

# Formulation of Natural Galactogogue Mix

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## Abstract

Galactogogues (or lactogogues) are medications or other substances believed to assist initiation, maintenance, or augmentation of the rate of maternal milk synthesis. Natural Galactogogue Mixes were formulated using food ingredients like flaxseed, fenugreek, garlic, ginger, almond and cashew nuts. Central Composite Design (CCD) was followed for selection of final best combinations of Natural Galactogogue Mix (NGM). The sensory evaluation of all the NGM combinations was also done. The NGM1, NGM4, NGM5, NGM6, NGM7, NGM8 and NGM9 were selected without repetition for sensory evaluations. From the mean scores of sensory evaluation of combinations of NGM, NGM4 and NGM8 had the highest score. The NGM4 and NGM8 were selected for the analysis of physicochemical properties and nutrient content. Physico-chemical parameters and nutrient contents of NGM4 and NGM8 were analyzed. The moisture content of the NGM4 (1%) was equal to the NGM8 (1%). The ash content of NGM8 (7.6%) was higher than the NGM4 (5%). The Bulk density, True density and porosity of NGM8 were higher than NGM4. Regarding the nutrient content, NGM4 had higher protein content than NGM8. This was perhaps due to the fact that the weight of flaxseed and fenugreek is slightly higher than NGM8. The carbohydrates and fibre content of both NGM4 (39.82 g and 1.2g) and NGM8 (39.82 g and 1.2g) were same. When compared to NGM4, NGM8 had more energy, fat, folic acid, riboflavin, vitamin- C, iron and calcium. So, NGM8 combination has been selected as best combination. The cost of NGM was also calculated.

**Keywords:** Galactogogue, Garlic, Ginger, Flaxseed, Fenugreek, Almond, Sensory Evaluation, Cost Calculation

## 1. Introduction

Breastfeeding is considered the optimal source of nutrition for infants from birth to one year and is supported by the American Academy of Pediatrics (AAP) and the World Health Organization. The American Academy of Paediatrics recommends exclusive breastfeeding for a minimum of four months but preferably for six months. Breastfeeding should be continued, with the addition of complementary, as long as mutually desired by mother and infant<sup>1,2</sup>. However, many mothers suffer from postpartum hypogalactia because of emotional stress, anxiety, and maternal illness.

To relieve postpartum hypogalactia pharmacological therapies such as metoclopramide, oxytocin, and domperidone are sometimes used, but safety concerns associated with these therapies have limited their use<sup>3</sup>. Therefore, Academy of Breastfeeding Medicine's recommendations regarding these drugs and herbs<sup>4</sup>. According to Gabay<sup>5</sup>, natural herbal medications, such as fenugreek (*Trigonella foenum-graecum*), garlic (*Allium sativum*), ginger (*Zingiber officinale*), milk thistle (*Silybum marianum*), *A. racemosus* (shatavari), alfalfa (*M. sativa*), blessed thistle (*O. benedictus*), goat's rue (*G. officinalis*), flax seeds (*Linum usitatissimum*), fennel (*F. vulgare*), almond (*Prunus dulcis*) and brewer's yeast, are

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often recommended to breastfeeding mothers to increase milk production.

Gbadamosi and Okolosi<sup>6</sup> explained that fenugreek is the most commonly used herbal galactagogue. Qin, *et al.*<sup>7</sup> reported that “Garlic (*Allium sativum*) contains alliin, which is metabolized by the enzyme alliinase to allicin, thought to be responsible for most of garlic’s medicinal properties and odour. Garlic’s odour in milk is attributed to allyl methyl sulfide”. Garlic’s odour is transmitted to breast milk, which may increase infant sucking time acutely and might enhance the breastfed infant’s food choices in the long term. Ginger is native to the tropical jungles of Southern Asia and has been used in Ayurvedic and Chinese traditional medicine for over 5000 years. The use of Ginger in the postpartum period and as a galactagogue is not new: In Chinese traditional medicine, Ginger is considered a ‘warming food’, which was commonly recommended to women in the postpartum period to aide in the healing process and initiate milk flow. According to Soliman *et al.*<sup>8</sup>, “Flaxseed has been a focus of interest in the field of functional foods because of its potential health benefits, such as antioxidant activity and lactation”. Fifty percent of the energy in human milk is supplied by fat along with omega 3 and omega 6 essential fatty acids needed to complete the development of the brain, retina, and other organs including the skin. Aleandril *et al.*<sup>9</sup> conducted a cross sectional study at an Italian public hospital in the centre of Italy for the use of herbal products is steadily increasing the breast milk secretion.

Many cultures have the practice of including special foods for enhancing milk production. Fenugreek, garlic, flaxseeds, dry ginger powder, are traditionally used in India in different forms of dishes like laddoo, porridge etc.<sup>10</sup>. Hence the present study entitled “Formulation of Natural Galactagogue Mix” was undertaken with the objective to optimize the ingredients of natural galactagogue mix using fenugreek, garlic, flaxseed, dry ginger, almonds and cashew nuts which provides adequate fibre, vitamins and minerals and has many functional properties.

## 2. Materials and Methods

### 2.1 Selection and Processing of NGM

The raw materials such as fenugreek, garlic, flaxseed, dry

ginger, almond and cashew nut were procured from an organic shop. The raw materials were cleaned off all dust and impurities. Garlic was grated and dried in microwave oven at 150°C for two minutes. All the ingredients were powdered and sieved separately.

### 2.2 Optimization Process

To select the best combination of fenugreek, garlic, flaxseed, dry ginger, almond and cashew nut powder, a Central Composite Design (CCD)<sup>11</sup> was conducted. The effects of the ingredients were investigated by modulating the levels of Factor<sup>1</sup> (F<sup>1</sup>- flaxseed and fenugreek powder) and Factor<sup>2</sup> (F<sup>2</sup>- garlic and dry ginger powder) according to a two-factor, five level CCD and by setting the amount of almond and cashew nut for NGM as completion to 100%. Five levels were chosen for each factor (independent variables). Natural Galactagogue Mixes were formulated using varying ratios of fenugreek, garlic, flaxseed, dry ginger, almond and cashew nut.

### 2.3 Sensory Evaluation of Combinations of NGM

To select the approximate amount of fenugreek, garlic, flaxseed, dry ginger and almond, 20 semi trained panel members were asked to give a judge on aroma, taste and mouth feel on each type of mixes and average of these parameters was considered as overall acceptability. Numerical Scoring Test was used for the sensory evaluation of NGM.

### 2.4 Physicochemical Properties of NGM

The NGM was subjected to physicochemical analysis in the Food Analysis laboratory. The moisture content, ash content, bulk density, true density, porosity and viscosity of NGM<sup>4</sup> and NGM<sup>8</sup> samples were analyzed.

### 2.5 Nutrient Analysis of NGM

Nutritive value of NGM<sup>4</sup> and NGM<sup>8</sup> samples were calculated in terms of macronutrients such as energy, carbohydrate, protein, fat and dietary fibre and micronutrients such as calcium, iron, folic acid, riboflavin and vitamin C by standard procedures.

### 3. Results and Discussion

#### 3.1 Yield of Raw Ingredients for Galactogogue Mix After Processing

The weight of ingredients used in NGM before (raw) and after processing (drying and powdering) are presented in Table 1.

Table 1 shows that the total weight of the flaxseed, fenugreek, garlic, ginger, almonds and cashew nuts

were reduced after processing due to moisture loss and reduction in the surface area. The garlic (70%) and ginger (80%) were having higher percentage of loss after processing when compared to other ingredients of NGM. The flaxseed and fenugreek had higher yield after processing.

#### 3.2 Optimization of NGM

The combinations of flaxseed, fenugreek, garlic and ginger were made according to a two-factor/five-level Central

**Table 1.** Yield of galactogogue mix after processing

Ingredients	Before Processing (g) (raw)	After Processing (g) (drying and Powdering)	Percentage of loss (%)
Flax seed	100	95	5
Fenugreek	100	95	5
Garlic	100	30	70
Ginger	100	20	80
Almonds	100	60	40
Cashew nuts	100	65	35

**Table 2.** Combinations of NGM in percentage

Trails	F <sup>1</sup> (%)		F <sup>2</sup> (%)		Almond(%)	Cashew nuts (%)
	Flax seed	Fenugreek	Ginger	Garlic		
NGM <sup>1</sup>	3	3	3	3	44	44
NGM <sup>2</sup>	3	3	3	3	44	44
NGM <sup>3</sup>	3	3	3	3	44	44
NGM <sup>4</sup>	1	1	3	3	46	46
NGM <sup>5</sup>	3	3	1	1	46	46
NGM <sup>6</sup>	3	3	5	5	42	42
NGM <sup>7</sup>	5	5	3	3	42	42
NGM <sup>8</sup>	2	2	2	2	46	46
NGM <sup>9</sup>	2	2	4	4	44	44
NGM <sup>10</sup>	4	4	2	2	44	44
NGM <sup>11</sup>	2	2	2	2	46	46
NGM <sup>12</sup>	4	4	4	4	42	42

F<sup>1</sup> - Factor 1, F<sup>2</sup> - Factor 2

Composite Design (CCD). The weight of NGM was set as completion to 100%. Table 2 shows the 12 combinations of ingredients used for the preparation of the NGM.

Natural Galactogogue Mixes were produced from the combination of flaxseed, fenugreek, garlic, ginger, almond and cashew nuts to balance the nutritional and sensory properties. Therefore, sensory analysis was done to finalize appropriate quantities of ingredients to be used. The NGM<sup>1</sup>, NGM<sup>4</sup>, NGM<sup>5</sup>, NGM<sup>6</sup>, NGM<sup>7</sup>, NGM<sup>8</sup> and NGM<sup>9</sup> were selected without repetition for sensory evaluations.

### 3.3 Acceptability of Combinations of NGM

The mean scores obtained through the sensory evaluation of optimized NGM are discussed in Table 3.

It is evident from the mean scores, that NGM<sup>4</sup> and NGM<sup>8</sup> had the highest score for aroma (90), taste (89.6) and mouth feel (90) when compared to other combinations of NGM.

Acceptability was also the highest for both NGM<sup>4</sup> and NGM<sup>8</sup> (89.86±0.23). This could be perhaps due to the fact that the proportion of almond and cashew nuts were

higher than other combinations of NGM. The NGM<sup>4</sup> contained 1% of flaxseed and fenugreek, 3% of garlic and ginger and 46% of almonds and cashew nuts and the NGM<sup>8</sup> contained 2% of flaxseed and fenugreek, 4% of garlic and ginger and 46% of almonds and cashew nuts. These two combinations contain same higher percentage of almonds and cashew nuts. And also the table clearly shows that the NGM<sup>7</sup> with 5% of flaxseed and fenugreek, 3% of garlic and ginger and 42% of almonds and cashew nuts received the lowest mean scores for aroma (70) and taste (70.4) and mouth feel (70) when compared to other combinations of NGM. The score for overall acceptability was also the lowest for NGM<sup>7</sup> (70.13±0.23). The reason could be due to bitter taste of fenugreek. So the NGM<sup>4</sup> and NGM<sup>8</sup> were selected for the analysis of physicochemical properties and nutrient content.

### 3.4 Physicochemical Properties of NGM

The physicochemical characteristics of the product help to identify the changes that occur during the storage period. The physicochemical properties such as moisture content, ash content, bulk density, true density and

**Table 3.** Acceptability scores for combinations of NGM

Criteria	Mean± Standard deviation						
	NGM <sup>1</sup>	NGM <sup>4</sup>	NGM <sup>5</sup>	NGM <sup>6</sup>	NGM <sup>7</sup>	NGM <sup>8</sup>	NGM <sup>9</sup>
Aroma	83.2	90	68	78	70	90	84
Taste	72	89.6	74.4	78	70.4	89.6	83.6
Mouth feel	79.2	90	83.2	77.6	70	90	83.2
Over all acceptability	78.13±5.67	89.86±0.23	75.2±7.63	77.86±0.23	70.13±0.23	89.86±0.23	83.6±0.4

**Table 4.** Physicochemical parameters of NGM<sup>4</sup> and NGM<sup>8</sup>

Physicochemical parameters	NGM <sup>4</sup>	NGM <sup>8</sup>
Moisture content (%)	1	1
Ash content (%)	5	7.6
Bulk density	0.526	0.523
True density	1.428	1.666
Porosity	63.1	82.8

**Table 5.** Nutrient Content of NGM<sup>4</sup> and NGM<sup>8</sup>

Nutrients	Nutrient Content	
	NGM <sup>4</sup>	NGM <sup>8</sup>
Energy(Kcal)	562.96	599.58
Carbohydrate(g)	39.82	39.82
Protein(g)	18.57	16.70
Fat(g)	36.60	41.50
Fibre(g)	1.2	1.2
Folic acid (µg)	31.6	38.8
Riboflavin(mg)	1.8	2.3
Vitamin-C (mg)	1.14	1.33
Iron (mg)	6.332	11.32
Calcium (mg)	0.999	1.998

porosity of Galactogogue Mix were determined and they were presented in the Table 4.

From Table 4 it is clear that the moisture content of the NGM<sup>4</sup> (1%) was equal to the NGM<sup>8</sup> (1%). The ash content of NGM<sup>8</sup> (7.6%) was higher than the NGM<sup>4</sup> (5%). The bulk density, true density and porosity of NGM<sup>8</sup> were higher than NGM<sup>4</sup>.

### 3.5 Nutrient Content of NGM

The nutrient content of 100g the NGM<sup>4</sup> and NGM<sup>8</sup> were analyzed using standard procedures and they are presented in Table 5.

Table 5 indicates that NGM<sup>4</sup> (18.57g) had higher protein content than NGM<sup>8</sup>. This was perhaps due to the fact that the weight of flaxseed and fenugreek is slightly higher in NGM<sup>4</sup> than NGM<sup>8</sup>. The carbohydrates and fibre contents of both NGM<sup>4</sup> (39.82 g and 1.2g) and NGM<sup>8</sup> (39.82 g and 1.2 g) were same.

When compared to NGM<sup>4</sup> combination, NGM<sup>8</sup> combination had more energy (NGM<sup>4</sup> – 562.96 Kcal & NGM<sup>8</sup> – 599.58 Kcal), fat (NGM<sup>4</sup> – 36.60g & NGM<sup>8</sup> – 41.50g), folic acid(NGM<sup>4</sup> – 31.6µg & NGM<sup>8</sup> – 38.8µg), riboflavin (NGM<sup>4</sup> – 1.8mg & NGM<sup>8</sup> – 2.3mg), vitamin – C (NGM<sup>4</sup> – 1.14mg & NGM<sup>8</sup> – 1.33mg), iron (NGM<sup>4</sup> – 6.332mg & NGM<sup>8</sup> – 11.32mg) and calcium (NGM<sup>4</sup> – 0.999mg & NGM<sup>8</sup> – 1.998mg).

## 4. Conclusion

Natural Galactogogue Mix helps in increasing milk secretion and it also possesses good nutritional properties. From the 12 combinations of ingredients used for the preparation of the NGM seven combinations were selected without repetition for sensory evaluations. The highest mean scores obtained through the sensory evaluation of optimized NGM were NGM<sup>4</sup> and NGM<sup>8</sup>. NGM<sup>8</sup> had higher nutritive value and physicochemical properties than NGM<sup>4</sup>. Storage stability of NGM could be conducted with different packaging materials and supplementation studies could be carried out to find out the therapeutic significance of the NGM.

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