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An extensive investigation into the bioactive component of breast milk, lactation, and clinical application of Galactagogues: A review

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ABSTRACT

Nowadays, people are becoming more and more conscious of the link between nutrition, diet, and health. This bond is established from birth. In addition to being thought of as the finest nutrition for a newborn to preserve its physical and nutritional well-being, breastfeeding is usually seen as the best choice for a baby during the early stages of life. The American College of Obstetricians and Gynecologists (ACOG) advises breastfeeding exclusively for six months, after which the mother and child may decide to continue nursing in addition to introducing supplemental meals for the remainder of the baby's first year or beyond. Since breast milk includes a variety of bioactive ingredients, including proteins, vitamins, nucleotides, oligosaccharides, immunoglobulin, and some minerals, it is often regarded as the major nutritional supply for babies. A crucial opportunity for intervention to improve breastfeeding success is when inadequate supply of breast milk is often identified as the primary reason for early breastfeeding cessation. When non-drug breastfeeding support approaches fail to improve a persistently poor milk production, mothers frequently turn to drugs called galactagogues for assistance. Galactagogues function by interfering with the complex hormonal balance that controls breastfeeding, specifically with regard to prolactin and oxytocin. The available data about the effectiveness and safety of pharmacological treatments for lactation insufficiency is assessed in this narrative review. The majority of research has focused on the use of domperidone, and studies have indicated that there are modest short-term improvements for breast milk production. While there is less evidence supporting metoclopramide safety and efficacy than there is for domperidone, metoclopramide functions similarly to domperidone, thus in the event that domperidone is ineffective, it may be a good alternative for therapy. Lack of information on alternative medicines, such as metformin, oxytocin, prolactin, and herbal remedies, renders their clinical usage unreasonable. The study points out important gaps in the data and makes recommendations for possible future research topics related to galactagogues' impact on nursing.

Keywords: Lactation, Breast milk, Metoclopramide, Galactagogues.

INTRODUCTION

The physiologically natural approach to nourishing newborns is through breastfeeding. Breast milk, sometimes referred to as mother's milk, is an exocrine gland-generated fluid that serves as a key source of sustenance for newborns. It is rich in nutrients such as carbohydrates (lactose and human milk oligosaccharides) as well as some minerals and vitamins [1]. For the first six months of an infant's life, the WHO recommends nursing exclusively to promote optimal growth and development. When it comes to nutritional assistance, infancy needs it the most than other life stages [2]. Optimal milk production is essential for feeding babies since it has a direct impact on the duration of time during which they grow and develop [3]. Perceived Insufficient Milk Supply (PIMS), or the idea that one isn't producing enough milk, is a major reason for moms quitting nursing [4]. Other nutritional and non-nutritional variables (endocrinology, health, and climate) can influence milk production and secretion. Not many ladies are unable to breastfeed their babies in sufficient quantities; such women can be supplemented with herbal galactagogues and medications or drugs prescribed by doctors such as Metoclopramide (Reglan), and Domperidone (Motilium) [5].

Physiology of lactation

During pregnancy, estrogen and progesterone inhibit milk secretion [6]. The commencement of milk production occurs between weeks 10 and 22, and the mother produces a small amount of milk, known as Colostrum, 48 hours after delivery. However, after a few days of postpartum, the milk supply becomes more plentiful, but if the baby is premature there may be a delay in lacto genesis. A multitude of hormones and neurotransmitters combine intricately to control the production of milk (Figure 1).

Regular nipple stimulation, which triggers the anterior pituitary glands production of prolactin and is impeded by dopamine from the brain, is necessary to sustain breastfeeding. Breast emptying that is successful—mostly because the baby is sucking—is seen as essential. Increased prolactin levels from nursing stimulate nerve endings. Furthermore, milk let-down is facilitated by oxytocin, which is secreted by the posterior pituitary gland in response to sucking [7]. When a mother is under distress, catecholamine are produced, which inhibit oxytocin. Breast milk contains a peptide that controls lactation. If this peptide is not expressed, milk production is stopped [8]. Prolactin and oxytocin are often the focus of pharmacological interventions meant to regulate the production of breast milk because of their important roles in regulating both milk production and release [9]. In conclusion, the hypothalamus regulates the anterior pituitary's synthesis of prolactin by the use of factors that either release or inhibit prolactin (PRF or PIF). The concentrations of these compounds are influenced by environmental variables like as stress, crying noises, and nursing infants. Due to its suppressive influence on prolactin synthesis, dopamine is the main agent preventing the production of prolactin. Positive external stimuli inhibit the production of dopamine, which raises prolactin levels. Prolactin production is also increased by drugs that inhibit dopamine, such as metoclopramide and domperidone. On the other hand, several hormones, including oxytocin, cortisols, and thyrotropin-releasing hormone, increase the synthesis of prolactin. Furthermore, hormones that directly or indirectly affect the mammary gland, such as growth hormone, prolactin, and insulin, affect the production of milk. A small amount of whey protein, known as the feedback inhibitor of lactation (FIL), is present in milk. The buildup of milk in the breast causes milk stasis and increases the levels of lactation feedback inhibitors, which have a detrimental effect on lactocytes' ability to produce milk by obstructing prolactin effect on them through negative feedback processes [10].

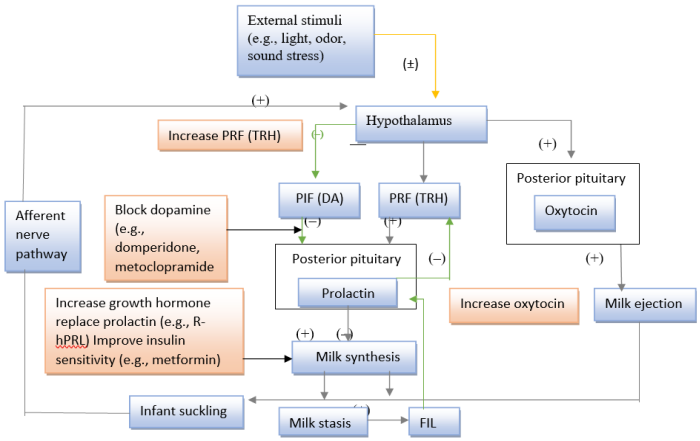

Figure 1: Lactation physiology and the mechanisms of action of various pharmaceutical galactagogues. Taken from [11,12]. Abbreviations: TRH, thyrotrophin-releasing hormone; R-hPRL, recombinant human prolactin; PIF, prolactin inhibitory factor; PRF, prolactin-releasing factor; DA, dopamine; FIL, feedback inhibitor of lactation

THE PHASES OF LACTATION

Phase 1: Colostrum

This is the first, thick milk that a pregnant woman's breasts release and shortly after birth. Because of its bright golden appearance and importance to the infant, clinicians may describe it as "liquid gold" [13]. Colostrum consists of more protein than mature breast milk and less carbs and fat. Significant amounts of secretory immunoglobulin A (IgA) found in Colostrum help protect the baby against infections and support the development of a thriving gut microbial population. It's important to remember that the baby's digestive system is completely germ-free at birth [14].

Phase 2: Transitional milk

Between two and five days following childbirth, transitional milk is generated when mature breast milk increasingly replaces Colostrum. This stage is distinguished by warmer, larger breasts and a progressive change in milk color to bluish-white. Breast milk changes at this time to meet the demands of the developing infant [14].

Phase 3: Mature milk

Secretion of mature milk starts about 10-15 days after gestation. The nutrients required for fetal growth and development are supplied at every stage of lactation, although the amount of fat in mature milk varies. Breast milk changes in content to suit the baby's growing needs. Relieving engorgement, making sure that milk is completely emptied, and feeding consistently are all important for maintaining milk supply [14].

BIOACTIVE COMPONENTS OF BREAST MILK

Lactoferrin

The second most abundant glycoprotein in human breast milk, lactoferrin, belongs to the transferring family. Its main function is to bind to iron in breast milk from mammals, protecting infants from anemia. It also acts as a preventative measure against respiratory and gastrointestinal illnesses. It was shown to be the second glycoprotein in human milk after being separated from cow's milk [15]. The highest amount of Lactoferrin has been found in human Colostrum (7 g/L). After two weeks, this quantity steadily decreases to 2-4 g/L during the mature milk phase [16]. Lactoferrin may bind Cu2+, Zn2+, and Mn2+ ions in addition to its excellent capacity for binding iron [17]. Depending on its saturation level with iron, Lactoferrin can be classified as either apo-Lactoferrin (lacking iron), mono-ferric form (carrying one ferric iron), or holo-Lactoferrin (able to bind two Fe3+ ions) [18].

Oligosaccharides

Milk from human oligosaccharides, or HMOs, is an additional adaptable component of human breast milk. HMO concentrations in Colostrum are greater (15–23 g/L) than in mature milk (8–2 g/L) [19]. Over a hundred oligosaccharides with various structures and functions can be found in breast milk [20]. The major factor in determining how HMOs function physiologically is that they are indigestible compounds. HMOs are resistant to low pH, digestive enzymes, and gastrointestinal disorders, which enables them to pass into the colon undamaged. When they are intact, they behave as fermentable materials that encourage the development and activity of healthy bacteria [21]. As a result, lactobacilli and bifidobacterium are more common in the feces of breastfed newborns and they have a lower risk of gastrointestinal disorders. The beneficial intestinal microbial balance that is largely due to HMOs is crucial for enhancing gut health [22].

Nucleotides

Another bioactive ingredient in human milk is nucleotides, which are nitrogenous compounds essential to several metabolic processes, including energy transfer, Breast milk contains nucleotides that infants that are fed enough protein use, namely ribonucleotides and ribonucleosides, which make up around 2–5% of the non-protein nitrogen. This use is necessary for the synthesis of proteins, lipids,

carbohydrates, and nucleic acids (DNA and RNA), among other physiological functions [23]. Many components of the nucleotides found in breast milk, including nucleosides, purines, and pyrimidine bases, as well as nucleic acids and some of their derivatives (such as uridine diphosphate galactose), are linked together [24].

Barriers to breastfeeding

Mothers may encounter obstacles that prevent them from completing their breastfeeding goals; few researchers suggest that only 25.4% of women are exclusively breastfeeding in the sixth month. There are many plausible causes why early weaning could occur. Persistent nipple soreness, perceptions of poor milk supply, and trouble getting the baby to latch are the most reported causes of undesired early weaning [25]. Lactation issues include mastitis, engorgement, pain or discomfort and medications while breastfeeding [26]. Continued discomfort during nursing due to vasospasm, stress from the pump, or nipple injury has to be addressed since it may increase the risk of postpartum depression [27].

Engorgement

The physiologic bilateral breast fullness is known as breast engorgement, which most frequently develops between days three and five following delivery. Typically, the secretion of mature milk is a reassuring sign.The severity and frequency of vascular and lymphatic compression carried on by milk-induced alveolar duct distention can alter. Multiple intravenous fluids administered during birth, genetic factors, a history of premenstrual breast pain, and previous breast surgery are all risk factors for severely symptomatic breast engorgement [28].

Mastitis

Mastitis is a persistent problem that comes with breastfeeding. It is more common among women who have previously dealt with problems including high milk production, nipple injury, difficulty latching, or inconsistent feeding patterns [29]. A breast abscess and sepsis are consequences that may be avoided with early diagnosis and treatment. Mastitis frequently begins with milk stagnation, making frequent and efficient milk removal an important step and can be the most crucial therapeutic strategy. A patient's production of milk may fall, However, as long as she persists in breastfeeding or properly expressing her breast milk, this decline usually shows signs of improvement as she initiates her recovery process [30].

Drugs and medication use during lactation

Some women choose not to breastfeed at all or stop nursing before their prescribed treatments are finished because they are concerned about taking drugs while lactating [31]. Healthcare practitioners frequently give women inaccurate advice regarding the use of medications and the necessity of discontinuing or ceasing breastfeeding [32]. It is imperative to abstain from the use of illegal narcotics such as cocaine and phencyclidine, and to counsel moms who are battling drug addiction not to breastfeed. Because there is not enough information on how marijuana affects milk and infant care, it should be avoided as it may be harmful. Breastfeeding mothers who are receiving stable medication-assisted therapy for opioid use disorders and who are not using illegal substances ought to be encouraged to do so [33].

Maternal stress and lactation

Stressful life situations that occur during pregnancy can have a negative impact on the outcomes of the mother and the unborn child, which could affect the decision to breastfeed. It's unclear, though, how much these occurrences impact how long breastfeeding lasts. Taking into account the importance of nursing for baby health, these kinds of stressful situations could lead to the cessation of exclusive breastfeeding [34]. Numerous studies indicate that women who have depressive symptoms in the early postpartum period may be more likely to experience adverse outcomes related to child feeding, such as a decreased likelihood of initiating breastfeeding and choosing to breastfeed exclusively [35]. The length of time mother’s breastfeed their children may be increased by concentrating on reducing maternal stress and the symptoms it causes in women before, during, and after pregnancy [36].

Risk factors for lactation inadequacy

Three factors are necessary to guarantee a plentiful supply of breast milk: adequate breast tissue, hormone balance, and regular, effective milk evacuation. Inadequate mammary tissue might result from breast surgeries such as reduction or mastectomy, underdeveloped breasts, or cyst excision. Hormone levels can be affected by a variety of maternal factors, including a placenta that remains, heavy bleeding after delivery, an underactive thyroid, elevated stress or anxiety, certain medications, low red blood cell count, diabetes, obesity, polycystic ovarian syndrome, smoking, or alcohol consumption [37]. Additionally, the frequency and techniques of expressing when not nursing the baby directly may have an impact on the consistency of milk extraction, as may the infant's incapacity to suckle milk from the breast during direct feeding due to problems such as low intraoral suction, an inadequate latch, or birth-related complications. Frequent dependence on formula, early introduction of solid meals, baby drowsiness, or health conditions such as low birth weight, congenital defects, and infections might all make breastfeeding challenging and result in milk loss. Due in large part to their newborns' extended hospital stays; mothers of preterm babies encounter several difficulties in starting and maintaining a sufficient breast milk production. The underdevelopment of the premature newborn's breast, the health problems of the mother, the preterm baby's difficulties with direct feeding, and the psychological stress of having a baby in the Neonatal Intensive Care Unit (NICU) are some of the reasons contributing to this challenge. According to a recent study, 82% of moms who gave birth early had delayed secretory activation, suggesting that these circumstances can interfere with the normal process of milk production [19]. While data about the long-term breastfeeding outcomes for this specific group were not gathered, other research on mothers of preterm infants has suggested that delayed secretory activation is associated with a greater risk of stopping nursing too soon [38].

Galactagogues

Galactagogues are compounds recognized for their ability to stimulate, sustain, and enhance the production of breast milk. They are distinct from essential nutrients required for lactation, and their deficiency can lead to a reduction in milk supply. These are the factors that lead to physiological alterations in the systems governing illnesses such as hypogalactia and non-infectious agalactia, which have lately raised concerns among nursing moms. These components include both artificial and natural substances that enable complex mechanisms involving the interplay of physical and physiological

systems. Prolactin (PRL) and other hormones that function as galactagogues, including oxytocin, estrogen, progesterone, insulin, cortisol, leptin, somatotropin, medroxyprogesterone, and thyrotropin-releasing hormone (TRH), are essential [38]. Most lactating mothers seek to increase the amount of breast milk sometimes by using prescription drugs or natural herbal foods known as galactagogues. The most commonly prescribed drugs by doctors for lactating women are domperidone, metoclopramide, metformin, chlorpromazine, thyrotropin-releasing hormone, and oxytocin. Other natural oral herbs known to boost the low milk supply are banana flower, fennel, fenugreek, ginger, moringa, Shatavari, garden cress seeds, sesame seeds, oats, almonds, jaggery and many other herbs used in various parts of the world. Antipsychotic drugs may increase the release of prolactin, which may increase the production of breast milk by blocking dopamine. But generally speaking, drugs that are known to affect gastrointestinal motility, such domperidone and metoclopramide, are classified as galactagogues. They function by preventing the anterior pituitary glands dopamine receptors from functioning, which encourages breastfeeding [39]. The safe duration of galactagogue therapy is contended and disputable.

Clinical application of galactagogues

There is not much data on how frequently pharmaceutical galactagogues are used. Domperide was universally chosen as the main pharmacological therapy for lactation insufficiency in a comprehensive review of clinical procedures in Australian neonatal units [40]. An analysis conducted recently on discussions on the use of galactagogues, with an Australian pregnancy and breastfeeding advising service, revealed that more than 90% of the talks were about domperidone. On the other hand, questions about the use of herbal galactagogues increased from 0% in 2001 to 23% by 2014. The patterns of domperidone throughout the last fifteen years were examined by three studies. Australian research at a single tertiary-level maternity hospital found that from 0.1% of all births in 2000 to 5% in 2010, more people were using domperidone [41]. A recent study that used data from England's Clinical Practice Research Datalink showed a notable increase in postpartum domperidone prescriptions. There was a 3.8-fold increase in the rate between 2002 and 2004 (0.56 per 100 persons) and 2011 and 2013 (2.1 per 100 individuals). Interestingly, overall utilization is still far lower than previously stated amounts. Domperidone usage was linked in clinical trials to an increased risk of maternal obesity, preterm birth, cesarean delivery, diabetes (including gestational diabetes), and first-time motherhood [42].

Domperidone

Domperidone functions as an antagonist of dopamine [43]. Although domperidone is available in other countries, the FDA has not approved its sale in the United States. Whether or whether a woman is nursing, domperidone raises the amount of prolactin in her blood [44]. It is occasionally used as a galactagogue to boost milk production [45]. Dopamine use may not provide noticeable benefits for mothers who frequently breastfeed and have received instruction on nursing techniques. When domperidone is used as a galactagogue in mothers of preterm neonates, there might be an abrupt rise in milk production, usually between 90 and 94 mL per day, according to many meta-analyses on the topic [46,47]. Other reviewers found that improving feeding methods appeared to be more beneficial and safer than using domperidone off-label [48]. There is no official recommended dose for domperidone to increase milk production. A regimen of 10 mg administered three times a day for a duration of four to ten days was used in several recognized investigations. Results from two small studies indicated that a three-daily dose of 20 mg did not provide a statistically significant increase in milk production when compared to the 10 mg regimen. Mothers who did not react to the larger dosages also did not respond to the lower dosage [49]. headache, nausea, dizziness, cramping in the stomach, diarrhea, and dry mouth, palpitations malaise, shortness of breath, gastrointestinal symptoms, breast engorgement, weight gain, and irritability have been documented as negative impacts and some common health effects of domperidone on maternal health [50,51]. Many of them developed at higher doses of 30 mg/dayand above [52,53]. The Committee for Pharmacovigilance Risk Assessment of the European Medicines Agency in 2013 recommended that the daily oral dose of domperidone be limited to 30 mg and also be employed for no more than one week. It is therefore critical that women who are being offered domperidone as a galactagogue first try non-be limited to 30 mg and also that domperidone be employed for no more than one week. It is therefore critical that women who are being offered domperidone as a galactagogue first try non-pharmacological alternatives.

Metoclopramide

Similar to domperidone, metoclopramide is a dopamine antagonist that is thought to work as a galactagogue through increased blood prolactin levels. It is a centrally-acting medication and can increase the production of milk by 66-100% within 2-5 days if ingested at 30-45 mg/day. There have been no reports of harmful effects on babies. Metoclopramide side effects include weariness, nausea, headaches, upset stomach, parched mouth, breast tenderness, dizziness, fidgety legs, abdominal pain, thinning hair, moodiness, and uneasiness in nursing moms when used for extended periods of time [54]. Postpartum depression is more likely to strike mothers who have recently given birth, and metoclopramide may also cause depression as a side effect. As such, it is best not to prescribe metoclopramide to women who have a history of severe depression and to restrict its use in all moms during this time of increased susceptibility [55].

Domperidone Compared to Metoclopramide

Although metoclopramide and domperidone are both dopamine antagonists that raise blood prolactin levels, they have different pharmacodynamic characteristics. Metoclopramide is the only medication that can effectively cross the blood-brain barrier, which is a notable distinction between them. There have been concerns raised by this difference about possible differences in the safety and efficacy of these two drugs. Particularly, two trials looked at the effects of metoclopramide and domperidone on female participants. Blanket et al. found that nine women using domperidone produced somewhat more breast milk per day (from 120 ± 81 mL/day to 239 ± 105 mL/day) than eleven women taking metoclopramide (from 100 ± 53 mL/day to 184 ± 100 mL/day) [56]. Nonetheless, no statistically significant difference was seen between the groups who received metoclopramide and domperidone. Ingram et al. observed a similar difference in the volume of breast milk produced by women using domperidone compared to those taking metoclopramide, with a volume of 31.0 mL/day (95%CI −5.67 to 67.6 mL/day) in their research including 65 women. Regarding adverse effects for mothers, Blank et al. reported that neurobehavioral symptoms such as sleepiness, restlessness, dizziness, or drowsiness were seen by two out of nine women who got domperidone and two out of eleven women who took metoclopramide. Compared to women using domperidone,

women receiving metoclopramide have a seven-fold increased risk of depression, according to observational studies. Furthermore, individuals are four to nineteen times more likely than those taking domperidone to experience symptoms such tremors, involuntary grimaces, and jerks, which are commonly associated with tardive dyskinesia [57].

Oxytocin

Although oxytocin has a critical role in regulating the flow of milk, nothing is known about its application in the management of established lactation insufficiency. Aiming to promote early milk production and avoid insufficiency, current research concentrate on women shortly after giving birth; however, they do not address the efficacy of oxytocin in this particular setting [58,59]. The trials' contradictory results raise doubts about their applicability in the treatment of lactation insufficiency. As of right now, little information exists to determine if oxytocin is a useful treatment for lactation insufficiency. However, data indicates that stress—acute or chronic—may block the release of oxytocin, which in turn may obstruct the transfer of milk and the mother-child relationship, The potential use of oxytocin to treat lactation insufficiency needs more investigation. This is particularly important for mothers of preterm infants, who frequently have elevated levels of anxiety and sadness.

Metformin

Because it is an insulin-sensitizing medication, metformin is frequently recommended to treat type 2-diabetes and is believed to have the potential to promote lactation. A randomized trial examining the effect of metformin on boosting the production of breast milk was conducted. Though the trial's outcomes were in line with predictions, there were issues with late participant enrolment, and only 20% of those who were given metformin continued to have enhanced milk production by Day 28. Not a single individual thought metformin was helpful [60]. Since metformin's data comes from small-scale pilot studies, it's unclear if it may be useful as a galactagogue.

Fenugreek (*Trigonella foenumgraecum*)

The FDA has approved fenugreek for use as a flavoring ingredient, and it is frequently used as a galactagogue—a technique to increase milk production. In humans, the galactagogue effect of fenugreek may be mostly psychological [61]. Nonetheless, research on animals indicates that fenugreek mostly acts via increasing the synthesis of oxytocin and insulin [62]. Research suggests that fenugreek may provide more benefits in the early postpartum days than in the latter, two-week period after labor [1]. The results may differ from studies when fenugreek was taken alone since some trials utilized combination products that contained fenugreek as a single component [15]. Fenugreek was the herb that Australian women polled reported using the most, with 56% of respondents saying they did. Furthermore, 98.2% of fenugreek users mentioned using it to increase the supply of breast milk. Fenugreek was used by 15% of lactation consultants in Switzerland and 99% in Canada to encourage breastfeeding. Scientific evidence supporting fenugreek's safety for nursing moms and their babies is scant. As a medical therapy, adults usually handle it well; nevertheless, they may have gastrointestinal side effects such as nausea, vomiting, diarrhea, and flatulence [63].

Shatavari (*Asparagus racemosus*)

There are over three hundred species of asparagus in the globe, with the most common being Asparagus officinalis, which originated in the Eastern Mediterranean. In Ayurvedic medicine, Asparagus racemosus, also known as Shatavari, is utilized for its hepatoprotective, immunomodulatory, and galactagogue qualities in its roots and foliage.

As of right now, no action plan has been suggested for using Shatavari as a galactagogue.. Uncertainty surrounds Shatavari's safety. When using asparagus, certain side effects have been documented, including runny nose, itchy conjunctivitis, contact dermatitis, tightness in the throat, and coughing [64]. In Ayurvedic scriptures, Shatavari is said to be safe when used during nursing for prolonged lengths of time [65].

Fennel (*Foeniculum vulgare*)

The volatile oil that is found in fennel seeds is primarily made up of anethole (secreted in breast milk), which is a phytoestrogen [66]. Fennel was shown to be a galactagogue that improved neonatal weight gain, fat concentration, and milk secretion in two short studies. Nonetheless, fennel supplementation did not appear to raise serum prolactin levels in nursing mothers [20]. Two babies became poisonous due to nursing moms' overindulgence in a particular herbal tea that contained fennel, anise, and other substances. This toxicity was in line with what anethole, which is present in fennel and anise, does. One lady who took goat's rue, fenugreek, and fennel to boost her milk supply developed diarrhea and an enlarged liver. In an Australian survey of nursing mothers, 157 women reported using fennel as a galactagogue. On a Likert scale, mothers ranked fennel between "slightly effective" and "moderately effective." Four percent of mothers who took fennel experienced side effects, the most prevalent of which were nausea and stomach pains.

Moringa (*Moringa oleifera*)

Essential nutrients such as vitamins, minerals, vital amino acids, and different glycosides are abundant in the foliage of the moringa tree. In Asia, it has been utilized as a galactagogue [67]. This plant is called malunggay in the Philippines, where it may help mothers of preterm babies produce more milk by increasing their prolactin and milk supply, according to a few modest studies done there. Moringa did not increase milk quality, according to many small, poorly conducted research [68]. Moringa oleifera leaves are widely consumed and used medicinally in Asia and Africa. Nursing moms who ate these leaves showed no negative consequences, according to a tiny study [69]. Moringa may induce blood clotting, therefore it should be used with caution if anyone is prone to blood clots [70]. There is no additional information available regarding moringa's safety for nursing babies.

CONCLUSION

Breast milk is a major source of nutrition for newborns. Breast milk contains a variety of bioactive ingredients, including proteins, vitamins, nucleotides, oligosaccharides, immunoglobulin, and some minerals, and it is often regarded as the major nutritional supply for babies. Lactation insufficiency is often identified as the primary reason for early breastfeeding cessation. However, when inadequate supply of breast milk is identified as the primary reason for early breastfeeding cessation, mothers often turn to drugs called galactagogues for assistance. Galactagogues function by interfering with the complex hormonal balance that controls breastfeeding, specifically with regard to prolactin and oxytocin. The available data

about the effectiveness and safety of pharmacological treatments for lactation insufficiency is assessed in this narrative review. The majority of research has focused on the use of domperidone, and studies have indicated that there are modest short-term improvements for breast milk production. Metoclopramide functions similarly to domperidone, thus in the event that domperidone is ineffective, it may be a good alternative for therapy.

Conflict of interest

The authors declared no conflict of interest.

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