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QUALITY EVALUATION OF GALACTAGOGUE CONCOCTION

CHANDANA M., NETRAVATI HIREMATH AND SHWEATHA H.E.

Department of Nutrition and Dietetics,
School of Life Sciences, JSS Academy of Higher Education and Research,
Mysuru 570 015, Karnataka, India

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Abstract– Dysgalactia is one of the major problems among breastfeeding mothers, where they are unable to produce adequate amount of breast milk. Poor or inadequate milk production with partial failure in lactation initiation or its continuation affects the child's growth. Decreased secretion of serum prolactin is the major reasons for inadequate milk production. To tackle the problem of insufficient milk production, a study was undertaken with an objective of developing galactagogue products. Herbal ingredients like moringa leaves, ginger and mint were used to develop moringa herbal tea concoction with different flavours. Further, best accepted product was subjected for macronutrients and minerals estimation. Standard AOAC protocols were used for macronutrients and micronutrients estimation. Total antioxidant activity was also best assessed by standard protocol. Moringa tea concoction containing both ginger and mint flavour recorded the highest acceptability scores by sensory panel members (n=50). Nutritional quality evaluation revealed the presence of good amount of macronutrients and minerals content in best accepted moringa tea concoction with both mint and ginger flavour. It has shown the highest calcium and iron content with the value of 1406±5.56 mg/100 g and 12.33±0.47 mg/100 g respectively. Calcium serves as an important essential mineral in the secretion of prolactin and oxytocin in breast feeding mothers. Where, prolactin has vital role in milk production and oxytocin needed for ejection of breast milk. Therefore, best accepted herbal tea being a rich source of calcium, is proposed to help produce good amount of breast milk and its ejection by enhancing the secretion of prolactin and oxytocin.

INTRODUCTION

Mother's milk is the best source of nutrients that plays an important role in the nourishment of baby (WHO, 2003; AAP, 2012) due to its unique nutritional quality. Breast-feeding fulfills optimal nutritional requirement of the growing baby along with immune support. Dysgalactia is one of the major problems among breastfeeding mothers, where they are unable to supply or produce adequate amount of breast milk. Poor or inadequate milk production with partial failure in lactation initiation or its continuation affects the child growth. Insufficient or low milk production in lactating mothers is related to physiological and psychological factors (Rozga *et al.,* 2015).

Risk factors for lactation failure are related to maternal malnutrition, weak suckling by the baby, engorged breast, sore nipples, low milk production and decreased ejection of milk. Generally, to overcome from the problems of low milk production, many lactating mothers take galactagogues in different forms. Galactagogues are substances that are supposed to assist in the initiation, continuation, or augmentation of breast milk production (Marasco, 2008; Zuppa *et al*., 2010 and Mortel and Mehta, 2013). Galactagogues are available in different forms as in pharmaceutical agent form, herbal supplement form and in different food forms. More than 30 kinds of herbs are known for their galactagogue property (Zapantis *et al.,* 2012; Damanik *et al.,* 2006) such as fennel seeds, fenugreek, milk thistle, shatavari, alfalfa, blessed thistle, moringa oleifera, garden cress seeds, garlic, and brewer's yeast, are often recommended to breastfeeding mothers to increase milk production (Gabay, 2002). Herbal galactagogues are rich sources of minerals which are required for increased

secretion of prolactin and oxytocin. The two primary hormones that are needed for lactation are prolactin and oxytocin which are secreted from pituitary gland. These hormones are responsible for let-down reflex and production of milk. Zinc and copper bind together to balance oxytocin during let down reflex. Calcium is important mineral essential for milk production, it increases the prolactin secretion (Vallee and Falchuk 1993; Zuppa *et al.*, 2010). Therefore, to overcome the problem of low milk production among lactating women this study was undertaken with an objective of developing calcium rich galactagogues. Moringa leaves were chosen as base ingredient in the preparation of concoction due to its excellent nutritional quality particularly of its calcium content. Moringa leaves are commonly known as drumstick leaves, are excellent source of many minerals and vitamins (Biel *et al.*, 2017).

MATERIALS AND METHODS

Raw food ingredients along with materials required for the development of galactagogue products were procured from local market of Mysuru according to the requirement. Moringa tea concoction was developed with different flavours and best accepted flavour was analysed for its nutritional quality. Moringa tea with ginger and mint flavours were developed with the acceptable level incorporation of each ingredient. The methods being applied in the product preparation is depicted in F**ig. 1.** Moringa tea concoction with ginger flavour (M1) and moringa tea concoction with ginger and mint flavour (M2) were developed. Galactagogue concoctions with different flavours were subjected to sensory evaluation. Fifty panellists were enrolled for sensory evaluation. Developed concoction was mixed with hot water and given for sensory evaluation as depicted in **plate 1.** Nine points

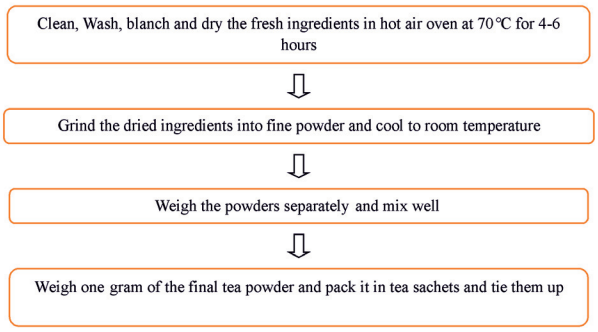

Fig. 1. Preparation of moringa herbal tea powder

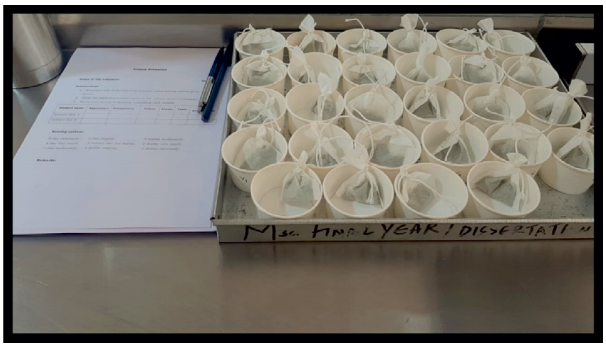

Plate 1. Table set with product and score card used in sensory evaluation

hedonic scale was used for organoleptic evaluation of developed concoction with different flavours. Sensory parameters such as appearance and colour, taste, consistency, aroma and overall acceptability were assessed in different flavoured concoctions. Best accepted concoction powder was subjected for chemical analysis by standard methods.

The macronutrients *viz.*, moisture, protein, fat, crude fibre and ash were analysed by AOAC, 2005 protocol. Carbohydrate and energy were calculated by computational methods. For moisture estimation, gravimetric method was applied. Each sample of 10 g was weighed and dried by using hot air oven at 100 °C until constant weight, further based on initial and final weight of sample moisture content was expressed in terms of per cent value. Crude protein was estimated in dried sample by using Kjeldahl instrument in terms of nitrogen value. Further Protein per cent was calculated by multiplying the per cent nitrogen with the 6.25 according to AOAC, 2005 protocol No. 978.04. Fat in each moisture free sample was extracted through petroleum ether (60–80° C). The solvent was removed through evaporation method and remaining residue was dried in oven to remove moisture content and after getting constant weight, total fat content was calculated (No. 930.09). Ash content in each sample was analysed using the protocol No. 930.05, AOAC, 2005. In brief, each known quantity of sample was incinerated in Muffle furnace at 550 °C followed by burning and total quantity of ash was weighed after cooling.

Minerals *viz.*, calcium, iron, copper and zinc were estimated from mineral solution by using AAS (Atomic Absorption Spectrophotometry) instrument. Ash solution was prepared from the ash of each food sample by the use of diluted HCL (1:1). Minerals were estimated in solution using AAS. Total antioxidant activity in vitamin C equivalent is

measured according to Williams *et al.*, 1995 with some modification. Further obtained results were expressed in average value with standard deviation.

RESULTS AND DISCUSSION

Sensory scores given by panel members for two variations of herbal moringa tea concoctions with different flavours marked as M1 and M2 and are depicted in **Fig. 2**. Moringa tea concoction with ginger flavour was M1 and moringa tea concoction with ginger and mint flavour was M2.The mean deviation scores were plotted over the double bar graphs to check the deviation among the sensory scores of 50 panel members. Among variations with two different flavours, moringa herbal tea with mint and ginger flavor, scored the highest acceptable taste compared to ginger flavor alone. Therefore, M2 variation that is moringa herbal tea with ginger and mint flavor was selected as best accepted galactagogue concoction.

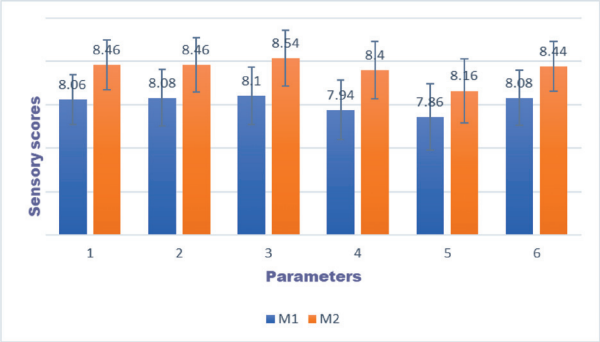

Fig. 2. Sensory scores for developed herbal tea drinks
M1 = Moringa herbal tea with ginger
M2 = Moringa herbal tea with ginger and mint
Note: 1=Appearance, 2=Consistency, 3=Colour, 4=Aroma, 5=Taste, 6=Overall acceptability.

For the comparison purpose, herbal tea available in market for lactating mothers named MOTHERG+ is used. MOTHERG+ was chosen based on the highest online review score. The results of reviews of acceptance fall between 3 and 4 stars out of 5 in total. Best accepted concoction was on par with MOTHERG+ herbal tea. Whereas, moringa herbal tea with mint and ginger was highly accepted for its flavor and aroma without bitter taste as per sensory evaluation it scored 8.44 as overall acceptability. The best accepted moringa herbal tea concoction was further subjected for chemical analysis by standard methods to evaluate its nutritional properties. The macronutrients such as moisture, protein, fat, crude fiber and ash carbohydrate and energy are presented in **Table 1**. Minerals *viz.*, calcium, iron, copper and zinc are resented in **Table 2.** Macronutrients as moisture, protein, fat, ash, crude fibre, carbohydrates and energy of best accepted moringa herbal tea with mint and ginger flavor was 2.25±0.03 g, 30.49±0.07g, 5.16±0.04g, 8.66±0.07g, 6.48±0.05g, 53.52±0.04g, 381.67±4.04 kcal per 100 g of sample respectively as shown in Table 1. Macronutrients labelled on MOTHERG+ are as follows, energy 9.82kcal, protein 0.57g, carbohydrate 1.88 g per 100 g.

Table 1. Macronutrient composition of herbal tea with moringa and mint per 100 g

Macronutrients	Content (Mean ±SD)
Moisture (g)	2.25±0.03
Protein (g)	30.49±0.07
Fat (g)	5.16±0.04
Ash (g)	8.66±0.07
Crude fiber (g)	6.48±0.05
CHO (g)	53.52±0.04
Energy (Kcal)	381.67±4.04

Table 2. Micronutrient composition of Moringa tea with ginger and mint per 100 g

Micronutrients	Content (Mean ±SD)
Calcium (mg)	1406±5.56
Iron (mg)	12.33±0.47
Copper (mg)	2.6±0.32
Zinc (mg)	0.1±0.27

Micronutrients as calcium, iron, copper and zinc ranged from 1406±5.56mg, 12.33±0.47mg, 2.6±0.32mg, 0.1±0.27mg per 100 g of sample, respectively as shown in Table 2. The developed concoction had highest amount of calcium where this plays an important role in milk production. Calcium is an important mineral essential for milk production, increased prolactin secretion (Vallee and Falchuk 1993; Zuppa *et al.*, 2010). Among various plant galactagogues, moringa oleifera leaves, ginger, sesame seeds and garden cress seeds are considered to be good source of nutrients. Most of herbal tea products available in market are not labeled with important nutrient values needed for lactating mothers that need to be included. Drumstick leaves possess the ability to increase prolactin levels and induce milk production in lactating mothers. Ginger is commonly known to stimulate milk supply, most common ingredient used traditionally for lactation mothers (Budzynska *et al.*, 2012; Co *et al.*, 2002; King *et al.*, 2013). Hence, this was used as an important galactagogue concoction component.

Table 3. Antioxidant property of galactagogue products (mg Vit C equivalent/100g)

Galactagogue product name	Content (Mean ± SD)
Moringa herbal tea with ginger and mint	0.110±0.002

An antioxidant property of moringa herbal tea with ginger and mint is presented in table 3. Moringa herbal tea showed the antioxidant activity of 0.110±0.002 mg Vit C equivalent/100g. Moringa leaves are excellent source of vitamins and minerals. Nutrients content in moringa leaves is said to be highly rich (Rasha *et al*., 2018). Moringa leaves are rich in antioxidants and helps in digestion which is beneficial during the postpartum recovery. Moringa leaves possess the ability to increase prolactin levels and milk production in lactating mothers. Ginger is another main ingredient with moringa leaves incorporated in tea powder because ginger is commonly known to stimulate milk supply. Therefore, herbal galactagogue tea made up of these galactagogue substances may help lactating mothers to induce breast milk production. Moringa leaves and ginger are the most common traditional foods used during lactation. They have milk production stimulating properties. Therefore, the developed galactagogue product namely moringa herbal tea is proposed to help to produce good amount of milk, increase prolactin levels and also balance oxytocin during let down reflex in the period of lactation cycle in nursing mothers. Further human trials are needed to substantiate the present study.

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Conflict of interest

The authors declared that there is no conflicts of interest relevant to this article.

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