016). People are considered obese when their body mass index (BMI) is over 30kg/M^2 (WHO 2015).

Body Mass Index: (BMI) is a simple index that reflects body fat and is used to categorize levels of obesity particularly in adults. More recently its use has become more common in children, but cut-off levels must be adjusted for age (World Health Organization, 2014). Body mass index (BMI) has been commonly used in epidemiological studies to predict morbidity and mortality related to obesity among adults. BMI provides the most expedient method in population and is gender independent and applicable to all ages of adults.

Maternal obesity: Maternal obesity refers to those pregnant women whose pre-pregnancy body weight, or in some instances whose weight gain during pregnancy, results in BMI within the obese ranged 30 - >30 - 40 kg/m^2 (Carryer 2001).

Exclusive breastfeeding: Exclusive breastfeeding is the process of giving or an act of giving an infant only breast milk from his or her mother or a wet nurse, or expressed breast milk and no other liquids or solids, not even water, with the exception of oral rehydration solution, drops or syrups consisting of vitamins, minerals supplements or medicines [6].

Classification of Body Mass Index (BMI)

Adult body mass index (BMI) classification (WHO 2010).

BMI range	Categories of weight problem
<18.5	Underweight range
18.5 - 24.9	Normal range
25.0 - 29.9	Overweight range
30.0 - >30	Obese range
30 - 34.9	Class 1 obesity
35 - 39.9	Class 2 obesity
≥40	Class 3 obesity

Table

Health implication of Obesity

Obesity aggravate a number of health problems either by independently or in relationship with other diseases.

1. Type 2 diabetes: Obesity is a risk factor for type 2 diabetes mellitus. About 90% of type 2 diabetics have a body mass index (BMI) of >23 kg/ M^2 (Hamid 2016).
2. Hypertension: There are higher risks of hypertension in obese individuals, 66% of hypertension is linked to excess weight gained while about 85% of hypertension is associated with a BMI > 25 kg/M^2.
3. Coronary artery disease (CAD) and stroke: Obesity increases the risk of coronary artery disease.

4. Dyslipidaemia progressively develops as BMI increases from 21 kg m^2 with rise in small particle low-density lipoprotein, 70% of obese women with hypertension have left ventricular hypertrophy. Obesity is a contributing factor to cardiac failure in >10% of patients.
5. Overweight/obesity plus hypertension is associated with increased risk of ischaemic stroke.
6. Cancers: Ten percent (10%) of all cancer deaths among non-smokers are related to obesity (30% of endometrial cancers).
7. Reproductive function: About 6% of primary infertility in women is attributable to obesity. Impotency and infertility are frequently associated with obesity in men (Kopelman 2007; Hamid 2016).

Maternal obesity

Maternal obesity is emerging as a public health problem, recently highlighted together with maternal under-nutrition as a 'double burden', especially in African countries undergoing social and economic transition. Pregnancy is a recognized trigger in obesity [7]. Maternal obesity refers to those pregnant women whose pre-pregnancy body weight, or in some instances whose weight gained during pregnancy, results in BMI within the obese ranged 30 - >30 - 40 kg/m^2 (Carryer 2001).

Maternal obesity incidence is increasing worldwide and associated with short and long term complications for mothers and children during pregnancy, delivery and post-delivery [8].

Many developing countries now experience a double burden of malnutrition with increased maternal overweight and obesity [9]. In Africa, the obesity increase in women has been steeper than in Asia with more than 40% reproductive aged women being overweight or obese [10].

Maternal obesity is assessed differently worldwide, but pre-pregnancy or first trimester body mass index (BMI) is widely recommended. The pre- pregnancy weight should be within the normal range (18.5 - 24.9 kg/M^2) of BMI classification. This is because it is more readily available from medical records than BMI at delivery and is highly associated with maternal obesity at the time when breastfeeding begins. The recommended weight gain in pregnancy that accounts for physiological changes has been calculated at around 9.1kg with an additional gain representing an ''energy reserve for the mother''. Recent reviews put pregnancy weight gain as 13 - 15 kg (Quinlivan., *et al.* 2011). This study suggests that it is pre - pregnancy obesity combined with excess weight gain during pregnancy itself that accumulates in the complication associated with maternal obesity. Other measures include weight and mid-arm circumference (Okereke, oAnyaehie and Dim., *et al.* 2014).

Determinants of maternal obesity

The determinants of maternal obesity are:

1. **Life style behavior**: The fundamental cause of obesity is an energy imbalance between calories consumed on one hand and calories expended on the other hand.

   Energy balance is when intake equals output for example when a person consume 3000 kcal and spends 3000kcal, long term maintenance of this balance contribute to good health and wellbeing. Energy balance can either be positive or negative

   a. Positive energy balance: this is when intake exceeds output, with the resultant storage of excess energy. For example, if one consumes up to 4000kcal and spends only 2000kcal.
   b. Negative energy balance: this results from energy deficit that is energy intake being less than output. For example, if a person consumes if a person consumes 2000 kcal and spends 300 0kcal (Okeke, Onyechi and Ibeanu 2011).

Lifestyle behaviours include:

- Hyperphagia (overeating)
- Poor food choice and food habit
- Inadequate physical exercise.

Studies by Alexander and Liston (2006); Shaikh, Robinson and Teoh (2010) emphasizes the role of fast food, supermarkets and the sedentary lifestyle created by television and cars as the main causal factors for increasing 'maternal obesity'. Shaikh, Robinson and Teoh (2010) was of the opinion that excess gestational weight is more likely to be associated with consumption of unhealthy foods and reduced time spent in physical exercise.

2. **Lack of understanding or motivation**: Studies by Furness., *et al*. (2011) shows that some women failed to understand the gravity of the 'obesity' related risks and to 'view it as a medical problem and lacked the information, motivation and skills to maintain a 'healthy lifestyle.
3. **Maternal age and parity**: Maternal obesity increases with maternal age and parity, some women now give birth at the age of 35 - 40 years. This means that 'women therefore enter the maternity care system when they are older and more likely to be obese. The number of rapid pregnancies can also increase maternal obesity; This is because one may not actually shed the weight gained in the last pregnancy before conceiving again [1]. Studies by Callaway., *et al.* (2006), Kerrigan and Kingdon (2010) observed that BMI and the incidence of maternal obesity have shown to gradually increase with increased parity and maternal age.

Maternal obesity and adverse outcomes

Maternal obesity is associated with a very broad range of adverse outcomes, perinatally and in the long-term health of mother and baby. These include a range of complications in obstetric and anesthetic care, which in turn are reported to result in increased maternal and child mortality and morbidity (Denison and Chiswick 2011). The adverse outcomes associated with 'maternal obesity' are considered to increase with the degree of obesity and to persist after accounting for other confounding demographic and health factors. The mechanism for the association between maternal obesity and adverse outcomes is due to the altered metabolic state associated with obesity. The accumulation of risk and harms considered to be associated with maternal obesity has led to the classification of obese pregnant mothers as high risk and requiring high risk management (Denison and Chiswick 2011).

Fertility: Obesity decreases the chance of spontaneous pregnancy regardless of menstrual cycle characteristics and presence of ovulation [1]. This is associated with the increased incidence of polycystic ovarian syndrome [1]. According to Jarvie and Ramsay (2010) up to 50 percent of obese women have polycystic ovarian syndrome compared with 30 percent of their 'lean counterparts'. Polycystic ovarian syndrome (PCOS) is a heterogeneous collection of signs and symptoms that, gathered together, form a spectrum of a disorder with mild presentation in some and in others a sever disturbance of reproductive endocrine and metabolic function (Balen 2004). It is associated with the absence of menstrual cycle, infertility and miscarriage.

Miscarriage: Maternal obesity is a risk factor for spontaneous abortion both for spontaneous conception and assisted conception. This can be attributed to increased risks of hypertensive disorders (preeclampsia, proteinuria, hypertension) and gestational diabetes. This risk increases linearly as BMI increases. For increase in BMI 5 - 7 kg/M^2, there is a corresponding 2-fold increase in the risk of developing preeclampsia (O'Brien, Ray and Chan 2003 in Leddy, Power and Schulkin 2008).

Obstetrics outcome: Obesity during pregnancy has been connected to many complications during and after pregnancy. Mothers who are obese are at increased risk for a number of complications during pregnancy (Iyoke, Ugwu, Ezugwu, Lawani and Onyebuchi 2013). And increased rate of both emergency and elective caesarean (Chu., *et al*. 2007; Minsart., *et al*. 2014). Following labour and delivery, they were also more likely to experience complications including postpartum haemorrhage (Blomberg 2011), blood clots, wound infection and antepartum venous thromboembolism (Robinson, O'Connell, Joseph and McLeod 2005; Sebire., *et al*. 2001), hence, these require longer duration of hospitalization (Heslehurst., *et al*. 2008).

Maternal obesity: Maternal obesity is also linked to a number of adverse health outcomes for the neonates (new born) as well (Iyoke., *et al.* 2013; Ruager-Martin, Hyde and Modi 2010; Scott-Pillai., *et al*. 2013).

Complications of maternal obesity in infant

The complications of maternal obesity in infants include;

a. Stillbirth: this is defined as fetal death at or after 20 to 28 weeks of pregnancy (WHO 2016). It results in a baby born without signs of life.

b. Neonatal mortality refers to a death of a live born baby within the first seven days of life (early neonatal mortality). Late neonatal mortality covers the time after 7 days until before 28 days. The sum of these two represents the neonatal mortality.

c. Macrosomia (large for gestational age) is defined as a weight, length or head circumference that lies above the 90th (Xu, Simonet and Luo, 2014).

d. Preterm delivery and congenital anomalies particularly in heart and central nervous system (Hamid 2016).

Breast Feeding

Figure 1

Breastfeeding refers to the act of feeding infants with breast milk, either direct from the breast or expressed. It is the normal way of providing young infants with the nutrients they need for healthy growth and development as well as for the prevention of childhood illnesses. It is also beneficial for pre-term babies as it is suitable for their immature digestive system and reduces morbidity (e.g. necrotising enterocolitis) and mortality. It contains higher quality protein and immunological components examples living cells, vitamins and minerals (Ballard and Morrow 2013).

Breast milk composition

Breast milk contains all the nutrients that an infant need in the first six (6) months of life, including fat, carbohydrates, proteins, vitamins, minerals and water (WHO 2009). It is easily digested and efficiently used. Breast milk also contains bioactive factors that augment the infant's immature immune system, providing protection against infection and other factors that help digestion and absorption of nutrients.

Fats

Breast milk contains about 3.5 g of fat per 100 ml of milk, which provides about one half of the energy content of the milk. The fat is secreted in small droplets and the amount increases as the feeding progresses. As a result, the hindmilk secreted towards the end of a feed

is richer in fat and looks creamy white, while the foremilk at the beginning of a feed contains less fat and looks somewhat bluish-grey in colour. Breast milk fat contains long chain polyunsaturated fatty acids (docosahexaenoic acid or DHA and arachidonic acid or ARA) that are not available in other milks. These fatty acids are essential for growth and neurological development of a child. DHA and ARA are added to some varieties of infant formula, but this does not confer any advantage over breast milk and may not be as effective as those in breast milk (WHO 2009).

Carbohydrates

The main carbohydrate is the special milk sugar lactose, a disaccharide. Breast milk contains about 7g lactose per 100 ml, which is more than in most other milks and is another important source of energy. Other types of carbohydrate present in breast milk is oligosaccharides, or sugar chains, which provide important protection against infection [11].

Protein

Breast milk protein differs in both quantity and quality from animal milks and it contains a balance of amino acids which makes it much more suitable for a baby. The concentration of protein in breast milk 0.9 g per 100 ml is lower than in animal milks. The much higher protein in animal milks can overload the infant's immature kidneys with waste nitrogen products. The proteins in milk are composed of two protein fractions:

a. Whey proteins
b. Casein proteins.

Breast milk protein is whey protein predominant, the average whey/casein ratio in breast milk is 60:40, which means that whey proteins represent 60% of the total protein and casein only 40%. The major whey proteins in human milk are lactalbumin, lactoferrin and immunoglobulins IgA. Cow's milk protein is casein-predominant: the average whey/casein ratio in cow's milk is 20:80, which means that whey proteins represent only 20% of the total protein and casein 80%. The whey/casein (60:40) ratio is important for digestibility and determines the essential amino acid pattern [11].

Vitamins and minerals

Breast milk normally contains sufficient vitamins for an infant, unless the mother herself is deficient, exception is vitamin D [12]. The infant needs exposure to sunlight to generate endogenous vitamin D, if this is not possible, a supplement required. The minerals iron and zinc are present in relatively low concentration, but their bioavailability and absorption is high. Provided that maternal iron status is adequate, term infants are born with a stored iron to supply their needs; only infants born with low birth weight may need supplements before six (6) months. Delaying clamping of the cord until pulsations have stopped (approximately 3 minutes) has been shown to improve infants' iron status during the first six (6) months of life [13].

Anti-infective factors

Breast milk contains many factors that help to protect an infant against infection [14] including:

- Immunoglobulin, principally secretory immunoglobulin A (IgA), which coats the intestinal mucosa and prevents bacteria from entering the cells;
- White blood cells (leucocyte) which can kill micro-organisms;
- Whey proteins (lysozyme and lactoferrin) which can kill bacteria, viruses and fungi;
- Oligosaccharides which prevent bacteria from attaching to mucosal surfaces.

The protection provided by these factors is uniquely valuable for an infant. First, they protect without causing the effects of inflammation, such as fever, which can be dangerous for a young infant. Secondly, IgA contains antibodies formed in the mother's body against the

bacteria in her gut and against infections that she has encountered, so they protect against bacteria that are particularly likely to be in the baby's environment.

Other bioactive factors

- **Bile-salt stimulated lipase:** Bile-salt stimulated lipase it facilitates the complete digestion of fat once the milk has reached the small intestine. Fat in artificial milks is less completely digested.
- **Epidermal growth factor:** Epidermal growth factor it stimulates maturation of the lining of the infant's intestine, so that it is better able to digest and absorb nutrients and is less easily infected or sensitised to foreign proteins. It has been suggested that other growth factors present in human milk target the development and maturation of nerves and retina [15].

Colostrum and mature milk

Colostrum is the special milk that is secreted in the first 2-3 days after delivery. It is produced in small amounts, about 40 - 50 ml on the first day (WHO, 2009), but is all that an infant normally needs at this time. Colostrum is rich in white cells and antibodies, especially sIgA and it contains a larger percentage of protein, minerals and fat-soluble vitamins (A, E and K) than later milk [16]. Vitamin A is important for protection of the eye and for the integrity of epithelial surfaces and often makes the colostrum yellowish in colour.

Colostrum provides important immune protection to an infant when he or she is first exposed to the micro-organisms in the environment and epidermal growth factor helps to prepare the lining of the gut to receive the nutrients in milk. Mineral content of colostrum is relatively high and concentrations of sodium, potassium and chloride are greater in colostrum than in mature breast milk. These increased concentrations correspond to the particular requirements of the newborn due to the immaturity of its renal function with, as a consequence, inadequate reabsorption and passage of these minerals into the urine during the first days of life. It is important that infants receive colostrum and no other feeds, at this time. Other feeds given before breastfeeding is established are called prelacteal feeds.

Milk starts to be produced in larger amounts between 2 and 4 days after delivery, making the breasts feel full; the milk is then said to have "come in". On the third day, an infant is normally taking about 300 - 400 ml per 24 hours and on the fifth day 500 - 800 ml [15]. From day 7 to 14, the milk is called transitional and after 2 weeks it is called mature milk.

Benefits of breast milk

- Breast milk contains all the nutrients an infant need in the first six months of life.
- Easily digested and efficiently used
- Breast milk protects against diarrhea and common childhood illness such as pneumonia.
- Prolonged breast feeding improves cognitive development among children and adolescents.
- Helps bonding and development
- Costs less than formula
- Helps delay a new pregnancy
- Protects mother's health

Hormonal control of milk production

There are two hormones that directly affect breastfeeding**:** prolactin and oxytocin. A number of other hormones, such as oestrogen, are involved indirectly in lactation [16]. When a baby suckles at the breast, sensory impulses pass from the nipple to the brain. In response, the anterior lobe of the pituitary gland secretes prolactin and the posterior lobe secretes oxytocin.

Prolactin

Prolactin is necessary for the secretion of milk by the cells of the alveoli. The level of prolactin in the blood increases markedly during pregnancy and stimulates the growth and development of the mammary tissue, in preparation for the production of milk [17]. However, milk is not secreted then, because progesterone and oestrogen, the hormones of pregnancy, block this action of prolactin. After delivery, levels of progesterone and oestrogen fall rapidly, prolactin is no longer blocked and milk secretion begins.

When a baby suckles, the level of prolactin in the blood increases and stimulates production of milk by the alveoli (Figure 2). The prolactin level is highest about 30 minutes after the beginning of the feed, so its most important effect is to make milk for the next feed. During the first few weeks, the more a baby suckles and stimulates the nipple, the more prolactin is produced and the more milk is produced. This effect is particularly important at the time when lactation is becoming established. Although prolactin is still necessary for milk production, after a few weeks there is not a close relationship between the amount of prolactin and the amount of milk produced. However, if the mother stops breastfeeding, milk secretion may stop too - then the milk will dry up.

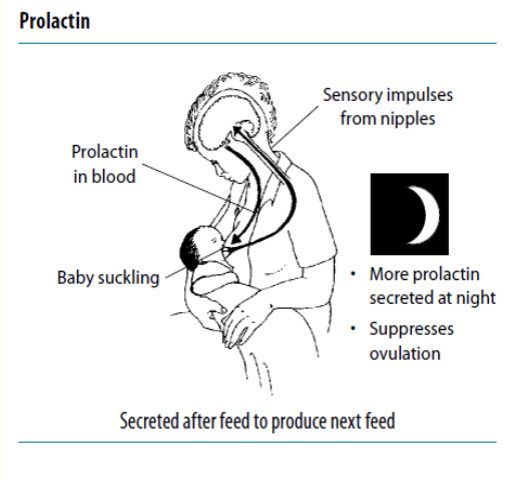

Figure 2

More prolactin is produced at night, so breastfeeding at night is especially helpful for keeping up the milk supply. Prolactin seems to make a mother feel relaxed and sleepy, so she usually rests well even if she breastfeeds at night.

Suckling affects the release of other pituitary hormones, including gonadotrophin releasing hormone (GnRH), follicle stimulating hormone (FSH) and luteinizing hormone (LH), which results in suppression of ovulation and menstruation. Therefore, frequent breastfeeding can help to delay a new pregnancy. Breastfeeding at night is important to ensure this effect.

Oxytocin

Oxytocin makes the myoepithelial cells around the alveoli contract. This makes the milk, which has collected in the alveoli, flow along and fill the ducts [18] (Figure 3). Sometimes the milk is ejected in fine streams.

The oxytocin reflex is also sometimes called the “letdown reflex” or the “milk ejection reflex”. Oxytocin is produced more quickly than prolactin. It makes the milk that is already in the breast flow for the current feed and helps the baby to get the milk easily.

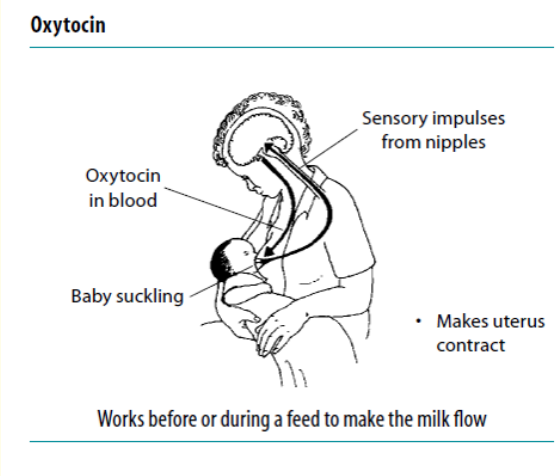

Figure 3

Oxytocin starts working when a mother expects a feed as well as when the baby is suckling. The reflex becomes conditioned to the mother's sensations and feelings, such as touching, smelling or seeing her baby, or hearing her baby cry, or thinking lovingly about him or her. If a mother is in severe pain or emotionally upset, the oxytocin reflex may become inhibited and her milk may suddenly stop flowing well. If she receives support, is helped to feel comfortable and lets the baby continue to breastfeed, the milk will flow again.

It is important to understand the oxytocin reflex, because it explains why the mother and baby should be kept together and why they should have skin-to skin contact.

Oxytocin makes a mother's uterus contract after delivery and helps to reduce bleeding. The contractions can cause severe uterine pain when a baby suckles during the first few days.

Signs of an active oxytocin reflex

Mothers may notice signs that show that the oxytocin reflex is active:

- a tingling sensation in the breast before or during a feed;
- milk flowing from her breasts when she thinks of the baby or hears him crying;
- milk flowing from the other breast when the baby is suckling;
- milk flowing from the breast in streams if suckling is interrupted;
- slow deep sucks and swallowing by the baby, which show that milk is flowing into his mouth;
- uterine pain or a flow of blood from the uterus;
- thirst during a feed.

If one or more of these signs are present, the reflex is working. However, if they are not present, it does not mean that the reflex is not active. The signs may not be obvious and the mother may not be aware of them.

Psychological effects of oxytocin

Oxytocin also has important psychological effects and is known to affect mothering behaviour in animals. In humans, oxytocin induces a state of calm and reduces stress. It may enhance feelings of affection between mother and child and promote bonding. Pleasant forms of touch stimulate the secretion of oxytocin and also prolactin and skin-to-skin contact between mother and baby after delivery helps both breastfeeding and emotional bonding [19].

Trends in exclusive breast feeding in Nigeria

Despite the benefits of breastfeeding that were well documented, the rate of breastfeeding in many countries is still far behind from WHO recommendations to exclusively breastfeed babies for the first six months of life and continue until age of 24 months or more (World Health Organization 2007).

Evidence from recent studies indicates that breastfeeding is critical to the survival of newborns and infants [20]. An estimated 13% reduction in infant mortality rate can be achieved through the practice of exclusive breastfeeding [21]. Initiating breastfeeding within the first hour of delivery could reduce the rate of neonatal mortality by up to 22%. The many benefits of breastfeeding notwithstanding, the rate of exclusive breastfeeding are only 39% in developing countries [22].

In Nigeria, almost all children are breastfed [23]. However, the rate of exclusive breast feeding is low and declining from 28% in 1999 to 17% in 2013. The rate of breastfeeding initiation within the first hour of delivery is equally low (38%) [24]. These low rates of breastfeeding practice possibly contribute to high burden of neonatal and infant mortality in the country.

Maternal obesity and exclusive breastfeeding

Obesity reduces breastfeeding success and lactation performance in women [25]. In recent years, many studies have found maternal obesity also has a significant independent effect on breastfeeding outcomes, which include breastfeeding:

a. Intention,
b. Initiation and
c. Duration

Intention to Breastfeed

Intention is an immediate precursor of behaviour and is defined as the perception of an individual towards performance of a particular behaviour (Ajzen and Fishbein 1980; Hamid 2016). breastfeeding intention is defined as the degree of confidence about practising optimal breastfeeding behaviour. Intention to breastfeed is closely related to early initiation to breastfeed and could also be a predictor of longer duration of breastfeeding (Tarrant., *et al*. 2010).

Initiation of breast feeding.

According to World Health Organization, early initiation of breastfeeding is defined as infants who were put to the breast within one hour of birth (WHO 2008). Meanwhile, late initiation indicated breastfeeding that began after the first day of life. Delayed timing of breastfeeding initiation is related to the increasing risk of neonatal mortality (Edmond., *et al.* 2006). Time of initiation of breastfeeding also will have a significant influence to the duration of breastfeeding. Research have shown that mothers who delayed initiation of breastfeeding and had breastfeeding difficulties were more likely to discontinue 'exclusive breastfeeding' (Tengku Alina, Wan Abdul Manan and Mohd Isa 2013).

Duration of breastfeeding and maternal obesity

Breastfeeding duration is the length of time for 'any breastfeeding' since initiation of breastfeeding to the introduction of solid/semi solid food together with breastfeeding until the child is weaned off from breastfeeding.

Overweight and obese women had less intention to breastfeed and were less likely to initiate breastfeeding. They also tended to breastfeed for shorter period, had inadequate milk supply and delayed onset of lactogenesis II [26].

Meta-analysis on maternal obesity and exclusive breastfeeding

This is the compilation of some studies carried out o maternal obesity and exclusive breastfeeding.

The inclusion criteria were studies that based their evaluation of maternal obesity on the World Health Organization (WHO 2010) definition of obesity: normal weight BMI<25, overweight BMI 25 ≤ 30, obese BMI > 30, or the US Institute of Medicine [27] definition: underweight/normal weight BMI < 26.1, overweight BMI 26.1 - 29.0, obese BMI > 29.0.

The exclusion criteria were studies that have the relationship between breastfeeding and childhood obesity. Papers that were case studies, clinical papers or reviews were not included.

The papers were grouped according to the content of the study and presented in tables.

Medical Factors

Obstetric complications that are common among mothers with higher BMI were gestational diabetes mellitus, pregnancy-induced hypertension, presence of polycystic ovary syndrome, prolonged gestation and had an induction ending in caesarean section [29,30]. Some women with PCOS have insufficient milk supply, which is thought to be related to the endocrinological changes associated with the syndrome (high levels of androgens, insulin resistance, frequently low progesterone levels) [31].

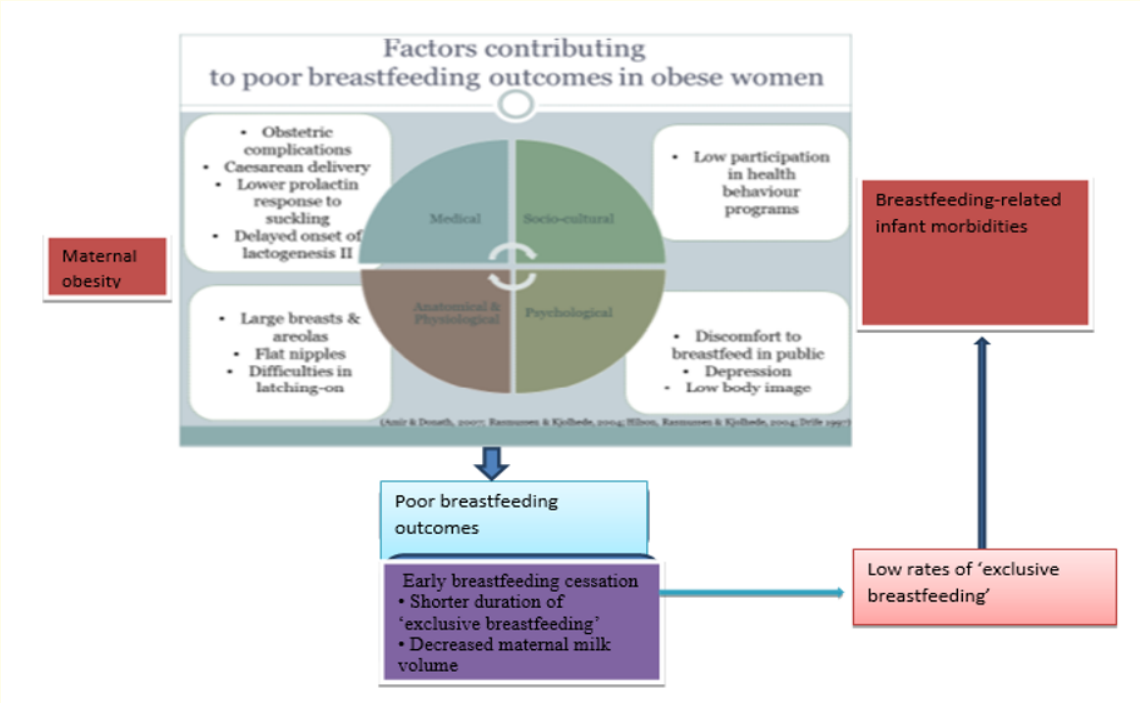

Figure 4

Authors, years of publication, country and years of study	Participants	Definition of obesity	Results
Hilson., *et al*. 1997 Cooperstown, NY, USA, 1992 - 1994	Medical record review eligibility: intended to breastfeed = breastfeeding at birth, healthy Singleton infants n=1109	IOM definition of obesity BMI calculated from pre- pregnancy weight and height	Quit breastfeeding by hospital discharge 2 days after birth: Normal 4.3% Overweight 8.9% Obese 12.2% Not breastfeeding at discharge/ of women who attempted to breast feed at birth Overweight 2.54 Obese 3.65
Hilson., *et al*. 2006 Cooperstown NY, USA 1988 - 1997	Expanded previous review of medical records Bassett Hospital, Cooperstown, NY intended to breastfeed, Singleton infant. No contraindication to breastfeeding, No diabetes N=2783	BMI calculated from pre - pregnancy weight and height IOM definition of obesity exclusive breastfeeding (EBF) = last time mother feed only breast milk, without adding non - human milk, juice, solids	Median duration of EBF (wks) Underweight 1.7 Normal 2.0 Overweight 1.7 Obese 1.1 P< 0.05
Li., *et al*. 2002 USA 1988- 1994 Exclusive breastfeeding phase 11, 1991 - 1994	The third National Health and Nutrition survey (NHANES 11) n=7712	BMI calculated from self-reported ht and wtat time of interview WHO definition of obsity	Exclusive breastfeeding at 2 months. Normal 35.4% Overweight 28.2 % Obese 25.9% Breastfeeding at 6 months Normal 25.0% Overweight 17.3% Obese 16.9% Breastfeeding at 12months Normal 10% Overweight 5.7% Obese 5.6%
Oddy., *et al*. 2006 Australia 1989 - 1991	Western Australian pregnancy Cohort study. Antenatal Cohort, King Edward Memorial Hospital, Perth WA n=1803	BMI calculated from pre- pregnancy weight and height (measured by research Midwives) WHO definition of obesity	Breastfeeding <2 months Normal weight 24. 0% Overweight 33.6% Obese women 41.6% P<0.0005 Breastfeeding <4 months Normal weight 37.9% Overweight 50.2% Obese women 57.5% P < 0.0005 Breastfeeding < 6 months Normal weight 49.0% Obese women 62.8%

Table 1: *Studies on maternal obesity and initiation of breastfeeding.*

Authors, year of publication, country and year of study	participants	Definition of obesity	Results
Chapman and Perez - Escamilla 1999 USA 1996 -1997 [28]	Hartford Hospital, Connecticut Healthy, Single, term infant n = 192	Women's bodies were classified as silm, average heavy or obese	Delayed lactogenesis (> 72hours) Silm/ average build 26.4% Heavy obese build 52.2%
Dewey., *et al*. 2003 USA 1999	Davis, California Healthy single, term infants planning to breastfeed > 1 month n=280	BMI measured 2 weeks postpartum BMI > 27.0 taken as overweight/ obese	Delayed lactogenesis (>72 hours) Normal 16% Overweight/obese 33%
Hilson., *et al*. 2004 USA 1998	Bassett Hospital, Cooperstown, NY, intended to BF, singleton infant n=114	BMI calculated from pre-pregnancy weight and height IOM definition of obesity	Delayed lactogenesis (72hours) Normal 18. 5% Overweight 30.8% Obese33.3%
Rasmussen., *et al*. 2004 USA year of study not stated [29]	Bassett Healthcare, Cooperstown NY n=40	Pre- pregnancy BMI from medical records IM definition of obesity	Duration of feed at 7 days postpartum: Overweight/ obese women: infants feed for longer 23.2 (5.6) mins compared to 15.3 (sd 6.1) mins for normal weight women P < 0.005 Prolactin response to suckling (ng/ml) 48 hours Normal women 26 .0 (sd 61.5) Overweight/ obese women 10.3 (sd 28.3) P<0.05 Prolactin response to suckling (ng/ml) 7 days Normal women 80.9 (sd 67.6) Overweight/ obese women 57.1 (sd 60.2)

Table 2: *Studies on maternal obesity and delayed onset of lactation.*
Factors that are associated with poor breastfeeding outcomes in obese mothers.

Kitsantas and Pawloski [32] found that obese women with medical problems or had obstetric complications were almost 1.4 times more likely to not to initiate breastfeeding and to cease breastfeeding earlier compared to non-obese women. There are many factors associated with reduced intention and initiation or early cessation of breastfeeding among obese mothers. One possibility is these women usually experienced delayed onset of lactogenesis II that resulted to cessation of breastfeeding.

Maternal obesity is associated with higher rate of caesarean deliveries (Cedergren 2004; Kumari 2001). In a study by Nissen, Uvnäs-Moberg, Svensson, Stock, Widström and Winberg (1996) they collected maternal blood samples from 37 mothers to investigate the difference in oxytocin, prolactin and cortisol levels between mothers delivered normally and by caesarean. They found that mothers who had

caesarean delivery has deficit rise of prolactin at 20 to 30 minutes after the onset of breastfeeding and mothers who had vaginal delivery had more oxytocin pulses. They concluded delivery method and the first time the infant breastfed play important role in influencing oxytocin level.

Anatomical and physiological

Anatomical factors that contribute to adverse breastfeeding outcomes [30]. Extensive studies have proved that maternal obesity is associated with breastfeeding difficulties and also associated with delayed onset of lactogenesis II. The possible explanation of the delay among obese women could be due to steroid hormone levels, latching difficulties by the infants to the bigger breasts and less ability to perceive breast fullness (Chapman and Pérez-Escamilla 1999; Hamid 2016). Large breast contributes to poor breastfeeding outcome due to, the heavy fat parts impeded the separation of the milk and its free passage through the narrow conduits to the nipples" [33]. Women with large breasts may have practical/mechanical difficulties with attaching the baby to the breast (Walker 2006). Some women with large breasts have broad areolae (rather than conical) with short nipples making it difficult to attach the baby. Lactation consultants have noticed that the weight of a large, heavy breast on the infant's chest can interfere with successful attachment [34].

Mastitis is a significant and common problem for lactating women, especially in primiparous breastfeeding mothers, often due to attachment difficulties. Nipple pain during feeding, blocked ducts and stress were significant predictors of mastitis. Development of mastitis commonly results in early cessation of breastfeeding (Hamid 2016).

Socio-cultural factors

Obese women were less likely to have intention to breastfeed and if they did, they intended to breastfeed for a shorter period compared to other women [26].

Obese women also were less likely to participate in any health screening for example pap smears and mammography. This may link to their own health beliefs or to feelings of embarrassment of exposing their body parts, thus they were less likely to want to breastfeed [35]. Furthermore, women who are obese are more likely belong to a social group that were less likely to breastfeed in public [36]. Difficulty to breastfeed discreetly while doing it in modesty were the main problems of women with larger breasts [30].

Psychological factors

Obese women were more likely to have negative body image perception compared to non-obese women [37]. Women with extra concern on their body shape and weight had less intention to breastfeed and shorter duration of breastfeeding [38].

Obesity has been associated with depression and is mediated by body image dissatisfaction [39]. Obese women were more likely to develop postpartum depression compared to normal weight women [40]. postpartum depression may in turn decrease the rate of breastfeeding [41].

Mechanism of action of how maternal obesity affect exclusive breastfeeding

Lactogenesis is defined as the onset of milk secretion, it can be divided into two phase. Lactogenesis I occurs during pregnancy when the gland becomes sufficiently differentiated to secrete small quantities of specific milk components such as casein and lactose. In addition, lactogenesis II is the onset of copious milk secretion stimulated by prolactin. This process usually begins approximately two (2) days after birth. Progesterone inhibits lactogenesis II; therefore, it is important for the placenta, which is the main source of prenatal progesterone to be expelled during the delivery [42]. However, progesterone hormones are also stored in the adipose tissues, leading to a higher progesterone level in obese women [29].

Meanwhile, prolactin and cortisol are the cofactors in the formulation and production of breastmilk. Overweight or obese women have also been associated with lower prolactin response to suckling, the reduced prolactin in the first two days after delivery predict the lower production of colostrum [29]. As a result, many obese women tend to give up on breastfeeding due to low milk supply [43,44].

Conclusion and Recommendation

Breastmilk is the best food for infant as it contains all the nutrient the infant needs for the first six (6) months of life. It confers numerous benefits on both the mother and her baby. World Health Organization recommends that an infant should be put to breast within an hour after delivery and exclusively breastfeed for the first six months of life and continue until age of 24 months or more. Exclusive breast feeding is rarely practiced due to certain factors that militate against its success such as maternal obesity. Maternal obesity reduces breastfeeding success and lactation performance in women, therefore overweight/obese women of child bearing age should be encouraged to lose weight before conception, as to reduce the level of progesterone in the adipose tissue and as well breastfeed successfully after delivery.

Bibliography

1. Parker C. "'Maternal obesity' research investigation Evaluation of some anthropometric indices for the diagnosis of obesity in pregnancy in Nigeria: a cross-sectional study". *African Health Sciences* 13.4 (2012): 1034-1040.
2. Racusin D., *et al*. "Obesity and the risk and detection of fetal malformations". *Seminars in Perinatology* 36.3 (2012): 213-221.
3. Fleming T., *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* 384.9945 (2014): 766 -781.
4. Ojochenemi J., *et al*. "Maternal obesity in Africa: a systematic review and meta-analysis". *Journal of Public Health* 38.3 (2016): e218-e231.
5. Kulie T., *et al*. "Obesity and women's health: an evidence-based review". *Journal of the American Board of Family Medicine* 24.1 (2011): 75-85.
6. WHO/UNICEF/USAID. "Indicators for assessing infant and young child feeding practices". World Health Organization, Geneva (2008).
7. Davis EM., *et al*. "Racial, ethnic, and socioeconomic differences in the incidence of obesity related to childbirth". *American Journal of Public Health* 99.2 (2009): 294-299.
8. Meehan S., *et al*. "Maternal obesity and infant mortality: a meta analysis". *Pediatrics* 133.5 (2014): 863-871.
9. Mendez MA., *et al*. "Overweight exceeds underweight among women in most developing countries". *The American Journal of Clinical Nutrition* 81.3 (2005): 714 -721.
10. Black RE., *et al*. "Maternal and child undernutrition and overweight in low-income and middle-income countries". *Lancet* 382.9890 (2013): 427-451.
11. Riordan J. "The biological specificity of breastmilk". In: Breastfeeding and human lactation. Boston, USA, Jones and Bartlett (2004).
12. Butte N., *et al*. "Nutrient adequacy of exclusive breastfeeding for the term infant during the first six months of life". *World Health Organization*, *Geneva* (2002).
13. Cernadas JMC., *et al*. "Effect of timing of cord clamping on neonatal venous hematocrit values and clinical outcome at term: a randomized, controlled trial: In reply". *Pediatrics* 117.4 (2006): e779-e786.
14. Hanson LA. "Immunobiology of human milk: how breastfeeding protects babies". Texas, USA, Pharmasoft Publishing (2004).
15. Innis SM. "Human milk: maternal dietary lipids and infant development". *The Proceedings of the Nutrition Society* 66.3 (2007): 397-404.

16. Lawrence RA and Lawrence RM. "Breastfeeding: a guide for the medical profession". 6th Edition. London, Mosby (2005).

17. Buonfiglio D C., *et al*. "Obesity impairs lactation performance in mice by inducing prolactin resistance". *Scientific Reports* 6 (2016): 22421.

18. Ramsay DT. "Ultrasound imaging of milk ejection in the breast of lactating women". *Pediatrics* 113.2 (2004): 361-367.

19. Moore ER., *et al*. "Early skin-to- skin contact for mothers and their healthy newborn infants". *Cochrane Database of Systematic Reviews* 18.3 (2007).

20. Gupta A., *et al*. "Infant malnutrition/Breastfeeding reference module in Biomedical sciences". Elsevier (2015).

21. Jone G., *et al*. "How many child deaths can we prevent this year?". *Lancet* 362.9377 (2003): 65-71.

22. Cai X., *et al*. "Global trends in exclusive breastfeeding, in Breast feeding". International Breastfeeding Journal 7.1 (2012): 2.

23. National Population Commission. "Nigeria 2013 demographic and health survey Abuja". National Population Commission (2014).

24. Adewuyi E O and Adefemi K. "Breastfeeding in Nigeria: a systematic review". *International Journal of Community Medicine and Public Health* 3.2 (2016): 385-396.

25. Buonfiglio D C., *et al*. "Obesity impairs lactation performance in mice by inducing prolactin resistance". *Scientific Reports* 6 (2013): 22421

26. Turcksin R., *et al*. "Maternal obesity and breastfeeding intention, initiation, intensity and duration: a systematic review". *Maternal and Child Nutrition* 10.2 (2014): 166-183.

27. Institute of Medicine: Nutrition during Pregnancy. Washington DC, National Academy Press (1990).

28. Chapman D J and Pérez-Escamilla R. "Identification of risk factors for delayed onset of lactation". *Journal of the American Dietetic Association* 99.4 (1999): 450-456.

29. Rasmussen., *et al*. "Prepregnant Overweight and Obesity Diminish the Prolactin Response to Suckling in the First Week Postpartum". *Pediatrics* 113.5 (2004): e465-471.

30. Amir L H and Donath S. "A systematic review of maternal obesity and breastfeeding intention, initiation and duration". *BMC Pregnancy and Childbirth* 7 (2007): 9.

31. Marasco L., *et al*. "Polycystic ovary syndrome: A connection to insufficient milk supply?". *Journal of Human Lactation* 16.2 (2000): 143-148.

32. Kitsantas P and Pawloski L R. "Maternal obesity, health status during pregnancy, and breastfeeding initiation and duration". *Journal of Maternal-Fetal and Neonatal Medicine* 23.2 (2010): 135-141.

33. Whitaker E D. "Blood and milk: medical and popular beliefs before the First World War". In Measuring Mamma's Milk: Fascism and the Medicalization of Maternity in Italy Ann Arbor, The University of Michigan Press (2000): 29-61.

34. Hoover K. "Latch-on difficulties: a clinical observation (Letter)". *Journal of Human Lactation* 16.1 (2000): 6.

35. Barnes J., *et al*. "Extreme attitudes to body shape, social and psychological factors and a reluctance to breastfeed". *Journal of the Royal Society of Medicine* 90.10 (1997): 551-559.

36. Mok E., *et al*. "Decreased full breastfeeding, altered practices, perceptions, and infant weight change of prepregnant obese women: a need for extra support". *Pediatrics* 121.5 (2008): e1319-1324.

37. Zanardo V., *et al*. "Body image and breastfeeding practices in obese mothers". *Eating and Weight Disorders* 19.1 (2014): 89-93.

38. Hauff L E., *et al*. "Associations of maternal obesity and psychosocial factors with breastfeeding intention, initiation, and duration". *American Journal of Clinical Nutrition* 99.3 (2014): 524-534.

39. Gavin A R., *et al*. "The association between obesity, depression, and educational attainment in women: The mediating role of body image dissatisfaction". *Journal of Psychosomatic Research* 69.6 (2010): 573-581.

40. Lacoursiere D Y., *et al*. "The association between prepregnancy obesity and screening positive for postpartum depression". *BJOG: An International Journal of Obstetrics and Gynaecology* 117.8 (2010): 1011-1018.

41. Hamdan A and Tamim H. "The Relationship between Postpartum Depression and Breastfeeding". *The International Journal of Psychiatry in Medicine* 43.3 (2012): 243-259.

42. Jevitt C., *et al*. "Lactation Complicated by Overweight and Obesity: Supporting the Mother and Newborn". *Journal of Midwifery and Women's Health* 52.6 (2007): 606-613.

43. Drife J. "Management of primary postpartum haemorrhage". *BJOG: An International Journal of Obstetrics and Gynaecology* 104.3 (1997): 275-277.

44. World Health Organization Expert Committee. "Physical status: the use and interpretation of anthropometry". *World Health Organ Technical Report Series* 854 (1995).

Volume 14 Issue 10 October 2019