



Original Research Article

## The Effect of Naturally Formulated Galactagogue Mix on Breast Milk Production, Prolactin Level and Short-Term Catch-Up of Birth Weight in the First Week of Life

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### ABSTRACT

**Objective:** To assess the effectiveness of naturally prepared galactagogue mix on breast milk production and prolactin levels in postnatal mothers. And also to compare the short-term catch-up of birth weight in the first week of life in new born.

**Materials and Method:** 30 mother-infant pairs were assigned to 3 groups. Group I (n=10) consisted of mothers who were receiving galactagogue mix containing fenugreek every day, Group II (n=10) consisted of mothers who were receiving galactagogue mix containing garlic every day and Group 3 (n=10) were assigned as control. Birth weight of the baby, serum prolactin levels of the mother and other anthropometric indices were determined.

**Results:** Maximum weight loss was significantly lower in infants in group I and II compared to control group ( $p < 0.05$ ). The mean measured serum prolactin levels of the mothers who received galactagogue mixes were higher than the control group ( $p < 0.05$ ).

**Conclusion:** Maternal galactagogue mixes supplementation seems to be useful for enhancing breast milk production and facilitating infant birth weight gain in early postnatal days.

**Key words:** Galactagogue, lactation, prolactin, birth weight, mid arm circumference, Head circumference, Chest circumference

### INTRODUCTION

Breastfeeding is considered the optimal source of nutrition for infants from birth to 1 year and is supported by the American Academy of Paediatrics (AAP) and the World Health Organization. [1,2] Breast milk is the natural food for the infant and it is "species specific".

The American Academy of Paediatrics recommends exclusive breastfeeding for a minimum of 4 months but preferably for 6 months. Breastfeeding should be continued, with the addition of complementary, at least through the first 12 months of age and thereafter as long as mutually desired by mother and infant. [3]

The recommendation for feeding full term and preterm infants with human milk arises because of its acknowledged benefits to infant nutrition, gastrointestinal function and host defence, and the potential beneficial influence on neuro development and chronic diseases of childhood. [2]

Infants who are exclusively breastfed for six months experience less morbidity from gastrointestinal infection than those who are missed breastfed as of three or four months, and no deficits have been demonstrated in growth among infants. Moreover, the mothers of such infants have more prolonged lactational amenorrhea and that the available evidence demonstrates no apparent risks in recommending, exclusive breastfeeding for the first six months of life. [4]

However, for normal infants too, exclusive breastfeeding has not been possible in certain households as mother is employed or for cosmetic and social reasons. Similarly, some mothers lack in milk production for various reasons that include poor nutrition, hormonal problems, parity, gravid, age and other associated problems. Yet, there has been evidence that some food products may enhance lactogenesis. Such foods are known as galactagogues

Galactagogues are substances or medications believed to stimulate initiation, maintenance, and augmentation of maternal milk production. [5-8] Galactagogues act by increasing the prolactin secretion which in turn the milk production. They also work psychologically and have a marginal effect on milk production. Suckling is the best lactagogue exercise. Garlic is commonly used galactagogue food. Fenugreek (*Trigonella foenum-graceum*), an herb from the pea family, is the most commonly used herbal galactagogue foods in the world. [5, 9]

Although the exact mechanism of action is still unknown, the fenugreek herb may increase milk flow by its

phytoestrogens and diosgenin contents. In terms of milk production, fenugreek is suggested to stimulate sweat production, which would enhance milk secretion as the breast is a kind of sweat gland. Fenugreek is listed as GRAS (generally regarded as safe) by the U.S. Food and Drug Administration. [5-9]

So in order to combat the inadequate milk supply and improve breast milk secretion and the stimulator prolactin levels, based on the above mentioned concepts, a natural galactagogue mix was formulated and standardized. This mix was also subjected to sensory evaluation. Indeed, this mix was used for the study to explore its effectiveness. Though Garlic and Fenugreek have been said to be the good functional foods in improving the breast milk production, seldom there are studies to prove they are effective in improving prolactin levels and explaining their impact on weight changes of the infants at the end of first week. Hence conceptualizing this in mind an effort has been taken to observe their effectiveness on prolactin levels and catch-up birth weight in the present study.

The aim of the study was to evaluate whether maternal consumption of the selected galactagogue food had any effects on breast milk production and on the recovery pattern of weight gain in infants in early postnatal period.

#### ***Objectives of the Study***

- Assess the birth anthropometric indices of infants and prolactin level of postnatal mothers in both experimental and control groups
- Compare the catch-up birth weight in babies between the experimental and control group
- Subjective evaluation of the effectiveness of the nutritional intervention on milk production in lactating mothers.

## **MATERIALS AND METHODS**

### ***Population of the Study***

The population included the mothers who had delivered babies in the maternity wards of Kovai Medical Centre and Hospitals, Coimbatore, India. Postnatal mothers selected were capable of breastfeeding but the secreting level was poor. Ethical approval was obtained from human ethics committee of Kovai Medical Centre & Hospitals Human Ethics Committee.

### ***Sample Size and Sampling Technique***

The sample size for study was 30 mother-infant pairs. 10 pairs were included in each group. The groups were categorized as Experimental – fenugreek, Experimental – garlic and the third one as Control group who were fed with any galactagogue mixes. The samples were chosen according to the inclusion and exclusion criteria through purposive sampling.

### ***Criteria for Selection of Samples***

The following criteria were used for selecting the samples:

#### ***Inclusion criteria:***

##### ***For infants***

- Full term and healthy neonates

##### ***For mothers***

- Having been willing to exclusively breastfeed their infants
- Having not enough secretion of breast milk without any abnormalities of nipples - pain, engorgement, mastitis, cracks etc.,
- Having consented to follow-up visit
- Having been consented to check the serum prolactin levels before and after the seventh day following the nutritional intervention

#### ***Exclusion criteria:***

##### ***For infants***

- Infants with low birth weight, low APGAR scores and intrauterine growth retardation

- Infants with any illnesses or congenital abnormalities

##### ***For mothers***

- Mothers who had chronic illness such as diabetes, hypertension, bronchial asthma and any allergies
- Mothers with any breast problems such as inverted nipples, mastitis, engorgement, cracks etc.,
- Mothers who had a history of smoking, alcohol, or any drug use meant for improving breast milk production

## **PHASE I:**

### ***Formulation Of Galactagogue Mix***

Two variations of galactagogue mix were prepared with the following ingredients:

#### ***Fenugreek- galactagogue mix:***

Sprouted, dried and powdered Ragi flour(60gm), Oat meal (20gm), Desiccated coconut powder(10gm), Jaggery(20gm), Fenugreek (20gm), Turmeric (200gm), Water(200ml)

#### ***Garlic- Galactagogue Mix***

Sprouted, dried and powdered Ragi flour(60gm), Oat meal (20gm), Desiccated coconut powder(10gm), Garlic(30gm), Turmeric(2gm), Water(200ml), Curds/Buttermilk(100ml), Salt(to taste), Jeera powder(a little), Coriander leaves( a little)

## **PHASE II**

Demographic and Clinical profile of the breast feeding mothers were recorded. Description of these data of the breast feeding mothers along with anthropometric indices of the infants was compared between the control and experimental groups. Particularly weight gain of the babies belonging to the mothers of the experimental and control groups were compared between pre and post intervention. Similarly comparison of the prolactin levels of mothers of control and experimental groups were made between pre and post interventional period.

### Analysis Of Prolactin Levels

Prolactin levels were determined individually before the commencement of intervention with galactogogue mix. Similarly the same was estimated after the study period.

The serum prolactin was estimated by the Electrochemiluminescence Immunoassay “ECLIA” - Roche Elecsys and MODULAR ANALYTICS E170 (Elecsys module) immunoassay analyzers.

## RESULTS AND DISCUSSION

Table 1 Baseline Characteristics of the breastfeeding mothers

S.no	Characteristics	Control group (n =10)		Experimental group Fenugreek(n =10)		Experimental group Garlic (n =10)	
		Frequency	Percentage (%)	Frequency	Percentage (%)	Frequency	Percentage (%)
<b>1.</b>	<b>Age of the mother</b>						
	Below 25 years	1	10	0	0	1	10
	20 – 25 years	3	30	0	0	4	40
	25 – 30 years	4	40	7	70	3	30
	30 – 35 years	2	20	3	30	2	20
<b>2.</b>	<b>Mode of delivery</b>						
	Normal delivery	2	20	5	50	6	60
	LSCS	8	80	5	50	4	40
<b>3.</b>	<b>Parity of mother</b>						
	Primi para	8	80	8	80	9	90
	Multi para	2	20	2	20	1	10
<b>4.</b>	<b>Educational status of the mother</b>						
	(a)Secondary	2	20	3	30	1	10
	(b)Graduate	4	40	3	40	4	40
	(c) Postgraduate	4	40	3	30	5	50
<b>5.</b>	<b>Economic level / Month</b>						
	Rs.10000-15000	4	40	4	40	3	30
	Rs. 15,000-20,000	2	20	2	20	3	30
	Rs.20,000-25,000	4	40	3	30	2	20
	Rs. 25,000-30,000	0	0	1	10	1	10
	>Rs. 30,000	0	0	0	0	1	10
<b>6.</b>	<b>Employed</b>						
	Yes	3	30	4	40	4	40
	No	7	70	6	60	6	60

Among the volunteers participated most of them were belonging to 20- 30 years. With regard to mode of delivery of babies, most of the control group mothers (80%) had undergone LSCS whereas more than 50% of the experimental group had delivered babies normally. Similarly with respect to parity of mothers majority of them (80 -90%) belonging to all groups was primi para. All of the mothers who participated in this study were literates and majority of 40-50% had a qualification from graduation to post graduation. Only 30- 40% of the study population was employed. Except control group both the experiment group

participants were found to be economically sound.

Majority of the participants belonging to all the three groups, that is 50-60% were having a height less than 155cm. With regard to the body weight particularly 60% of the control group, 30% of Fenugreek –Galactogogue group and 40% of Garlic-Galactogogue group were found to have a weight between 60- 70 kg. Surprisingly, 50% of the Garlic- Galactogogue group were found to have 70- 80 kg. Whereas, 90% of the Garlic- Galactogogue group and 100% of control group possessed BMI above 25. While, 50% of the Fenugreek –

Galactogogue group were having a BMI less than 25.

Table 2 Baseline Anthropometric Indices of the breast feeding mothers

S.no	Characteristics	Control group (n =10)		Experimental group Fenugreek (n =10)		Experimental group Garlic (n =10)	
		Frequency	Percentage (%)	Frequency	Percentage (%)	Frequency	Percentage (%)
<b>1.</b>	<b>Height of the mother</b>						
	(a)Less than 155 cm	6	60	2	20	5	50
	(b)155 – 160 cm	3	30	5	50	4	40
	(c) 160-165cm	1	10	3	30	0	0
	(d)Above 165	0	0	0	0	1	10
<b>2.</b>	<b>Weight of the mother</b>						
	Less than 50kg	0	0	0	0	1	10
	50-60 kg	0	0	3	30	0	0
	60-70 kg	6	60	3	30	4	40
	70-80 kg	3	30	3	30	5	50
	Above 80 kg	1	10	1	10	0	0
<b>3.</b>	<b>BMI of mother</b>						
	Less than 25	0	0	5	50	1	10
	Above 25	10	100	5	50	9	90

The table no. 3 describes the food frequency pattern of the breast feeding mothers selected for the study. GroupWise discussion is as follows:

**Control Group**

All the participants under this group were found to consume cereals, pulses and milk every day. While only 60% of same group had revealed that they consume fruits on alternate days. Similarly, 60% of the mothers were poor eaters of green leafy vegetables and accepted that they have it only once in a week. However though 80% of the mothers were non- vegetarians yet 50% of them reported that they consume only once in a week and another 30% only once in a month. Even, worse than this 80% of the mother consume egg weekly once and rest did not consume egg at all.

**Experimental Fenugreek Galactogogue Group**

Cereals, pulses and milk were consumed cent percent by this group. Surprisingly 70% of the mothers consumed vegetables every day and 50% were found to consume fruits on alternate days. However, 30% of mothers, consumed fruits only 3 days a week. Forty percent of this group subjects were found to consume green leafy

vegetables every day but 50% reported to consume only once in a week. 80% of the fenugreek galactogogue group were non vegetarian but out of this, only 30% of mothers consumed once in a week. Whereas, 50% of mothers consumed once a month. However, 70% of the mothers were found to consume eggs weekly once. Yet another 10% on all alternate days and rest of the 20% did not consume at all.

**Experimental Garlic Galactogogue Group**

Consumption of cereals and pulses were similar to the other two groups, whereas 70% of mothers consumed vegetables everyday followed by another 30% consuming on all alternate days. With regard to fruits 50% consumed on all alternate days and another 40% consumed only once in a week. Forty percent of this group consumed green leafy vegetables once in a week and another 40% consumed on all alternate days. Among this group 90% were non- vegetarians. However, only 50% of them reported to consume non vegetarians once in a week and 40% once in a month. However, 70% the same group consumed eggs weekly once and 20% on all alternate days.

By and large there was no much difference in the food frequency pattern between the experimental groups but the control group was found to be slightly better

than the other two groups. However, frequency of non-vegetarian intake was not up to the mark to the control group.

Table 3 Description of food frequency profile of the breastfeeding mothers

S.no	Characteristics	Control group (n =10)		Experimental group Fenugreek (n =10)		Experimental group Garlic (n =10)	
		Frequency	Percentage (%)	Frequency	Percentage (%)	Frequency	Percentage (%)
<b>1.</b>	<b>Food frequency</b>						
	Cereals						
	Everyday	10	100	10	100	10	100
	Alternate day	0	0	0	0	0	0
	Weekly	0	0	0	0	0	0
	Monthly	0	0	0	0	0	0
<b>2.</b>	<b>Pulses</b>						
	Everyday	10	100	10	100	10	100
	Alternate day	0	0	0	0	0	0
	Weekly	0	0	0	0	0	0
	Monthly	0	0	0	0	0	0
<b>3.</b>	<b>Milk</b>						
	Everyday	10	100	10	100	10	100
	Alternate day	0	0	0	0	0	0
	Weekly	0	0	0	0	0	0
	Monthly	0	0	0	0	0	0
<b>4.</b>	<b>Fruit</b>						
	Everyday	1	10	2	20	1	10
	Alternate day	6	60	5	50	5	50
	Weekly	3	30	3	30	4	40
	Monthly	0	0	0	0	0	0
<b>5.</b>	<b>Vegetables</b>						
	Everyday	6	60	7	70	7	70
	Alternate day	4	40	1	10	3	30
	Weekly	0	0	2	20	0	0
	Monthly	0	0	0	0	0	0
<b>6.</b>	<b>Green leafy vegetable</b>						
	Everyday	1	10	0	0	1	10
	Alternate day	3	30	4	40	4	40
	Weekly	6	60	5	50	4	40
	Monthly	0	0	1	10	1	10
<b>7.</b>	<b>Food habits</b>						
	Vegetarian	2	20	2	20	1	10
	Non-vegetarian	8	80	8	80	9	90
<b>8.</b>	<b>Non-vegetarian</b>						
	Everyday	0	0	0	0	0	0
	Alternate day	0	0	0	0	0	0
	Weekly	5	50	3	30	5	50
	Monthly	3	30	5	50	4	40
<b>9.</b>	<b>Egg</b>						
	Everyday	0	0	0	0	0	0
	Alternate day	0	0	1	10	2	20
	Weekly	8	80	7	70	7	70
	Monthly	0	0	0	0	0	0

### Control Group

In the control group, regarding the sex of the babies, there were 80% males and 20% females. Considering the gestational age of the baby, 20% babies were of 32-36

weeks of gestation while 50% babies were of 36-40 weeks and 30% babies were more than 40 weeks of gestation. Regarding the birth weight of the baby, 40% babies weighed between 2500-3000gm and 60%



babies weighed between 3000-3500gm. With respect to the length of the babies,

60% babies were between 45-50 cm and 40% babies were 50-55 cm length.

Table 4 Baseline Characteristics of the breastfeeding babies

S.no	Characteristics	Control group (n =10)		Experimental group Fenugreek (n =10)		Experimental group Garlic (n =10)	
		Frequency	Percentage (%)	Frequency	Percentage (%)	Frequency	Percentage
<b>1.</b>	<b>Sex of the baby</b>						
	(a) Male	4	40	5	50	5	50
	(b)Female	6	60	5	50	5	50
<b>2.</b>	<b>Gestational age of the baby</b>						
	32-36 weeks	2	20	2	20	0	0
	36-40 weeks	5	50	6	60	8	80
	Above 40 weeks	3	30	2	20	2	20
<b>3.</b>	<b>Birth weight of the baby</b>						
	2500-3000 gms	4	40	4	40	6	60
	3000-3500 gms	6	60	4	40	3	30
	>3500 gms	0	0	2	20	1	10
<b>4.</b>	<b>Length</b>						
	40-45 cm	0	0	2	20	2	20
	45-50 cm	6	60	5	50	5	50
	50-55 cm	4	40	2	20	3	30
	Above 55 cm	0	0	1	10	0	0

### Experimental Groups

In the experimental-fenugreek group, regarding the gender of the babies, there were 50% males and 50% females. Considering the gestational age of the baby, 20% babies had 32-36 weeks of gestation, 60% were of 36-40 weeks and 20% had more than 40 weeks of gestation. Regarding the birth weight of the baby, 40% babies weighed between 2500-3000gm, 40% babies' weight were between 3000-3500gm and 20% babies were above 3500gm of weight. On the account of the length of the baby, 20% babies were between 40-45 cm, 50% babies were between 45-50cm, 20% babies were from 50 to 55 cm and 10% baby were more than 55cm length.

In the experimental-garlic group, regarding the sex of the babies, there were 50% males and 50% females. Considering the gestational age of the baby, 80% babies were 36-40 weeks of gestation and 20% babies were more than 40 weeks of gestation. Regarding the birth weight of the baby, 60% babies weighed between 2500-3000gm, 30% between 3000-3500gm and 10% baby was above 3500gm weight. On

the account of the length of the baby, 20% babies were between 40-45 cm lengths, 50% were 45-50cm and 30% babies were 50-55 cm length.

TABLE 5- One way ANOVA of mean baseline Prolactin levels among the groups

Sr no	Groups	N	Mean ± SD	S/NS (P<0.05)
<b>1</b>	<b>Fenugreek</b>	10	116.64 ± 40.71	0.993 NS
<b>2</b>	<b>Garlic</b>	10	117.91 ± 89.86	
<b>3</b>	<b>Control</b>	10	120.04 ± 59.15	
	Total	30	118.20 ± 64.10	

The above table no. 5 depicts the mean ± Standard deviation of baseline mean Prolactin levels of all the three groups namely fenugreek, Garlic and Control groups. However, the one way ANOVA test showed that there was no significant difference among all the three groups. Thus, it is conversely understood that there was no much difference between the initial mean Prolactin levels of the lactating mothers. Even, Duncan's Mean Range Post Hoc Tests of the mean Prolactin levels revealed that there was no significant difference between the baseline initial mean Prolactin levels for groups in homogenous subsets.

Hence, it is understood that all the three groups were not having a significant difference in their initial mean Prolactin levels.

TABLE 6- One way ANOVA of final mean Prolactin levels among the groups

Sr no	Groups	N	Mean ± S D	S/NS (P<0.05)
1	Fenugreek	10	236.98 <sup>a</sup> ± 59.36	0.013* S
2	Garlic	10	226.74 <sup>a</sup> ± 100.98	
3	Control	10	142.49 <sup>b</sup> ± 48.69	

\* Significant at P<0.05

The above table no. 6 depicts the mean ± Standard deviation of final mean Prolactin levels of all the three groups namely fenugreek, Garlic and Control groups. The mean prolactin level is comparatively higher in the experimental groups and lower in control group.

However, the one way ANOVA test showed that there was a significant difference among all the three groups. Thus, it is conversely understood that there was significant difference between the final Prolactin levels of the early postnatal lactating mothers at the level of  $p < 0.05$ . Thus, further looking at the mean prolactin values of experimental groups which are quite higher than the Control groups and with the inferential statistics computed proved that there was a significant difference that makes to understand that such an increment could be due to the supplementation of galactogogue mixes. This result also correlates with a study done by Canan Turkyilmaz et.al, (2011) [11] in which they have proven that by giving herbal tea containing fenugreek as galactogogue agent improved the breast milk production in the early postnatal period.

The above table shows the mean ± Standard deviation of baseline mean birth weight of the babies of all the three groups namely fenugreek, Garlic and Control groups. The initial mean birth weight of the

garlic group is lesser compared to other two groups.

TABLE 7- One way ANOVA of initial mean Birth weight of the baby among the groups

Sl no	Groups	N	Mean ± Std. Deviation	S/NS (P<0.05)
1	Fenugreek	10	3.05 ± 0.42	0.768 NS
2	Garlic	10	2.93 ± 0.38	
3	Control	10	3.02 ± 0.33	
	Total	30	3.00 ± 0.37	

However, the one way ANOVA test showed there was no significant difference among all the three groups. Thus, it implies that there was no significant difference between the groups in the initial birth weight of the breast fed babies.

TABLE 8- One way ANOVA of final mean Birth weight of the baby among the groups

Sl no	Groups	N	Mean±Std. Deviation	S/NS (P<0.05)
1	Fenugreek	10	3.2840 ± 0.46812	0.024* S
2	Garlic	10	3.3190 ± 0.37355	
3	Control	10	2.836 ± 0.38103	

\* Significant at P<0.05

The above table reveals that the mean ± standard deviation of final mean birth weight of the babies of all the three groups namely fenugreek, Garlic and Control groups. The mean birth weight of the control group is lesser than the other two groups.

However, the one way ANOVA test showed that there was a significant difference among all the three groups. Thus, it is categorically understood that there was a significant difference between the final mean body weight of the different groups of breast fed babies. This in fact explains that such gain in weight of the infants which made them to achieve their catch-up of weight at the end of the first week could probably be attributed to the increment in the Prolactin levels of the breast feeding mothers who were receiving galactogogue mixes which in turn, could have further improved the breast milk production and thereby augmenting adequate nutrition to the



child. The overall weight gain also suggests that there could have been a positive momentum in the Nutritional Status of the infants. The mean body weight gain of the

infants belonging to experimental groups (both Fenugreek and Garlic galactogogue groups) was appreciably higher than the control group.

TABLE NO.9 One way ANOVA of Initial mean Chest, head and mid arm circumferences of the baby among the groups

Groups	N	Chest circumference Mean ± SD(Cms)	Head circumference Mean ± SD(Cms)	Mid-arm circumference Mean ± SD (Cms)	S/NS
Fenugreek	10	30.75 ± 2.39	33.95 ± 1.90	9.62 ± 0.94	} NS
Garlic	10	32.30 ± 1.63	34.25 ± 0.82	9.65 ± 0.65	
Control	10	32.30 ± 1.25	34.20 ± 0.91	9.65 ± 0.78	
Total	30	31.78 ± 1.91	34.13 ± 1.27	9.64 ± 0.83	

The above table depicts the mean ± Standard deviation of Initial mean chest, head and mid arm circumference of the babies of all the three groups namely fenugreek, Garlic and Control groups.

However, the one way ANOVA test showed there was no significant difference

among all the three groups. Thus, it is conversely understood that there was no much difference between the initial mean chest, head and mid arm circumferences of the breast feeding babies.

TABLE NO. 10 One way ANOVA of Final mean Chest, head and mid arm circumference of the baby among the groups

Groups	N	Chest circumference Mean ± SD (Cms)	Head circumference Mean ± SD(Cms)	Mid-arm circumference Mean ± SD (Cms)	S/NS
Fenugreek	10	29.95± 2.37	33.00 ± 2.17	9.35 ± 0.91	} NS
Garlic	10	31.00 ± 0.94	33.00 ± 0.67	9.05 ± 0.59	
Control	10	31.75 ± 1.56	33.00 ± 1.08	9.20 ± 0.75	
Total	30	30.90 ± 1.83	33.20 ± 1.41	9.2 ± 0.74	

Similarly, from the mean ± Standard deviation of final mean chest, head and mid arm circumference of the babies of all the three groups namely fenugreek, Garlic and Control groups. Nevertheless, the one way ANOVA test showed there was no significant difference among all the three groups. Thus, on the contrary it is understood that there was no much difference between the final mean chest, head and mid arm circumferences of the breast feeding babies.

## DISCUSSION

Several herbal galactogogues have been reported to be useful for nursing mothers. Mortel and Mehta (2013) in their systematic review of the efficacy of herbal galactogogues revealed that the outcomes included effect on serum prolactin and

oxytocin levels, breast milk volume, infant weight, weight loss as a percent of birth weight, time to regain birth weight and the chemical composition of breast milk. [10] In one of the studies, Turkyilmaz (2011) has documented that commercially prepared herbal tea containing fenugreek increased milk production within 24-72 hrs after consumption, [11] however, the herbal tea also included fennel, raseberry leaf and goats rue, substances that are traditionally used to augment lactation. [12] Hence, it was not possible to assess which herb or combination of herbs used in this study and that of Ushiroyama (2007) was responsible for the reported positive galactogogue activity. [13] Nevertheless, in our study only fenugreek was used as a galactogogue for an experimental group. Fenugreek seeds belong to pea family and its effect on milk

production has been reported anecdotally. Although there is contradictory evidence of its impact, yet it is attributed to stimulation of sweat production after inducing sweat gland, and since the breast is a modified sweat gland, thus the effect of fenugreek on milk production is possible. [14] Looking at the bioactive components in fenugreek, phytoestrogens and diosgenin (a steroid sapogenin) have been expected to exert estrogenic activity. In this lineage, Sreeja et al (2010) in their invitro assays found that fenugreek seeds contain estrogen like compounds, and they induce pS2 expression in MCF-7 cell lines. This pS2 is frequently used as a bio-marker for assessing the estrogenicity of a compound, and this steroidal sapogenin of fenugreek appear to account for the increase in milk flow observed from its use. [15] However, the exact mode of action is not yet clear. Hence, further studies are required to explore the exact mechanism of action at molecular level.

Human milk is complex mixture of substances that best meets the nutritional requirement of infants. It has been documented that when mother's milk added with garlic, the infants breast feed longer and suck more overall than they do when garlic is absent, at least under circumstances in which mothers have been consuming bland diet (without garlic) for several days. Desor et al(1997), claimed that infants may be attracted to or stimulated by garlic volatiles which in turn would increase the suckling process. This phenomenon implies prolonged suckling process would in turn induce production of more oxytocin and as a consequence more milk is that will be ejected. However these researchers point out that there is no evidence that will flavour of garlic in milk inherently be attractive to human infants in the same way that sweets and sugars do. [16] Similarly, Mennella et al (1993) found out in her research that the

infants of mothers who have repeatedly consume garlic during the experimental periods breast feed for more periods of time when compared with the mothers who had ingested the placebo. [17] Similarly, when aroused with the volatile sulphur containing garlic like compounds, the mammalian infants would suck more [18] and exhibit variety of other oral behavior. [19,20]

Thus with the above documentation it is imperative that garlic consumption in nursing mothers would enhance the suckling ability of the infants and thereby sustaining long period of feeding. Nonetheless there is no clear evidence that garlic can increase the milk production. However, in our study comparatively garlic-galactagogue consumed nursing mothers showed a significant improvement in prolactin levels. Yet, as the population size for each group was less, a large population based interventional study would further clarify our hypothesis.

## CONCLUSION

The results of the present study implies that fenugreek and garlic galactagogue supplementation could increase the production of Prolactin levels which in turn can therefore raise the breast milk production and thereby can also help to accomplish catch-up weight of the infants in the first week of the postnatal period.

With regard to the anthropometric indices such as Chest Circumferences, Head Circumferences and Mid Arm Circumferences both as neither baseline values nor after intervention with galactagogue supplementation to mothers, except body weight did not get affected. This shows that only body weight though it is affected predominantly by change in the body fluids still the overall nutritional adequacy could also matter the weight gain at the end of the first week of postnatal life of the infants. It is also clearly evident that

any change in the amount of breast milk produced or nutrition obtained by the infant may not alter the so called anthropometric measurements like head, mid arm or chest circumferences within a week as they are influenced by long time at least more than a fortnight's nutrition by breast feeding.

Consumption of maternal galactagogue mix supplementation seems to be useful for promoting and increasing the breast milk production in early postnatal days. However, use of any galactagogue should never replace lactation evaluation and counselling. Close follow-up of both mother and baby is essential even in instances of galactagogue support.

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