

Review Article

Understand Lactation and Lactation Failure: Fight the curse of insufficient breast milk

Dr. Rita Hajela

Assistant Professor, Department of Pediatrics, Maharishi Markandeshwar Medical College and Hospital, Kumarhatti, Solan, PIN code 173229, Himachal Pradesh.

***Corresponding author**

Dr. Rita Hajela

Email: hajelarita@gmail.com

Abstract: In spite of medical, scientific and natural recommendation of breast feeding, along with its mass media propaganda, breast feeding failure is still a common occurrence. The usual story of inadequate breast milk production starts soon after birth with a hungry baby and concerned family. The resultant anxiety leads quickly to top feeding usually by bottle which further aggravates the gloomy picture and the ultimate result is complete or partial cessation of breast milk production or Lactation failure. Infections, diseases and malnutrition line up fast to paint an ugly picture of future. Lactation is influenced by a lot of factors and failure may result due to interplay of any one or more than one factors. Understanding the whole process of lactogenesis is a must for planning strategies of interference. It is basically a hormonal driven process but modification occurs with demand and supply and control shifts to autocrine mode. Production and let down although inter related, are two different things. Perceptions of inadequacy, emotional bonding psychological support and diet go a long way in successful breast feeding experience. Prevention of lactation failure and reversal of failure both are important. Different strategies have been advocated and they usually work synergistically, including physical methods of milk expression, baby positioning, establishing good latch on, understanding baby cues, avoiding nipple confusion etc. Traditional and medicinal Galactagogues and lactogenic diet all play a role and must be considered. Each mother and baby duet having trouble has to be individually assessed and management personalized for them. To achieve the millennium development goals it is a must that all concerned in infant care, understand it properly to solve the concerned issues.

Keywords: Breast feeding, Lactation failure, infant, breast pump, milk expression, Galactagogues, lactogenic diet, prolactin, oxytocin

Introduction:

Mothers suffer from a feeling of inadequacy, failure, incomplete motherhood and a sense of inferiority when they are not able to produce sufficient milk for their baby. Deprived of benefits of breast milk baby is also a loser. In spite of all advocacies and propaganda it is still a common encounter to meet someone who admits with a sadness that she has to top feed her baby as breast milk production has either stopped or is insufficient. The situation is just accepted with a questionable frown, not only by friends and family but also by health personnel. Either they do not know how to turn the tables or are not willing to extend help, give time and effort to change the situation. It is worthy to note here, that a mother can even breast feed an adopted child if she really wishes to do so, therefore not able to feed her biological baby is just an issue not properly managed [1]. Be assured there is a way. It is

actually a very rare situation when nothing works, usually seen with Primary lactation failure.

WHO and UNICEF recommend exclusive breast feeding for first six months of life, it gives baby the healthiest start in life and it is the simplest, smartest and most cost effective way of ensuring health and survival of children across the globe [2].

In spite of breast feeding being the utmost natural act with numerous benefits, the incidence of failure is as high as 5-15% in first month [3] and when the term exclusive is incorporated for 6 months it goes up to as high as 40%. [4] This is an alarming situation and we need to address it with our mind body and soul for the sake of helpless baby and as a tribute to heroic efforts of failing mothers. The biggest question remains why this natural process fails? Is all this a human error? Lactation is part of normal human physiology,

involving two human beings and like all other human physiology; it can fail for various reasons.

The most crucial period for success or failure of breast feeding are the first 10 days after delivery, which is also the most stressful period for mothers, they may develop engorgement of breasts, soreness of nipples, apprehensions and doubts about their breast milk adequacy. The ability to recognize delayed or failed lactogenesis, interventions required to meet the nutritional requirements of baby and preservation of full or partial breast feeding are essential components of newborn care.

The process of lactation appears to be very simple and natural but in reality it is very complex, and influenced by a large number of factors in mother's internal and external environment. Internal environment includes her physical and mental health, past experiences, hormonal balance along with her intentions of breast feeding, perception of body image, convictions regarding breast feeding and child rearing. Her external environment includes, husband's help and encouragement, job status, office and home structure and concerns of sustenance of job, support and child rearing practices in family and friends and most of all knowledge, aptitude and practice of all hospital staffs.

PHYSIOLOGY OF LACTOGENESIS AND HORMONAL INTERPLAY:

The five distinct stages through which human mammary gland passes are Embryogenesis, puberty, pregnancy, lactation and involution. Mammatogenesis is the pre-pregnancy stage of development of breast; lactogenesis begins after pregnancy and ends with involution of breast and cessation of milk production. Lactogenesis itself is a three-stage event [5].

Stage 1-Lactogenesis I, the stage of secretory differentiation

Stage 2-Lactogenesis II, the stage of secretory activation

Stage 3- Lactogenesis III, the stage of mature milk production

Lactogenesis I (Secretory Differentiation)

Full development and maturation of mammary epithelium takes place during pregnancy [6]. In the 1st trimester mammary epithelial cells proliferate, ductal sprouting and branching takes place, lobular formation occurs. Ducts proliferate to form fatty pad and ductal end buds form alveoli, mammary blood flow increases and new capillaries form around lobules. By mid-pregnancy mammary glands have developed extensively and become competent to secrete milk proteins but are kept inhibited by high levels of progesterone. Most milk products secreted during pregnancy find their way back in plasma from inter-alveolar spaces. Glands continue to develop until

parturition. During the last trimester secretory cells fill with fat droplets and alveoli are filled with colostrum, which is available for infant as soon as baby is born because colostrum is an antepartum secretion. As the pregnancy advances colostrum shows a gradually increasing presence of lactose, casein, alpha-lactalbumin and after delivery an increase in concentrations of immunoprotective proteins sIgA and lactoferrin also takes place.

Lactogenesis is a hormonally driven endocrinally controlled system. Main hormones responsible are estrogen, progesterone, placental lactogen and prolactin, supported by glucocorticoids like cortisol, insulin, thyroid, parathyroid and growth hormone. Human placental lactogen, prolactin, human chorionic gonadotrophin, a form of estrogen 17 beta estradiol, are required for mammary growth and epithelial proliferation during pregnancy. Glucocorticoids enhance formation of lobule, estrogen stimulates ductal sprouting. Prolactin secreted by anterior pituitary gland stimulates prolactin receptor sites located on alveolar cell surfaces for initiation of milk secretion. Prolactin levels rise throughout pregnancy but is prevented from exerting positive influence on milk secretion by elevated levels of progesterone. Prolactin-inhibiting factor is secreted from hypothalamus and it negatively controls prolactin effect. Progesterone increases during pregnancy and stimulates lobulo-alveolar growth while suppressing secretory activity; it also sensitizes mammary cells to the effect of insulin and growth factor which are also involved in copious milk production stage. Secretory cellular activity and milk production starts around 16 weeks prenatally. Human placental lactogen and growth factors are supposed to be responsible for it. Thyroid hormones increase responsiveness of mammary cells to prolactin and can improve lactation performance.

Lactogenesis II (Secretory activation)

Placental expulsion abruptly decreases levels of human placental lactogen, estrogen and progesterone. Progesterone being a prolactin inhibitor, its absence eliminates the inhibition and milk secretion starts. This decline acts best in presence of lactogenic hormones prolactin; insulin and cortisol for full secretory activation which happens between 30 and 72 hours, therefore mothers feel fullness of breast on 2nd or 3rd day after delivery. [7].

Prolactin is the main hormone governing milk production and its levels increase and fall with intensity and duration and frequency of nipple stimulation, it also shows a circadian rhythm of being higher at night, and surging in response to baby's sucking. Prolactin levels otherwise fall by 50% in first week postpartum. Frequent breast feeding stimulates development of prolactin receptor sites in mammary gland and their

number plays a major role in amount of milk being produced. Initiation of lactogenesis II takes place earlier in woman who have nursed their previous born possibly because of already existing prolactin receptor sites.[8] Prolactin is necessary for milk production but its levels are not directly related to the amount of milk being produced, thus prolactin plays a permissive role only.

Lactogenesis III (Mature Milk Production):

This is the maintenance phase of milk supply. It starts around 9th day and ends with beginning of involution. Neuro hormonal feedback pathway shifts to autocrine or local control in response to direct stimulation of nipple and areola and removal of milk in this phase. This path is regulated and controlled by

1. Feedback inhibitor lactation (FIL) : a small active whey protein synthesized by Lactocytes accumulates in alveolar lumen and moderates milk synthesis locally based on fullness of breast and initiating a chemical feedback loop.[9] Speed of milk production increases when less feedback inhibition is present.
2. Another local mechanism is presence of Prolactin receptors in the basement membrane of alveoli to which Lactocytes are attached. As milk accumulates the shape of Lactocytes gets distended and distorted and prolactin can not bind to its receptor, prolactin uptake is inhibited and this creates an inhibitory effect on rate of milk production thereby down regulating milk synthesis.
3. All milk production starts out as concentrated hind milk but as it accumulates and remains there, it draws in water and becomes diluted for milk. Hind milk has a higher fat content. This changing proportion changes the calorie value of milk varying it widely throughout each feeding and also upon time of last feeding. Milk content and fat type also varies according to maternal weight, metabolism, diet, and gestational age of infant.[10].

Involution

When the milk producing system is not being used, secretory epithelium apoptosis or programmed cell death occurs. Complete involution takes place around 40 days following total cessation of feeding depending upon the rapidity with which cessation occurs whether abrupt or gradual.

Milk ejection /let down /release

Direct stimulation of sensory neurons in areola by the baby initiates a neuroendocrine arc to posterior pituitary releasing oxytocin. Impulses through exteroceptive stimuli like hearing infants cry, emotions from cerebral cortex and looking at baby also initiate let down reflex, perceived by mothers as an increased pressure, a tingling sensation or a sharp shooting pain or

a warm flushed feeling in breasts and sure sign is dripping of milk from breast.

A simultaneous secretion of oxytocin occurs into brain regions of lactating mothers which regulates maternal blood pressure; it has a soothing effect, lowers BP, decreases cortisol level, decreases anxiety and aggressive behavior and permeates through areas of brain associated with mothering and human bonding behaviors. It leads to contraction of myoepithelial cells surrounding the alveoli, expressing milk into collecting ducts of breast. Oxytocin causes shortening of ducts without constricting them and this increases intraductal mammary pressure and the amount of milk transferred to baby is co-related to number of ejections per feeding and is independent of time spent on breast feeding. Nipple stimulation cause 3-4 second pulsatile bursts of oxytocin into blood stream every 5-15 minutes whether done by infant sucks or by mechanical stimulation , and also by pre nursing stimulus and cues of infant on the other hand oxytocin release is inhibited by stress and pain.

FACTORS TO BE KEPT IN MIND FOR FACILITATION OF BREAST FEEDING

1. Establishment of Lactation begins with separation of placenta and a mother's lactation may be profoundly affected by exactly what happens within one hour just after birth. If the natural contact and interaction between mother and baby is disrupted in this period due to either maternal or infants reasons the long term success of breast feeding might get jeopardized should be avoided [11].
2. Primiparity, cesarean section , stressful vaginal delivery , prolonged second stage of labor, Breast hypoplasia, Maternal obesity, diabetes ,thyroid dysfunction, infertility, polycystic ovarian syndrome, maternal medication, illness, or situation interfering with early milk removal , Retained placental fragments, Sheehan's syndrome (pituitary infarct caused by maternal post partum hemorrhage) the risk factors for delayed lactogenesis and thereby increasing the chance of infant being fed with other modes of nutrition which may later lead to total or partial failure of breast feeding [12].
3. Large amount of IV fluids to mother especially with addition of Pitocin increases the risk of maternal fluid retention, an edematous areola and a difficult latch on one hand and on the other an inflated infant birth weight with subsequent diuresis to shed excessive fluid may be interpreted as abnormal weight loss and inadequate feeding [13].
4. Maternal analgesic may cause behavioral change in infant, Narcotics and barbiturates can depress

- and sedate baby, leading to depressed efficacy of sucking, seeking and latch.
5. Epidural analgesia increases risk of maternal fever, leading to separation of baby, investigations , antibiotic therapy and septic work up for baby
 6. Prolonged second stage of labor, vacuum or forceps use, all might cause pain in infants head even without apparent trauma leading to impaired suckling reflexes delaying successful initiation of breast feeding
 7. Stress and pain of neonatal procedures might result in sensory overload and may cause the baby to temporarily shut down recognition of his nervous system and reflexes
 8. Suctioning of newborns mouth and nares may cause physical injury leading to edema pain and stuffiness, making the latch on difficult for baby, therefore suctioning should be kept to minimum.
 9. Routine suctioning of gastric contents is harmful for healthy term newborn and should not be done. It may injure the oropharynx causing persistent pain , may induce retching and vomiting , precipitate changes in heart rate , blood pressure , and electrolyte imbalance and disrupt cueing behavior and suppress desire to latch.
 10. Bathing should be delayed not only for the sake of thermoregulation and maintenance of temperature but also to prevent sudden loss of amniotic fluid odor, as odors play an important role in mediation of infant's early behavior. Vernix should be allowed to soak into the skin to protect and lubricate it. Infants show a preference to objects coated with amniotic fluid unto 4-5 days after birth when it changes to a preference for smell of mother's milk. Therefore while drying it is an advisable step to leave some amniotic fluid on hands and forearms, so that when infant latches on breast it leaves the smell of amniotic fluid on it, further augmenting breast feeding establishment.
 11. Painful procedures in baby should preferably be delayed till after first contact with mother. It is a good idea to give vit k injection after first hour to minimize its painful effect and circumcision should be delayed until baby had several feeds.
 12. As the baby is awake and active in the 1st hour after birth , eye contact should be held between mother and baby. It is a strong bonding force and is beneficial for successful establishment of breast feeding .The quiet and alert state may last upto 2 hours and baby must be put to breast in this period , after which baby may sleep as long as 24 hours and mother should be reassured about this.
 13. Soon after birth baby should be allowed to remain in skin to skin contact with mothers breast to go through the 9 phases of self attachment which are Cry ,relaxation ,awakening , activity ,crawling ,resting , familiarization ,suckling , sleeping .
 14. Several attempts: Licking movements precede and follow rooting reflex when tongue is placed on the floor of mouth, followed by mouth and lip smacking which starts drooling, then baby begins to move forward slowly, turns head from side to side and opens mouth widely nearing nipple and after several attempts latches on areola and not nipple, so give time for several attempts.
 15. Contact between mother and baby start a number of bioactive processes that are mutually interconnected guiding the mothering behavior by release of interdependent hormones progesterone, oxytocin and prolactin and GIT hormones insulin, somatostatin, gastrin, and cholecystokinin.
 16. The environmental modification is necessary for establishment of successful breast feeding by supporting privacy, visitors and family members should be made sensitive to the issue of privacy and leave the room at feeding times.
 17. Swallowing colostrum causes digestive peristalsis which leads to early passage of bilirubin laded meconium reducing jaundice. Meconium is also the first medium for growth of lactobacillus bifid us which is introduced in gut via colostrum and Skin contact colonize baby's skin with mothers normal body flora facilitating infants adaptation to new no sterile environment.
 18. Episiotomy can be extremely painful for mothers for first 10 days and it becomes difficult for mothers to attain a comfortable breast feeding position.
 19. Expression of colostrum is not easy, as it is very thick in consistency and low in volume, assists it with warmth massage and gravity, initially only a few drops might be expressed and it should be collected in spoon as it might stick to the container and becomes unavailable for baby.
 20. Supply and demand principle regulates the production of milk, volume of milk being produced directly correlates to the milk being removed by feeding or expression.
 21. Maternal nutrition and diet do effect milk production
 22. Normally the infant recovers in 24 hours after birth and if the infant is not able to latch on after 24 hours it becomes crucial that stimulation and removal of milk is done to maintain milk supply for future.,
 23. If the full term infant fails to latch, Breast feeding is attempted in a quiet dark atmosphere and all diverting activities like changing diaper, clothing or bathing avoided just before offering

breast. Mother is encouraged to massage breast and hand express colostrum in baby's mouth.

24. If still the baby is not able to feed milk expression is done using a pump around 8 times per 24 hours including night time expressions for 10-15 minutes and then breast is massaged to express any additional milk available after massage. Once milk volume increases the combination of breast pump suction, breast compression and hand expression works best.
25. Although storage capacity of milk varies with breast size and it increases with increase in size but small breasts are capable of secreting as much milk as large breasts over a 24 hour period.
26. Local or autocrine control regulates short term milk supply and is the main governing factor in maintenance phase of Lacto genesis.
27. Milk synthesis is individually controlled in each breast
28. Milk production responds to the amount of residual milk after feeding with degree of fullness correlating inversely to the amount secreted for each feed.
29. Infants are obligate nose breathers and cannot continue to feed if not able to breathe. Mother should be able to see the tip of infant's nose. If not, raising the infants bottom or wrapping the baby's legs around mother's waist usually clears the nose or lifting up breast from underneath clears the nose.
30. Effective communication in form of Scripting, explaining and Proper Phrasing inferences are not to be drawn by calculation, they are clear and precise at the first instance e.g. same message, 8-12 times per day versus breast feed baby every 2-3 hours.

LACTATION FAILURE:

The hall marks of successful breast feeding or failure are apparent within first week of delivery. An abnormally long interval between colostrum phase and copious milk production is called delayed lacto genesis, but here the mother has capacity to reach the copious milk phase. When the natural process is not established properly infant is exposed to outside milk and nutrients and his health is very easily jeopardized. Therefore every effort should be made to prevent it with good anticipation and to reestablish it if encountered late.

Primary Lactation failure:

When mother is unable to reach copious milk production stage it is called Primary lactation failure or Primary milk insufficiency syndrome and is due to intrinsic factors [14]. They will not be able to provide adequate nutrition to their baby but should never stop breast feeding altogether as it is good for emotional regions, for effective bonding and to give whatever breast milk benefits can be transferred to baby .

Etiology

1. Undiagnosed retained placenta
2. Breast nipple or peri areolar surgery or incisions including implants.
3. Breast hypoplasia
4. very minimal breast enlargement during pregnancy
5. No fullness felt postnatally
6. severe post partum hemorrhage, infection ,hypertension

Secondary Lactation failure:

When an initial normal milk supply rapidly diminishes, it is called secondary lactation failure or secondary milk insufficiency syndrome and is due to extrinsic factors. This is the commonest, preventable and treatable cause and hence focused here [15].

Since breast feeding is a hormonal emotional physical and dietary process, it is bound to be effected by all the components. Hormonal component is the major player but is universally established as a natural consequence of child birth and therefore other factors are the one usually mismanaged.

INCREASING BREAST MILK PRODUCTION/ MANAGING LACTATION FAILURE

A combined physical, dietary and medicinal approach is the best and most successful method of increasing the breast milk supply quickly, although only one may suffice. Effective breast and nipple stimulation complete repeated removal of produced milk is the key to success. Various strategies applied are following

PHYSICAL METHODS

This is the safest easiest, noninvasive and most economical method, as mother has to take nothing orally, no drug, no substance, nothing additional goes inside her body and no side effect is possible. Based on the golden rule of breast feeding that is Demand feeding. A simple equation of demand and supply, more demand more supply works [16]. Every drop available is removed and consumed either by sucking or by expression and nothing is left behind.

In the Physical context, there are two major players, mother should be able to produce and the baby should be able to drain and swallow. If the baby is too weak or is ill or cannot swallow because of some defect, milk production decreases or stops.

Nine physical points to be noted and tick marked right are [17]

1. Mothers Position
2. Baby's position
3. Skin to skin contact
4. Latching

5. Breast compression
6. Hand compression
7. Breast pumping
8. Frequency
9. Ejection Stimulation

Proper positioning and effective attachment called latch on, facilitates milk secretion and transfer, increases duration, minimizes nipple trauma. There is no single right or wrong position for any mother or baby couplet, both is preprogrammed by nature with reflexive skills towards its success. However the points to be kept in mind are

- A. The feeding should not initiate a chain of protocols to be followed as a rule because then it becomes an emotionally distressing and tiring procedure and is easily postponed.
- B. Positions can be individualized according to their own comfort zone while ensuring infants optimal latch, which is a prerequisite for effective milk transfer.
- C. Baby is able to empty breast quickly and efficiently if he is well attached and this is the first thing to be checked and taught as a good latch enhances babies' ability to draw milk.
- D. The main idea is that mother's breast areola and nipple should be positioned deep into the mouth of baby so that both mother and baby are comfortable and right suction pressure is created and milk is sucked. Mother should not feel any pain and baby should be able to breathe and swallow milk comfortably.
- E. Like facial features every mother's breast shape size anatomy and shape size anatomy of every baby's mouth differs .Basically every baby is biologically programmed to actively seek a good latching position. The best way is to give him a chance to do so in a comfortable position patiently and ignore the initial failed attempts. The Latch is designed to be baby driven and babies can do it remarkably well provided they are given the right working conditions or signals and cues to understand what to do.
- F. Bring baby to breast and not breast to baby. Let baby draw the breast in his mouth and baby cheeks should not dimple inward while sucking.
- G. Mother should be preferably sitting and baby is supported in a way that his own body weight does not cause fatigue in him. Head neck and back are in line and all supported so that infants muscles do not have to work to maintain latch on position.
- H. Mothers hand supports infants head from base of skull and not from occiput as occipital support causes baby to arch away from breast.
- I. Baby's head is held in a way that his chin touches mothers chest

- J. Baby's neck is neither extended nor flexed and baby faces mothers body with ear, shoulder and hip in a straight line, limbs are tucked in to prevent flailing, nose and mouth are aligned with nipple and areola and baby is in a position to readily access mother's breast.
- K. Mother supports the weight of breast to prevent baby from pulling down on nipple or losing the latch as the baby does not have much oral strength to maintain position on a heavy breast. Large breasted woman can keep a small rolled towel under the breast to elevate it. C- Hold of breast with thumb above and all four fingers below works well for most mothers. Scissors hold, grasping breast between index and middle fingers also works well as long as fingers are kept away from areola .Dancers hold grasping breast from below in a U shaped manner might be needed for some preterm infants.
- L. Gently brushing the lips of baby with nipple by moving breast up and down is a good way to elicit rooting reflex however mother should be cautious to keep her fingers away from baby's mouth and never attempt to open mouth with finger, as touching baby's chin or mouth can cause a bite or clamping reflex
- M. Wait for baby to open mouth with tongue at floor of mouth, a crying baby opens mouth wide but the tongue is usually at roof of mouth and latching is not established if nipple is thrust in mouth at this time.
- N. A crying infant is disorganized and may not be able to latch until calm. Watch for early feeding cues when baby is calm and alert, if these cues are ignored baby becomes fussy crying and disorganized and fails to latch.
- O. There are concerns about blocking of infants nose and his ability to breathe while on breast.

Indications of a good latch are [18]

1. wide open mouth
2. flared lips
3. chin touching breast
4. more areola visible above than below

Signs of milk transfer

1. "Ca" sound from throat
2. Preceding swallow a deeper jaw exertion can be appreciated
3. slight movement can be felt in front of ear near temporal region of face
4. Swallow can be heard with a stethoscope over baby's throat.
5. Top of areola moves inward towards baby's mouth.
6. a puff of air comes from nose

Emotional:

Prompt recognition of feeding cues goes a long way in solving breast feeding issues.

Early feeding cues:

They tell mother baby is hungry and wants to feed, signs are baby stirring, mouth opening, turning head, seeking, rooting, this is the best time to put baby to breast.

Mid feeding cues:

When baby tells mother leave everything else and feed me I am really hungry and cannot wait any further, the signs are stretching, increased physical movement and hand to mouth movement.

Late feeding cues:

The baby is now disappointed with you and signs are crying, agitated body movements and color turning red, means apologies for the delay, first calm me by cuddling, stroking, talking and putting skin to skin on chest and then only feed me.

A good latch starts from an early feeding cue; baby is brought close to the breast with nipple pointing towards his nose. This prompts him to tilt his head back helping him open his mouth wide as he lowers and extends his tongue to reach up and forward towards the breast; this brings his chin first in contact and to close his upper jaw over the nipple.

Motherly signals:

Verbal and visual cues by mother like she saying open and opening her own mouth wide might also facilitate latching.

Skin to Skin contact:

(Kangaroo mother feeding) Baby wearing only a diaper and mother wearing nothing on top, holding baby skin to skin just in between the breast, nestling and nursing the way kangaroo mother care is given. Baby remains warm, keeps on smelling milk and is likely to feed more. Alternatively wear a front open blouse or gown and keep it open with baby held skin to skin in the same kangaroo position and wrap together a shawl or dupatta. Baby remains physiologically stable and warm, temperature is stabilized as the breast in itself is the best warming isolate it increases or decreases in response to baby's body temperature. In addition baby hears tick of mother's heart beat a very familiar recognizable and reassuring sound to him from his time in womb, baby feels very secure and sleeps peacefully.

Nursing vacation /Baby mooning / Holidaying with baby:

When milk production is falling it is a good idea to just spend two days in bed with baby, doing nothing but cuddling, nursing and the things will turn

around. Baby mooning just like honeymooning is spending time together with Kangaroo mother care as explained above, may be a weekend off or deliberately taken off from all other things including household work. Take all necessary help for daily chores from spouse, family, friends, elders and servants. It may not be possible in every circumstance but the basic concept must be understood which is uninterrupted body contact and quick responses to feeding cues and it usually translates into more milk production by third day.

Increasing Frequency:

Third strategy is to increase milk production by increasing the frequency as infrequent feeding is a common cause of low milk production and is also a reversible one and it is especially important in the first few weeks of life. When milk production is low, logically more frequent feeding is needed to maintain a total 24 hour nutrition supply to baby. The question mothers are worried about is, will the baby nurse more often if offered. The answer is Yes! Try to reduce the gap from two hours to one and a half hour, even if baby refuses one time try again. Baby may nurse for comfort in between feedings, and some extra amount of milk goes in, which in turn tells breast to make that much more. If baby does not suck on repeated attempts, then other strategy is to pump and evacuate in between. Collect whatever milk comes and feed him later by spoon.

Snacking:

Normally what adult people think is that babies having feed is like having full meals whereas babies tend to feed in terms of snacks that add up to full feedings, therefore increasing frequency is very physiological.

Maximizing milk removal:

After baby has latched well and has started sucking, second strategy is to maximize the breast drainage, so that it is totally empty, not partially filled at the end. Low milk production is often associated with less effective milk ejection reflex and a vicious cycle of low feedback is established. When simultaneous massage or breast compression is done while baby is sucking about 40 to 50% of more milk is fed to baby. Breast is held by hand cupping it from underneath with thumb on one side and fingers on other, then compressed gently but firmly, then pressure is released, synchronizing it with each swallow of baby. Relax hand in between to allow filling of areola again. Keep rotating hand position so that areola and breast is compressed from all possible sides and circumference. The hand pressure should be such that it does not hurt breast. This is a very simple and very effective way to increase breast drainage, when all the milk is removed meaning larger amount is removed body gets the message to produce and replace a larger amount.

Stimulation of milk ejection:

Milk ejection reflex is very important for milk production. Milk must be removed from breast in order to stimulate more milk production but it cannot be easily removed without the help of milk ejection reflex. Oxytocin hormone causes muscle like cells around the milk making alveoli to contract and push milk out. The process of milk ejection is unique and can be triggered both by physical stimulation and emotional thoughts. Mothers with low milk production often do not experience any noticeable symptoms of milk ejection. Although it is likely to be more a reflection of low volume of milk availability than any physiological problem. When milk production increases it may be the first positive noticeable sign, i.e., drops of milk coming from the opposite non feeding breast, the sure shot sign of increased milk production. Increased gulping sound of baby is another indication of increased milk production. To stimulate milk ejection following techniques are applied.

Hot water fermentation:

Hot showers, hot water fomentation or warm moist compresses applied to breast; prior to nursing or pumping make milk ejection easy. A small warm and wet towel kept for a few minutes before initiation of breast feeding is very helpful in augmenting milk ejection.

Massage:

Breast massage and rubbing with oil is a stimulating factor for milk ejection.

Nipple stimulation:

A gentle tickling, rolling and pulling are effective means of activating milk ejection. Tactile stimulation results in oxytocin release which not only causes milk ejection but also induces a feeling of well being, reduces stress level encouraging more milk ejection. Synthetic oxytocin spray has also been successful for this purpose.

Conditioned Reflex:

Milk ejection is partly a conditioned response, therefore having a special earmarked private area or nursing station where mother is able to position herself in a relaxed manner creating a psychological and physiological routine, helps to train milk ejection reflex, similar to trained ejection reflex in response to baby cry.

Breast pump use:

Since babies normally do not drain the breast completely. Breast pumping acts as an adjunct to what baby has done. Babies leave on average about 25% of milk in breast when they are finished. Pumping the breast removes this remaining amount of milk and in

return gives signal to produce more [19]. Emptier the breast, faster and larger amount of milk it makes. In addition suction causes nipple stimulation releasing prolactin and oxytocin and hence all positive impacts are for more milk production.

Pumping is especially helpful when baby is not well, premature or ill. If needed a pumping session for 8 to ten times per day of about 5 to 15 minutes depending upon how well it has been drained will augment supply. It is a time consuming process and easy to feel frustrated and give up but do not, just keep cookies or nuts nearby and snack it after each session. There are two ways of pumping and it works either way.

- 1) Nurse baby first for as long as he will suck actively and then pump.
- 2) Delay pumping halfway between feedings to avoid any conflict between the need to feed baby and need to pump.

The best way to know if breast has been effectively and thoroughly drained is that it is noticeably lighter and softer than at the beginning of feeding. Although when tried a few drops can always be expressed because they are always being produced. It is advisable to pump each breast for about ten minutes even if no flow of milk is seen during this time. It does not matter how much milk is expressed by pumping at this point. It is not the goal, the goal is to stimulate the breasts and tell the body to make more milk than it is presently making.

Night Time Pumping:

It is a good idea and an effective one but not at the cost of mothers sleep and rest because night time pumping is exhaustive. It is a balancing act if mother can sleep in day time or is able to fall asleep easily after pumping session, it is OK to go with it, but if sleep is compromised and mother is not sufficiently relaxed and rejuvenated afterwards then it is better not to opt for it.

Simultaneous Pumping of both breasts:

Instead of pumping one breast at a time both breasts can be pumped together with electric breast pumps. It definitely saves amount of time spent on pumping and if not more it is equally effective and is emotionally less draining.

Hand expression:

Hand expression is a suitable alternative to pumping. It is a good easily available and more acceptable alternative to any mechanical device. Expressing milk by hand is an art which comes naturally to most of the women. Learning it is also not difficult. Use your thumb on one side and fingers on the other side of areola, press gently and express milk in a large mouth cup or bottle so that you are not spilling it.

Keep rotating hand and cover whole off the circumference of areola. The frequency and duration should be the same as for pumping. The basic concept is that any system which allows expressing milk repeatedly without hurting breast is right and good for increasing milk production.

Comfort nursing:

Comfort nursing is wonderful for both baby and mother; it gives the baby to feel secure. Babies find comfort when they are put to breast instead of pacifiers, even when they are already fed and satisfied because of the Psychological bond it creates. This sucking will stimulate the lactation system very well and extra pumping may not be required.

Eliminating artificial teats:

It is an advisable step to avoid the confusion of teats, bottle nipples, and also to deliver a message to the baby that sucking at breast is not a futile exercise but a satisfying feeding experience. For this a feeding tube is attached to breast with a syringe, and milk is dripped on nipple while baby sucks on it, flow is controlled with a mechanical devise by mother.

GALACTOGOGUES:

Preparations which are added to mothers diet to increase the milk production are known as Galactogogues and are of three types

1. Tested Pharmaceutical drugs
2. Anecdotal Herbal drugs
3. Lactogenic diet

Tested Medicinal drugs

So far no drug has been specifically made, tested and recommended for this purpose. However following medications are being used successfully for this purpose. They is very effective and is safe for baby, but there may have some side effects on mother, although actually needed for a very short period. They effect by interacting with Dopamine system in a way that the endogenous production of Prolactin hormone is increased. Both Metoclopramide and Domperidone give good results but only one drug is to be used not both [20].

Metoclopramide:

It can boost milk production by about 40%. Side effects are usually not seen but have been documented as anxiety, tiredness and gastro intestinal symptoms felt as cramps in stomach, diarrhea. Dose is 10- 20 mg TDS.

Domperidone:

Domperidone is also a dopamine antagonist; very little side effects are reported. It is given in a dose of 10-20 mg three to four times daily [21].

Uncommonly used drugs:

Chlorpromazine (largectil) and haloperidol and sulpiride increase milk production as their side effect but their own major effects of sedation, fatigue and neurogenic aberration do not allow their use for this purpose.

Risperidone an anti psychotic drugs when used causes lactation in both man and woman.

Metformin:

It helps in increasing milk production in some woman suffering from PCOS. It works by improving insulin resistance which in turn reduces hyper androgenism which interferes with lactation.

HORMONES:

Oxytocin Nasal Spray:

It has been used to increase milk production but is more successful when let down reflex is the major factor for low supply.

Human Growth hormone:

Significantly increases milk production and no adverse side effects have been noted, neither in mother nor in baby but are very costly and not an economically viable recommendation [22].

Recombinant human prolactin: has been used successfully to increase milk production [23].

Thyrotropin releasing hormone:

Has been successfully used to increase prolactin levels and milk production but may cause hyperthyroidism in large doses.

Anecdotal Herbal Galactogogues/ Traditional Galactogogues

There are many herbs which are used as Galactogogues during lactation to increase the quantity of breast milk, usually based on traditional knowledge of hundreds of years and have not been scientifically tested [24, 25, 26, 27]. They give varying results, but people know that a fact which has survived for centuries is most likely to survive scientific tests also, and they have a placebo effect also. A combination of two or more Galactogogues works better than using just one. They are available raw in normal kitchen and commercial preparations are available in market for easy consumption.

Fenu Greek (Hindi name methi Dana):

Traditionally used, widely available spice in every Indian home; however it gives a peculiar odor to urine, a smell of maple syrup. Simmer one and a half teaspoons of seed in one cup of water and drink one cup three times a day. Increased milk production is seen around 24 -72 hours. Although dose is usually

individualized and assessed by slowly increasing it till urine gives the peculiar maple syrup smell. Once milk production is achieved to desired level, herb can be stopped; further milk supply is maintained by stimulus and emptying only. Fenu Greek is considered safe when used in moderation and is on US food and drug administrators Generally Recognized as safe list. Occasionally it causes GI Symptoms in very high doses. Recommended dose is 8 grams per day and side effects occur around 100 gm per day . Fenu greek belongs to same family as of Peanut and chick pea therefore it can cause allergy in individuals who have allergy to Pea nut or chick pea . It is also used for controlling Diabetes as it reduces blood glucose levels, therefore it can cause hypoglycemia.

Fennel (*Foeniculum vulgare*)-Hindi name – Moti Saunf:

Indian mothers have been traditionally advised to drink fennel brewed water post partum for 40 days, may be for its lactogenic and carminative effect, and for release of digestive enzymes.

Anise seed (*Pimpinella anisum*) - Sweet cumin – Hindi name maheen saunf / meethi saunf: has mild estrogenic and carminative effect and is also used to ease colics and gas pain. It is drunk by mothers to relieve colicky babies also.

Blessed Thistle (*Cnicus Benedictus*) /Milk Thistle / holy thistle (*Silybum marianum*)-Hindi name Bhatkataiya /Oontakara: a bitter herb which increase and enrich the flow of milk, also used for liver and digestive problems as it contains Silymarin

Chaste Berry (*Vitex Angus – castus*) Hindi name-Nirgunthi / monks pepper:

Suppresses sexual desire and was used for this effect in monasteries and therefore known as monks pepper. It was traditionally used for correction and regulation of female reproductive system including amenorrhoea, dysmenorrhoea etc. It has a normalizing effect on progesterone and stimulates prolactin production and thus increases milk production.

Hops (*Humulus Lupulus*) Hindi – Dangshesh bellflower or poor man’s Ginseng:

It belongs to marijuana family and has been traditionally used to relieve stress, anxiety and insomnia, it also has anti viral and anti bacterial property. They have numerous flavonoids and estrogen precursors. All these act to increase lactation.

Nettle leaf (*Urtica urens*) hind name bichchu booti:

An abundant source of vitamins, trace elements and iron. One ounce of herb in one pint of water taken ½ to 1 cup 3 times a day

Mothers Milk Tea:

Instead of one herb, a mixture of few working together has been found to be more effective known as Mothers Milk Tea prepared with

- 1 Part Blessed Thistle
- 1 Part Fenugreek
- ½ Part Hops
- 2 Parts Fennel
- 1 Part Nettle

All these seeds are grinded together so that water can come in contact with its inner parts on brewing .1 pint of boiling water is added to about 1 ounce of seeds and kept for about 10 minutes , sugar or stevia can be added to taste, as the seeds are bitter. However bitter is good as it stimulates release of bile and other digestive enzymes

Fennel Tea:

Easy to prepare and acceptable to palate, as tastes is sweet with an agreeable aroma, Seeds are crushed coarsely either in a mixer grinder or in a pestle mortar ½ to 1 tsf added to a cup of boiling water and kept for 10-15 minutes after placing a lid over cup. Dose is 1 cup three times a day. Honey or jaggery can be added to increase palatability, can also be added to normal Indian tea with milk and sugar and allowed to steep and then taken, but best results are seen with its purest form.

Dietary Modifications and Lactogenic diet

Proper nutrition including adequate Protein, B vitamins, and essential fatty acids are essential to milk production, therefore first thing to be checked is diet. In order to hurriedly get back into shape, compromising on diet is common .As pregnancy delivery and Lactation phase is also a phase of quite a lot of weight gain. Deficiency in diet is like trying to produce a cloth without having yarn or more aptly a thick woolen cloth with a very thin yarn or like producing a recipe without a substrate. Although human body is unique in nature milk is produced for baby at the cost of mother’s health that is nature’s law but then, both quantity and quality of milk is compromised.

Traditional lactogenic foods are [28].

1. Oat meal: It has a long standing recommendation for mothers. Research has proved it to be a good snacking, nutritious food; it has cholesterol lowering properties and maintains a healthy blood pressure giving a feeling of relaxation. All these might be a good help for her body to release oxytocin, a hormone involved in milk production and let down process.

2. Spinach (palak in Hindi) is a good source of calcium, iron, vitamin k and folate, all very important for pregnant and lactating mothers. It also contains, plant based chemicals having properties of estrogen, the Phytoestrogen which are known to promote breast tissue health and lactation.

3. Carrot: also contain Phytoestrogen, along with beta-carotene and Vitamin A . Carrot juice is very good for lactating mothers or they can eat whole raw carrot in salad.

4. Hummus : chick peas (chole /kabli chana in hindi) , lentils (masoor ki dal in hindi) , lima beans(sem phali in Hindi), or green beans/ hari phali / borda), garlic are all lactogenic food and hummus is traditionally made from all such ingredients chick pea, tahini ,garlic , lemon juice ,olive oil making it a good nutritious lactogenic food for mothers .

5. Papaya: (papeeta in Hindi) is a commonly known lactogenic food. However green not ripe papaya soup has been used more frequently. It has enzymes and phytochemicals which increase breast tissue and milk production, it also acts as a natural sedative, good sleep and relaxation may also help in augmenting let down reflex.

6. Asparagus (shatavari in Hindi): It is loaded with folic acid, Vitamin A, C, K and also contains Phytoestrogens; the hormonal effect of phytoestrogens is like estrogen in milk production. It also contains tryptophan, an essential amino acid which is said to stimulate prolactin production, there by leading to increased milk production.

7. Brown rice: is the unprocessed raw rice with just its outer shell removed. It increases the serotonin level, the feel good hormone, helps regulate, mood, sleep, appetite and decreases anxiety and also stimulates prolactin secretion, leading to an increase in milk production.

8. Apricots: are naturally occurring galactagogue. Apricots especially dried apricots contain phytoestrogens which help like estrogens in body. It is also a rich source of Vitamin A , C, potassium ,calcium and tryptophan, and thus is helpful in milk production. Figs and dates also belong to this group and act as galactogogues.

9. Salmon: is good source of essential fatty acids, omega 3fatty acids and gives a boost to mothers' nutrition and health. EFAs are part of mother's milk and their abundant availability boosts milk production.

10. Flax seeds: (also in Hindi), pumpkin seeds (kaddu in Hindi), Dill seed (sanwa in Hindi) are all traditionally supposed to be helpful in breast feeding.

11.Torbangun: (Coleus amboinicus) or bangun bangun as locally called leaf soup is used in Indonesia for hundreds of years and it is found to increase milk by 65% as compared to 20% by Fenugreek.

12. Water: Water is an essential component of milk, Milk is 97% water. Nursing depletes mother of water and pushes body in a state of mild dehydration. Therefore staying well hydrated makes a lot of sense. Drinking extra fluid apart from quenching thirst improves milk supply; a glass of water just before nursing is the simplest way to boost milk production.

Complementary therapies

Relaxation and or Hypnosis audio tapes- to relieve mother from tension, anxiety and stress of delivery and baby care.

Acupuncture / Acupressure- traditionally used in China as early as A.D. 256 and is supposed to be most effective if started within 20 days of delivery and does not work after 6 months. The production can increase as early as 2 hours or as late as 72 hours, earlier the response better is the outcome.

Reflexology – to augment lactation associated reflexes

What are the things to be avoided?

1. Birth control pills

Any form of hormonal birth control measures, pills, injections or patch may cause a significant drop of milk supply, therefore use mechanical methods if you need to , although breast feeding is a natural contraceptive , but may sometimes fail.

2. Medicines

Pseudoephedrine (part of sudafed and other cold medications), methergine, bromcriptine may cause a drop in milk production and therefore should be avoided.

3. Food

Large amounts of parsley sage and peppermint may affect milk supply.

4. Not giving Night feed

Avoiding giving night feed to baby is a major hurdle in adequate milk supply because levels of prolactin are naturally higher during night and they are the one signaling breast to produce more. When they are not stimulated at night, levels fall and milk decreases. Avoidance of night time feed also decreases babies' weight gain and his energy level and long sucking efficiency. Therefore one to two night feeds are an

essential part of baby feeding and adequate milk production although the lure of uninterrupted sleep is difficult to resist.

5. Using pacifier in between feeds

Using a pacifier in between feeds delays breast feeding and their feeding cues are lost, this also creates different sucking experience for baby and nipple confusion and is not good for baby and will lead to decrease in milk production.

6. Scheduling Feeds with clock

Scheduling decreases milk removal and since breasts make milk at the rate on which milk is removed under autocrine control. Less frequent emptying translates into less production.

7. Supplementing feed and lowered Calibration:

Since capacity of milk production is calibrated and is under autocrine control. In early weeks capacity of milk production is set in response to the amount of milk that is removed. If less milk is removed it assumes that less is needed and capacity is calibrated at a lower point of production. Supplementing feed with formula plays the same trick as it will delay the next feed because baby will not get hungry early, which means less removal of milk, decreased emptying of breast and a vicious cycle of decreased production, further supplementation and further decrease in milk supply. This is the commonest cause of insufficient milk production. If supplementation is really needed breasts should simultaneously be pumped to see there is no milk left and to coax it to produce more.

Commercially available galactogenic ready to eat preparations, to be taken with milk

Lepta den (Alarsin) 2 tablets TDS x 4 weeks

Shatavari (Organic India) 2 capsules BD with meals (Ayurvikalp)

Satavarex granules (Zandu) contains Shatavari 1-2 table spoonful twice daily mixed with milk

Lactare capsule (ttk health care) 2 Capsules TDS after one month than reduce to 1 TDS

Lactare granules (ttk health care) 2 Tea spoonfuls three times a day with milk than reduce to 1TSF TDS

Perceived milk insufficiency versus true milk insufficiency:

Dispelling the Myth of Low production is necessary and needs to be addressed at first encounter. Mothers may think that they are not able to breast feed their baby adequately where as in reality their judgment might be totally wrong. This may happen because,

1. Mothers may start thinking this even before 9-10 days i.e., before full Lactogenesis II has established

normally and due to this judgmental error may set in motion the vicious cycle.

2. A fussy, crying baby or a baby needing more attention or a baby sleeping less or a baby demanding feeds early all may be judged as having not enough milk to feed.

3. The behavior of wakefulness at night and demanding feed may be misinterpreted as insufficient milk, where as this behavior is normal for newborn.

4. Small size of breast, cessation of leaking in the nonfeeding breast may be perceived as less production.

5. Socio cultural influence and grandmother's insistence may also lead a mother to believe she is producing less milk and keeping the baby hungry.

6. Psychological and emotional issues, wanted or unwanted child, sex of baby all may affect mothers feelings towards baby and influence her milk production or perception of it.

Instead of a true milk insufficiency a perceived milk insufficiency is the major hurdle as this starts the downhill path towards true milk insufficiency and should be taken care of at the first encounter. It sets in motion the vicious cycle of supplementation decreased sucking and low milk production. Breast feeding is almost universally started but is stopped very soon due to this myth and if not corrected in time leads to true milk insufficiency, therefore it is necessary to estimate if sufficient breast milk is being produced

Adequate breast milk supply is assessed

1. By weighing baby before and after breast feeding, which tells the weight baby has gained; 50 mg gain translates into 50 ml of milk transferred and needed is 150 ml/ kg / day.

2. By estimating his daily eight gain, New born normally gains weight of about 25 gm /day from 2 weeks to 3 months and about 20 gm per day from 3 months to 6 months, from 6-9 months about 15 gm /day and from 9-12 months about 12 gm /day. If he is gaining weight at about this rate there is no fear of low milk supply

3. By passage of adequate urine and stool passage, passage of at least 6 times urine per day and at least one motion per day

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