

Katlu, a Traditional Functional Food from Gujarat, India

Aditi Goyal^{1*}, Shobha Udipi², Ashish Phadke³, Neeta Raval⁴, Varsha Thakker⁵, Rama Vaidya⁶

¹Project Associate, ²Research Director & Head, ³Deputy Director, Div. of Endocrine & Metabolic Disorders,

⁴Dietitian, Mumbai, Maharashtra, India

⁵Culinary Laboratory In-charge, Div. of Integrative Nutrition & Ayurceuticals,

⁶Director, Div. of Endocrine & Metabolic Disorders,

^{1, 2, 3, 5, 6}Medical Research Centre – Kasturba Health Society, Mumbai, Maharashtra, India

ABSTRACT

Introduction: India has a tremendous food culture with varied regional cuisines. All communities value certain foods for their health and medicinal benefits. There are many regional and community-wise dietary practices recommended for pregnant and lactating women. In Gujarat, *Katlu* is a traditional postpartum polyherbal formulation. Similar preparations are given in other states also. In Gujarat, this formulation is also consumed during winter by persons of all ages.

Methods: The ingredients for preparation of *katlu* powder in Gujarat were identified from records dating back to the 19th century maintained by an Ayurvedic practitioner, and from 17 commercial dealers. Information on how *Katlu* is provided to the mothers was recorded. The possible health benefits of the ingredients were studied from Ayurvedic texts and published scientific evidence.

Results and Discussion: While the traditional formulation is supposed to contain 32 plant materials, it was observed that none of the commercially available powders contained all 32 plant materials. Majority contained 10-12 of the ingredients. One or two products contained a variety of other plant materials not listed in the original formulation. *Katlu* is incorporated into a local sweet preparation providing considerable energy and moderate protein. Besides containing herbs with galactagogic properties, *Katlu* contains plant materials with other health benefits e.g., anti-inflammatory. However, there are no studies on this formulation per se.

Conclusion: *Katlu* appears to have numerous health benefits and merits scientific investigation. This functional food and its health value should be promoted in the community and among nutrition and public health professionals.

KEYWORDS: *Batrisu*, *Galactagogue*, *Katlu*, *Lactation*

INTRODUCTION

Food has been a vital part of Indian culture and continues to occupy an important place at family and community level. India is unique in several ways - the use of ingredients and preparation methods. To a considerable extent the food culture is influenced by religious beliefs and the traditional systems of medicine i.e., *Ayurveda* and *Siddha*, as well as the geographic region and seasons that influenced the availability of foods. Several ingredients and foods are valued for their medicinal properties and health

benefits, and many such foods have been incorporated into local cuisines.

Every community in India has its do's and don'ts, particularly for pregnant and lactating women, as these periods are considered to be very important epochs in a woman's life. The postpartum period is considered to be a period of rest and rejuvenation because the mother's body is 'depleted' and her digestion is 'weak'. It has been well recognized since ancient times that the neonate and the infant are nourished through

How to cite this paper: Aditi Goyal | Shobha Udipi | Ashish Phadke | Neeta Raval | Varsha Thakker | Rama Vaidya "Katlu, a Traditional Functional Food from Gujarat, India"

Published in International Journal of Trend in Scientific Research and Development (ijtsrd), ISSN: 2456-6470, Volume-6 | Issue-4, June 2022, pp.776-785, URL: www.ijtsrd.com/papers/ijtsrd50084.pdf

Copyright © 2022 by author(s) and International Journal of Trend in Scientific Research and Development Journal. This is an Open Access article distributed under the terms of the Creative Commons Attribution License (CC BY 4.0) (<http://creativecommons.org/licenses/by/4.0>)



the mother[1]. Hence, it is considered important to nourish the mother during lactation, particularly in the first two or three days after delivery. Every mother is taken care of by her mother and/or mother-in-law.

Special foods are generally given during the postpartum period that tend to be energy dense as they are made from dry fruits, nuts and seeds, cereals/ millets and large amounts of ghee[2]. Many such preparations also include plant materials/ herbs. Some of these are believed to be galactagogues, but many of the herbs that are used in preparation are likely to have anti-bacterial or other properties[3].

In the Gujarat state in India, particularly in the Saurashtra and Kutch region, a preparation known as '*Katlu*' (Plate 1), also called '*Batrisu*' is a traditional food given to lactating mothers. A similar preparation is also used in Maharashtra state. It is known as *Balant* (the woman who has delivered) *Battisa* (32-herb containing preparation). It is also consumed during winter by people of all ages and regardless of the physiological state, as a protection against the cold weather. The polyherbal mixture is mixed with a sweet preparation that contains wheat flour, ghee, and jaggery. An internet search using the key words *Balant Battisu* yielded 314 results in 30 seconds. Similarly, the key word *Katlu* gave 7,14,000 results in 47 seconds, whereas *Batrisu* yielded 5070 results in 32 seconds. Most of these are posts by dealers who market this polyherbal formulation and many posts as well as YouTube videos describe the benefits of using it. However, none of these cite any scientific literature and there is little information about the preparation of *Katlu* and its possible benefits available in the published literature. Therefore, we undertook the present investigation to study the composition of '*Katlu*' and to extract information from the Ayurvedic texts and scientific studies on the health benefits of the various herbs that are used in its preparation.

METHODOLOGY

Study location

The study was conducted in the cities of Junagadh and Ahmedabad, Gujrat state and Mumbai in Maharashtra state.

Sample for the study

Twenty-five shopkeepers/ medical stores that sold the *katlu* powder were contacted to obtain information about *katlu*. From these, twelve shopkeepers consented to give the required information. Also, the investigator (NR) had written in two Gujrati newspapers '*Fulchhab*' and '*Gandhinagar Samachar*' requesting readers to share information about the composition of *Katlu* and its preparation. Two readers contacted the investigators and information about the composition of *Katlu*. In addition, five dealers of *katlu* powder were

identified via internet and the ingredients listed on the labels were recorded.

Data collection

An interview schedule was used to obtain information regarding the composition/ contents of *katlu*. Interviews were conducted in Gujrati language, as the respondents were comfortable conversing in their mother tongue.

Ethics approval

The study was approved by the Inter System Biomedica Ethics Committee (letter no. ISBEC/NR-52/KM-JVJ/2013 dated 6th May, 2013).

RESULTS

Composition of Katlu

The composition was compared with a reference composition that was compiled by the investigators based on the diary of a Vaidya from Saurashtra region where *katlu* is prepared traditionally. Also, information was gleaned from a YouTube video[4]. A total of 31 plant materials were identified and the 32nd ingredient was dry coconut.

Further, based on the information given by the 12 dealers who were personally interviewed and the label information of five brands that were advertised on the internet, ingredients listed by them were compared with the reference list. Table 1 lists the number of dealers who named the different plant materials as being present in the commercially available *katlu* powder. Long pepper/ *Pippali* (*Piper longum*) was universally mentioned by all 17 dealers and dry ginger/ *Sunthi* powder (*Zingiber officinalis*) was listed by all except one dealer. *Shatavari*/ Asparagus (*Asparagus racemosus*) was commonly used.

Other ingredients that were most commonly mentioned were *Kali Maril*/ Black Pepper (*Piper nigrum*), *Kali Musali* (*Curculigo orchoides*) and *Bada Gokharu* (*Pedaliium murex*). Ten dealers listed Nutmeg/ *Jatiphall*/ *Jayphal* (*Myristica fragrans*), Cinnamon/ *Dalchinil*/ *taj* (*Cinnamomum cassia*), *Suvadana* (*Peucedanum graveolens*), and *Gunda* (*Balsamodendron mukul hook*). Approximately half of the dealers listed 11 herbs/ plant materials such as Fennel/ *Saunfl*/ *Variyali* (*Foeniculum vulgare*), Poppy Seeds (*Papaver somniferum*), *Kaunch* (*Mucuna pruriens*), Fenugreek/ *methi* (*Trigonella foenum graecum*), Clove (*Caryophyllus aromaticus*), Turmeric/ *Haldi* (*Curcuma longa*), *Baldanal*/ *balbij* (*Sida cordifolia*), and *Tamalpatra* (*Cinnamomum tamala*). Eleven other plants were listed by six or less than six dealers (Table 1). Three ingredients that were not found in the diary or in the formulation given in the video were *Indigofera trifoliata* (Three leaf indigo/ *Vekaryo*/ *Vekariya*/ *kathi*), *Asparagus adscendens*

(*Safed musali*) and *Cassia absus* (*Chimad/ chaksu*). These were listed by 9, 8 and 7 dealers respectively.

Besides the herbs listed in Table 1, use of other plant materials was mentioned such as bay leaf (*Laurus nobilis*, n=2), *vaskapoor* (edible camphor, n=2), *vavding* (*Embelia ribes*, n=2), Cardamom (*Elettaria cardamomum*, n=2), *Anatamul/* Indian sarsaparilla (*Hemidesmus indicus*, n=2). Besides these, a variety of other plant materials are used in the commercial formulations such as *salamdanal gaamdol* (*Orchis musculam*), *kolanjan/ kulanjan* (galangal/ *Alpinia galangal*), Indian arrowroot lily/ *chavar* (*Taeonia officinalis* Linn, *ud salap*), *Suranjan/ hirantutya* (*Colpsitum luteum*), Red/ dalmatian sage/ *Lal bahman* (*Salvia haematodes* Linn), *Ikshural/ Ikshugandha* (*Hydrophila spinosa*), wild guava/ *kumbhi* (*Careya arborea*), liquorice/ *Mulethi* (*Glycyrrhiza glabra*), Quince/ *behidana* (*Cydonia oblonga*), *akkalkarol/ akkalgarol/* Spanish chamomile (*Anacyclus pyrethrum*), white *behen* (*Centaurea behen*), Indian laurel/ *saj* (*Terminalia tomentosa*), False black pepper/ *vidang/ vavding* (*Embelia ribes*). One product label even listed oats as an ingredient (*Avena sativa*).

Other information obtained

Eight of the 12 shopkeepers prepared the powder themselves, and the other four were bulk producers. When they were asked whether the product was sold seasonally, all dealers stated that the powder was sold throughout the year. and seven of them reported that it is used more in winter, when sale of the *katlu* powder is more. All of them stated that use of this powder is not restricted to only lactating women. According to the shopkeepers, the *katlu* powder has a good shelf life.

Method of preparation

Generally, '*katlu*' is sold in the form of a dry powdered mix. This mix is added to a preparation called '*Golpardi*', a traditional sweet made by roasting

whole wheat flour in ghee and then adding jaggery to the mix and shaping it into squares (Plate 2). The *golpardi* is often garnished with poppy seeds, and/ or desiccated coconut. Often, almonds and/ or cashew nuts are also added by the families at the time of preparation. This preparation was standardized in our laboratory without the incorporation of cashew nuts and almonds and the nutritive value was calculated using the database for Indian foods[5]. The nutrient content per 100 g of the product was: Energy – 554 kcal, Protein – 5.12 g, Fat – 34.78g, Total Carbohydrate – 54.1 g, Iron – 3.24 mg, Calcium – 51.1 mg, and Zinc – 1.38 mg.

Descriptions on the internet have recommended use of additional ginger powder, fennel seeds powder, dill seeds powder, poppy seeds powder, almond and pistachio powder, *gond* i.e., edible gum after frying, in equal proportions (one cup each) to be used with 2 Tbsp of the *katlu* powder. In addition, one tsp of saffron and one Tbsp of turmeric is recommended, although *katlu* powder contains all of these except saffron. In one recipe, the author has recommended the use of half a teaspoon of chilli powder to ward off the 'evil eye'. Plate 2 shows the *Katlu* laddu prepared in our laboratory.

The properties ascribed to the herbs in Ayurveda and evidence provided through scientific studies reported in the literature each of the ingredients have been summarized in Table 2.



Plate 1: Image of *Katlu*

Table 1: Ingredients used in *katlu* preparation and number of shopkeepers listing various ingredients

Sr. No.	Ingredient mentioned in Reference Composition	Number of dealers
1	Piper longum (Long pepper/Piper root, Ganthoda/ Pipramul)	17
2	Zingiber officinale (Dry ginger/ sunthi)	16
3	Asparagus racemosus (Shatavari)	15
4	Piper nigrum (Kali mari/ Black pepper)	14
5	Curculigo orchoides (Kali Musali)	14
6	Pedaliu murex (Bada Gokharu)	13
7	Lepidium sativum (Garden cress seeds/ Aseliyo/ Aliv)	11
8	Withania somnifera (Indian ginseng/ winter cherry/ Ashwagandha)	11
9	Myristica fragrans (Jaiphal/ Nutmeg/ Mace)	11
10	Cinnamomum cassia/ Cinnamomum zylanicum (Dalchini, taj)	10
11	Peucedanum graveolens (Suwadana/ Dill seeds)	10
12	Acacia Senegal (Gum acacia/ Gond/ Gunda/ Edible gum)	10
13	Foeniculum vulgare (Fennel/ Saunf/ Variyali)	9

14	Papaver somniferum (Poppy Seeds/ Khus khus)	9
15	Mucuna pruriens (Kaunch/ Kruancha beej)	9
16	Trigonella foenum graecum (Fenugreek/ methi)	9
17	Caryophyllus aromaticus (Clove/ Lavang)	9
18	Curcuma longa (Turmeric/ Haridra/ Haldi)	8
19	Sida cordifolia (Bala/ Baldana/ balbij)	7
20	Cinnamomum tamala (Tamalpatra)	7
21	Coriandrum sativum (Coriander/ Dhania/ Dhanvak)	6
22	Smilex china (Chopchini)	6
23	Mesua ferrea (Nag kesar)	5
24	Zanthoxylum clava (Tejbal/ Tejpatra)	5
25	Amomum subulatum (Big cardamom/ Badi elaichih/ Brihat ela)	5
26	Cuminum cyminum (Cumin/ Jeera)	4
27	Trachyspermum ammi (Ajwain/ Ajmoda)	4
28	Pueraria tuberosa (vidarikand/ Indian kudzu)	4
29	Plantago ovata (Isabgul/ Psyllium)	4
30	Sphaeranthus indicus (East Indian globe thistle/ Gorukhmundi)	3
31	Piper chhaba (Chavak)	3
32	Cocos nucifera (Dry coconut/ narikel/ copru)	



Plate 2: Image of Golpapdi

There appear to be six main benefits such as being anti-inflammatory, strength enhancement, galactagogic effect, warming or cooling effect and may be involved in prostaglandin synthesis (Figure 1). Some of the ingredients as shown in Table 2 also have an influence on the uterus such as *Trigonella foenum graecum*, *Mucuna pruriens*, *Peucedanum graveolens*/ *Anethum graveolens*, *Curcuma longa*, *Foeniculum vulgare*, and *Piper chhaba*.

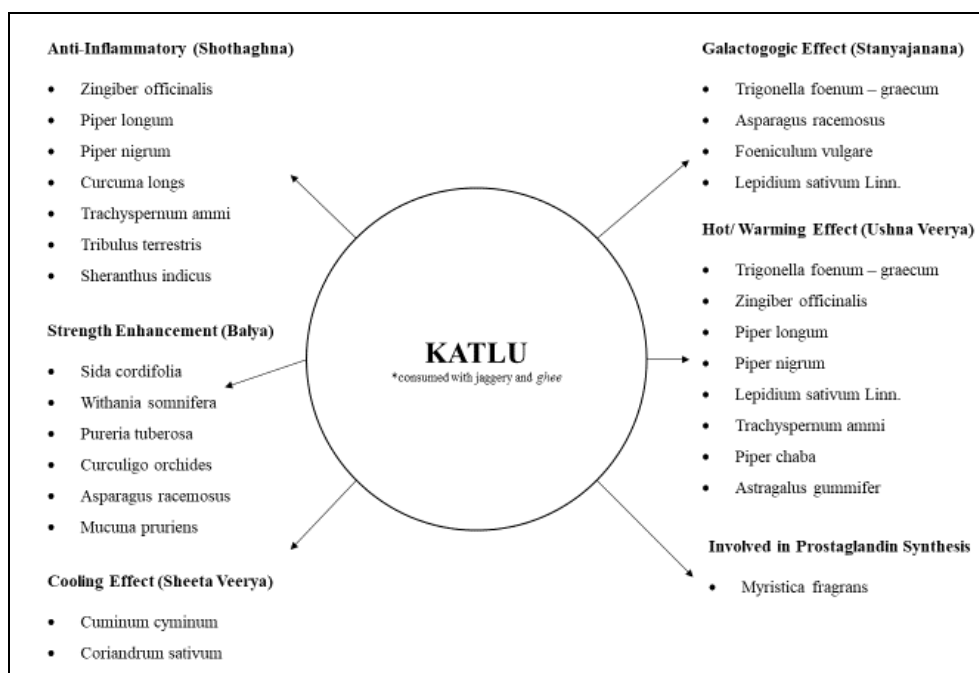


Figure 1: Health Benefits of Katlu

Table 2: Common ingredients used to prepare *katlu* powder and their health benefits as per Ayurveda

Sr. No.	Ingredient	Properties ascribed in Ayurveda 'Dravyaguna' Shastra	Reference
1	<i>Zingiber officinale</i> (Dry ginger/ <i>sunth</i>)	Appetizer, Anti-microbial, useful in cough, and 'Kapha' & 'Vata' problems.	6, 7, 8
2	<i>Asparagus racemosus</i> (<i>Shatavari</i>)	Foetal tonic, Galactagogue and aphrodisiac, Gives strength, Used as a Rasayana, an adaptogen	6, 7, 8
3	<i>Piper longum</i> (Piper root, <i>Ganthoda</i>)	Appetizer, digestive, Balances "kapha" and "vata" dosha.	6, 7, 8
4	<i>Pedaliu murex</i> (Large Caltrops/ <i>Bada Gokharu</i>)	Used as a tonic, diuretic, used in diseases of the reproductive organs, vaginal disorders, postnatal discharges. Gives strength	6
5	<i>Piper nigrum</i> (black pepper)	Stimulant, tonic for nerves, useful in hepatitis, balances 'kapha' and 'vata' dosha.	6
6	<i>Curculigo orchioides</i> (Golden eye grass, <i>Kali Musali</i>)	Rejuvenating, anabolic and has tonic properties. Gives strength, Used as a Rasayana, as an adaptogen.	6
7	<i>Myristica fragrans</i> , (<i>Nutmeg/ Jaiphal/ Mace.</i>)	Slightly sedative, digestive, nerve tonic.	6
8	<i>Commiphora wightii</i> (<i>Balsamodendron mukul hook/ Gunda</i>)	Useful as a tonic, applied on wounds, useful in anaemia, Maintains balance of all three 'doshas'. Generally added to <i>laddus</i> prepared at home.	6
9	<i>Lepidium sativum</i> (Garden cress seeds/ <i>Aseliyo</i>)	Considered to be nutritious, acts as a galactagogue, gives strength, acts as an analgesic	9
10	<i>Withania somnifera</i> (<i>Ashwagandha</i>)	Tonic properties, used as 'Rasayana'. Used as an adaptogen and immunomodulator. Maintains balance among doshas. Used to increase fertility. Gives strength	6
11	<i>Trigonella foenum graecum</i> (<i>Fenugreek/ methi</i>)	Galactagogue, used in uterine inertia, purifier, and maintains a balance between <i>vata dosha</i> and <i>kapha dosha</i>	6
12	<i>Cinnamomum cassia</i> , (<i>Cinnamon/ Dalchini/ taj</i>)	Appetizer, Digestive, carminative, liver stimulant, cardio stimulant, blood purifier, useful in infertility	6
13	<i>Papaver somniferum</i> (Poppy Seeds)	Used as a sedative, helps in weight gain, Gives strength	6
14	<i>Mucuna pruriens</i> (Velvet bean/ <i>Kaunch</i>)	Tonic for neurons, kills roundworm, useful in oligospermia and impotence, relieves vaginal laxity, expedites labour. Gives strength	6
15	<i>Peucedanum graveolens/ Anethum graveolens</i> (<i>Suvadana/ dill</i>)	Galactagogue, Appetizer, digestive, especially used in the postpartum period to help the uterus regain its shape.	6
16	<i>Indigofera trifoliata</i> (<i>Vekaryol/ Three leaf indigo</i>)	Good for postpartum health	
17	<i>Asparagus adscendens</i> (<i>Safed musali</i>)	Highly nutritive, used in impotence, diarrhoea, postpartum health.	6
18	<i>Cinnamomum tamala</i> (Bay leaf/ <i>Tamalpatra</i>)	Used as a galactagogue, for uterine inertia, Also helpful to improve fertility, in habitual abortion, amenorrhea	6
19	<i>Cassia absus</i> (<i>Chimed</i>)	Applied over wounds, ulcers of genital organs, applied in eye infections like conjunctivitis	
20	<i>Sida cordifolia</i> (Flannel weed/ <i>Baldana</i>)	Nutritious, 'Rasayana'. Balances <i>kapha</i> and <i>vata dosha</i> . Gives strength.	6
21	<i>Caryophyllus aromaticus</i> (<i>Clove/ Lavang</i>)	Digestive, Appetizer, Analgesic	6

22	<i>Piper longum</i> (Lindi piper/ Indian long pepper)	Rejuvenator, Useful in painful labour, brain tonic, Used in <i>rasayana</i> therapy, carminative, analgesic, mild laxative, Regulates liver and spleen function, cough medicine.	6, 7, 8
23	<i>Curcuma longa</i> (Turmeric/ <i>haldi</i>)	Appetizer, laxative, analgesic, reduces pain, promotes circulation, anti-diuretic, has purifying effects on the uterus and breast milk. Antiseptic	
24	<i>Foeniculum vulgare</i> (Fennel/ <i>Saunfl Variyali</i>)	Appetizer, digestive, galactagogue, helps the uterus regain its shape	6
25	<i>Smilax china</i> (China root/ <i>Chopchini</i>)	Used as ' <i>Rasayana</i> '. Useful in leucorrhoea	6
26	<i>Cocos nucifera</i> (Dry coconut)	Good source of fat and minerals.	6
27	<i>Mesua ferrea</i> (Ceylon ironwood/ <i>Nag kesar</i>)	Anti-microbial, anti-pyretic, anti-inflammatory, anthelmintic activity	6
28	<i>Cuminum cyminum</i> (Cumin seeds/ <i>Jeera</i>)	Appetizer, digestive, carminative, analgesic, astringent, blood purifier, used in the inflammation of uterus, galactagogue and aphrodisiac, gives strength	6
29	<i>Coriandrum sativum</i> , (Coriander/ <i>Dhania</i>)	Galactagogue, diuretic, useful in summer, astringent, appetizer, digestive, liver stimulator, brain tonic.	6
30	<i>Amomum subulatum</i> (Greater or black/ <i>Badi elaichi</i>)	Used as a mouth freshener, deodorant, appetizer, digestive, laxative, diuretic.	6
31	<i>Zanthoxylum clava</i> (Pepperwood/ Southern prickly ash/ <i>Tejbal</i>)	Antiparasitic, stimulant, prevents necrosis, cardiac stimulant, diuretic.	
32	<i>Trachyspermum ammi</i> / <i>Carum copticum</i> (Carom seeds/ <i>Ajwain</i>)	Used as digestive, and for pain relief.	6
33	<i>Pueraria tuberosa</i> (Indian kudzu/ <i>vidarikand</i>)	Anabolic, stimulates bile production, carminative, cardio tonic, haemostatic, demulcent, aphrodisiac, galactagogue, diuretic effects, rejuvenator	7
34	<i>Plantago ovata</i> (<i>Psyllium</i> / Isabgul)	Acts as a laxative, said to cure ulcers, used in summer for relief from dehydration. Refrigerant, reduces thirst. Seeds are useful in acute and chronic dysentery.	6
35	<i>Sphaeranthus indicus</i> (East Indian Globe Thistle/ <i>Gorakhmundi</i>)	Nerve tonic, analgesic, used for lethargy, epilepsy, appetizer, digestive, laxative, loss of appetite, jaundice, cardiac problems, gout	6
36	<i>Piper chhaba</i> (Piper chili/ <i>Chavak/ Gujj Pipal</i>)	Used in the postpartum period for purification of the uterus, prevents fever after delivery	6

DISCUSSION

'*Katlu*' or '*Battrisu*', that literally means 32, is a polyherbal formulation that is given to mothers after delivery. While this is made in Gujarat, one of the western states in India, similar preparations are used in other states for the same purpose. In Maharashtra, the state adjacent to Gujrat, *Battisa* and *Balant Battisa* are given to mothers after delivery. In Rajasthan, the same preparation is known as *Battisa*. As in the case of *Katlu/ Battrisu*, *Battisa* means that the preparation has 32 ingredients. While *laddu* or *pak* are the food vehicles for this polyherbal formulation in all three

states, in Maharashtra, it is also given in the form of a *kadha*, a liquid preparation.

At the community level, these preparations are believed to have several benefits. Besides serving as a galactagogue, ingredients like the *gond* i.e., Gum acacia confer benefits such as relieving back pain, warming the body. In an online blog, Route to Roots[10], the author has stated that long pepper and dry ginger have warming properties and that the dill seeds, poppy seeds and dry coconut promote lactation.

The findings of our study indicate that although the original polyherbal formulation contains 32 herbs, presently almost half the herbs/ plants do not seem to be used in the commercial preparations. Overall, besides edible gum, only approximately 10 herbs are commonly used particularly dry ginger, long pepper/ *Piper longum*, *Shatavari*, garden cress seeds, etc. Each of these ingredients has special beneficial properties. Among these, *Shatavari* (*Asparagus racemosus*), fenugreek seeds and garden cress seeds are used as galactagogues in other communities as well[11].

A wide variety of herbs have been used as galactagogues since ancient times[12]. Mortel and Mehta (2013)[13] in their systematic review on the efficacy of herbal galactagogues observed that some of the herbs may be prescribed as alternatives to domperidone. In many countries, herbs or various foods are used as galactagogues. Some herbs that are used include fenugreek, goat's rue, milk thistle (*Silybum marianum*), oats, dandelion, millets, seaweed, anise, basil, blessed thistle, fennel seeds, and marshmallow among others[14]. Nice (2015)[15] reported that a wide variety of foods and herbals are used for their galactagogic properties. These include alfalfa, almonds, anise, asparagus, barley, basil, beets, borage, caraway, carrots, chaste tree fruit, cherries, chicken broth/soup/stock, chickpeas (garbanzo beans), coconut, coriander seeds, cumin, dandelion, dill, fennel, fenugreek, flax seeds, garlic, ginger, goat's rue, green beans, hibiscus, hops, lemon balm, lentils, lettuce, *malunggay*/ drumstick (moringa), marshmallow root, millet, molasses (blackstrap), mung, mushrooms, nettle, oat straw (oats), papaya, peas, pumpkin, quinoa seeds, red clover, red raspberry, rice, sage, seaweed soup, sesame seeds, spinach, sunflower seeds, sweet potatoes, thistles, turmeric, and vervain. Many of these components, e.g., dill, fennel, fenugreek, turmeric, coriander seeds, and cumin are also used in the *katlu* powder.

Sim et al., (2013)[16] reported that in Western Australia, a little more than half of the 304 respondents surveyed, used one or other herbal medicine while breastfeeding. Many of these were herbs with potential medicinal properties. The ten most commonly used herbs were fenugreek, ginger, dong quai (*Angelica sinensis*), chamomile (*Matricaria chamomilla*), garlic (*Allium sativum*), blessed thistle (*Cnicus benedictus*), cranberry (*Vaccinium macrocarpon*), fennel (*Foeniculum vulgare*), aloe vera and peppermint. Other herbal galactagogues included goat's rue (*Galega officinalis*), nettle (*Urtica dioica*), blackthorn berry (*Prunus spinosa*), and *Shatavari* (*Asparagus racemosus*).

Dandotiya, Singh and Kashaw (2013)[17] reported that in different tribal communities from different states of

India, a variety of materials are used such as *Asparagus racemosus*, *Arundinella setosa*, *Alstonia scholaris*, *Curculigo orchoides*, *Euphorbia hirta*, *Euphorbia fusiformis*, *Piper nigrum*, *Ricinus communis*, *Tinospora cordifolia*, *Nigella sativa*, *Madhuca longifolia*, *I. frutescens*, *Nigella sativa*, *Pheretima posthuman*, and *Pouzolzia zeylanica*. *Katlu* contains some of these herbs. *Asparagus racemosus* is used as a galactagogue in several states including Sikkim, Bihar, Assam, Chhattisgarh, Maharashtra, Rajasthan, and Madhya Pradesh; *Curculigo orchoides* is used in Maharashtra; *Piper nigrum* in Tamil Nadu; and *Tinospora cordifolia* in Gujarat and Rajasthan.

Studies on the effects of some of the ingredients used in *Katlu* have been reported in the literature. Herbal galactagogues have been evaluated for their effect on serum prolactin and oxytocin levels, breast milk volume, infant weight as well as milk composition[13]. An evaluation of a commercial polyherbal tea containing fenugreek and other traditionally used ingredients – fennel, raspberry leaf and goat's rue showed that it augmented milk production within 24-72 hours after consumption. However, since it was a polyherbal formulation, it was not possible to attribute this effect to any single ingredient. As such, no reports could be found in the literature about *Katlu* as a polyherbal formulation.

The herbal ingredients of *Katlu* powder like *Trigonella foenum graecum*, *Asparagus racemosus*, *Lepidium sativum*, *Foeniculum vulgare*, *Peucedanum graveolens*, *Coriandrum sativum*, *Pueraria tuberosa* are said to be galactagogues[18,19]. Among these, fenugreek has received considerable attention. Sakka et al., (2014)[20] evaluated the effect of fenugreek herbal tea on breast milk production by Egyptian mothers and their infants' weights, over 14 days. At 3 days postpartum, the fenugreek herbal tea enhanced breast milk production, although on the 14th day there was no difference between these mothers and those in the control group. Sevrin et al., (2019; 2020)[21,22] using stable isotope labelled water observed that when dams were confronted with increased litter size, fenugreek effectively increased the milk flow. The effect of fenugreek on breast milk production may be attributed to one or more of the following factors: (i) fenugreek stimulates sweat glands, as the breast is a modified sweat gland, fenugreek may stimulate milk production[23], (ii) fenugreek contains phytoestrogens and diosgenin that may exert estrogenic activity[24] and in turn increase prolactin secretion, while decreasing the secretion of dopamine that inhibits prolactin secretion[25], (iii) possibly promotes energy storage. Energy storage may occur because fenugreek may increase food consumption by inhibiting leptin secretion. However, In India, *katlu* powder or

fenugreek are given to lactating mothers along with wheat flour, ghee and jaggery/ sugar. This itself will provide a considerable amount of additional energy that may be stored. Fenugreek also increases the expression of genes involved in *de novo* fatty acid synthesis, uptake of glucose, synthesis of galactose and lactose as well as milk proteins. Another possible advantage mooted by the authors is that “the increased consumption of milk trigonelline by pups during lactation may help them to develop higher insulin sensitivity in the short-term and thus favour long-term glucose metabolism” and is a good source of antioxidants. Some fenugreek constituents may increase the secretion of growth hormone as seen in a rat model²¹. The authors also stated that “fenugreek may act by extending the duration of peak lactation until the beginning of involution rather than intensifying it”[22].

Asparagus racemosus (*Shatavari*) is prescribed by Ayurveda for use in lactation[26]. In rat models, it was found to inhibit involution of lobular-alveolar tissue and maintained milk secretion[27]. Sholapurkar (1986)[28] found that when women who had scanty milk production consumed *Asparagus racemosus* as part of a commercial preparation that contained other herbal substances, milk production was enhanced. A randomized clinical trial conducted by Gupte and Shaw in 2011[29] showed that the root powder had a positive effect on prolactin secretion. Infants of mothers in the intervention group weighed more than those whose mothers were in the control group. The galactagogue effect may be attributed to the steroidal saponins present in the plant.

Fennel (*Foeniculum vulgare*) that is used in *katlu* is also used as a galactagogue, particularly in southern Europe and southwestern Asia. The volatile oil contains anethole, a phytoestrogen. Other components include fenchone, estragole, 1, 8-cineole (eucalyptol), and other constituents. In two studies, the use of fennel as a galactagogue improved milk volume, fat content and infant weight gain but there was no effect on serum prolactin[30]. In small amounts, fennel may not be harmful and it has GRAS status[31]. However, excessive maternal use of herbal tea prepared with fennel, anise and other herbs was reported to cause toxicity in two new-born infants, as it caused allergic reactions such as effects on the respiratory system or skin, including photosensitivity. Side effects have been reported in mothers including diarrhoea, hepatomegaly[32], and elevation in liver enzymes[33,34]. It has been recommended that infants or if their mothers are allergic to plants from the Apiaceae family e.g., carrots, should be advised to avoid fennel, because of possible cross- allergenicity [31].

This aspect also needs to be considered when *katlu* is given to mothers and a monitoring study of mothers who consume this may be undertaken to determine whether this lactational supplement has any side effects, although the amount used is relatively small.

While single individual ingredients have received some attention, *Katlu* the polyherbal formulation has not been studied at all. According to Ayurveda, some of the herbs like *baldana*, *gokharu*, and *vidarikand*, in *Katlu* powder give energy and confer immunity; while dry ginger, pepper and turmeric have anti-microbial properties. *Gokhru* or *Gokshuru* as it is known in Ayurveda, can be *Bada Gokhru* or *Chhota Gokhru* (*Tribulus terrestris* and *Pedaliu murex*). *Gokshru* has been described in Ayurveda as having several medicinal properties including anti-ulcerative, anti-urolithic, anticancer, aphrodisiac, analgesic, anti-hypertensive, diuretic, urinary anti-infective, cardio-tonic, antibacterial, anti-inflammatory, nephroprotective, antispasmodic, anthelmintic, and anti-carcinogenic[35]. Herbs like dill help the uterus regain its shape. Some of them are *Rasayana* and are useful for rejuvenation like *Shatavari*, *Ashvagandha*. Herbs like cumin (*jeera/cumin* seeds), fennel (*saunf*) and carrom seeds (*ajwain*) improve digestion; and *Peucedanum graveolens* (*Suvadana*) and *Cuminum cyminum* (*jeera/cumin* seeds) may improve appetite. Pepper, *kaunch* (*Mucuna pruriens*) and *gorakhmundi*/ East Indian Globe Thistle are said to be nerve tonics. Some of them may help to purify the blood[36].

CONCLUSION

Katlu is a traditional polyherbal formulation commonly consumed as an energy- and protein-dense food supplement, i.e., *laddoo* or *pak*. It may be regarded as a functional food and merits scientific investigation to determine its potential to help overcome widespread undernutrition in Indian women. Furthermore, it is evident that current commercial products contain only about one-third of the herbs that were traditionally used. A comparative study between common commercially used herbs and the traditional formulation is needed to determine its biological effects. If found beneficial for health, *katlu* should be promoted in the community as well as among medical professionals.

ACKNOWLEDGEMENTS

Not applicable

CONFLICT OF INTEREST

The authors declare that they have no competing interests.

AUTHOR CONTRIBUTIONS

AG and SU contributed to the review of literature and writing of the manuscript. AP provided expertise in

Ayurvedic information consolidation about the constituents of *katlu*. NR participated in the data collection. VT prepared *katlu* and *god papdi*, analysed the nutrition profile for both foods. RV mentored the entire project and was a major contributor to its final writing and editing. All authors read and approved the final manuscript.

FUNDING

Not applicable

REFERENCES

- [1] KS. Nagral, "Ayurved for Modern Medical Practitioners", 1st ed. Delhi: Chaukhamba Sanskrit Pratishthan, 2008, pp. 435 – 442.
- [2] N. Kajale, A. Khadilkar, S. Chiplonkar, J. Unni and N. Mansukhani, "Impact of traditional food supplements on nutritional status of lactating mothers and growth of their infants," *Nutrition*, 30 (11-12) (2014) 1360-1365
- [3] H. Dorman and S. Deans, "Antimicrobial agents from plants: antibacterial activity of plant volatile oils," *J. Appl. Microbiol.*, 88 (2) (2000) 308-316.
- [4] Kitchen Series. How to make Katlu Powder (Batisu) at home [Internet]. 2020 [cited 21 January 2022]. Available from: https://www.youtube.com/watch?v=J_MUbaRVb2E
- [5] T. Longvah, I. Anantan, K. Bhaskarachary and K. Venkaiah, "Indian Food Composition Tables," Hyderabad: National Institute of Nutrition, Indian Council of Medical Research, 2017.
- [6] KC. Chuneekar, "Bhavaprakash Nighantu", Varanasi: Chaukhambha Bharati Academy, 1999, pp. 13-20, 25-26, 28, 31, 34-36, 38, 145, 205-208, 216-219, 221, 225, 228, 230, 249-252, 357, 367, 390-394, 413, 559, 812.
- [7] VM. Gogate, "Dravyagunavijnan (Marathi)," 1st ed., Pune: Continental Prakashan, 1982, pp. 251-252, 350-352, 412-414, 620.
- [8] GA. Phadke, "Dravyagunashastra (Sanskrit)," 1st ed., Mumbai: Shuddha Ayurved Pathyakrama, 1960, pp. 153-154, 249-252, 341-345
- [9] MH. Ghante, SL. Badole and SL. Bodhankar, "Health Benefits of Garden Cress (*Lepidium sativum* Linn.)," in Seed Extract, Nuts and Seeds in Health & Disease Prevention, VR. Preedy, RR. Watson and VB. Patel, Eds. London: Academic, 2011, pp. 521 -525.
- [10] Katlu - a traditional recipe for nursing mothers [Internet]. theroute2roots. 2018 [cited 20 January 2022]. Available from: <https://www.theroute2roots.com/katlu-traditional-recipe-for-nursing-mothers/>
- [11] AS. Sathe, "Gharaguti Aushadhe (Marathi)," 6th ed., Mumbai: Ayured Bhavan, 1969, pp. 19.
- [12] P. Anderson, "The Galactagogue Bandwagon," *J Hum Lact*, 29 (1) (2012) 7-10.
- [13] M. Mortel and S. Mehta, "Systematic Review of the Efficacy of Herbal Galactagogues," *J Hum Lact*, 29 (2) (2013) 154-162.
- [14] W. Brodribb, ABM Clinical Protocol #9: Use of Galactagogues in Initiating or Augmenting Maternal Milk Production, Second Revision, *Breastfeed Med*, 13 (5) (2018) 307-314.
- [15] F. Nice, "Selection and Use of Galactagogues," *Infant Child Adolesc. Nutr.*, 7 (4) (2015) 192-194.
- [16] T. Sim, J. Sherriff, H. Hattingh, R. Parsons and L. Tee, The use of herbal medicines during breastfeeding: a population-based survey in Western Australia, *BMC Complement Altern. Med.*, 13 (1) (2013).
- [17] H. Dandotiya, G. Singh, and SK. Kashaw, "The Galactagogues Use by Indian Tribal Communities to Over Come Poor Lactation," *IJBBR*, 4 (3) (2013) 243-248.
- [18] N. Srikanth, N. Haripriya, D. Tewari and AK. Mangal, "Plant-based galactagogues in Ayurveda: A promising move towards drug development," *World J. Pharm. Res.*, 4 (11) (2015) 687-705.
- [19] S. Foong, M. Tan, W. Foong, L. Marasco, J. Ho, et al., "Oral galactagogues (natural therapies or drugs) for increasing breast milk production in mothers of non-hospitalised term infants," *CDSR*, (5) (2020)
- [20] AE. Sakka, M. Salama and K. Salama, "The Effect of Fenugreek Herbal Tea and Palm Dates on Breast Milk Production and Infant Weight," *Journal of Pediatric Sciences*, 6 (2014) e202.
- [21] T. Sevrin, M. Alexandre-Gouabau, B. Castellano, A. Aguesse, K. Ouguerram, et al., "Impact of Fenugreek on Milk Production in Rodent Models of Lactation Challenge," *Nutrients*, 11 (11) (2019) 2571.
- [22] T. Sevrin, C. Boquien, A. Gandon, I. Grit, P. de Coppet, et al., "Fenugreek Stimulates the Expression of Genes Involved in Milk

- Synthesis and Milk Flow through Modulation of Insulin/GH/IGF-1 Axis and Oxytocin Secretion,” *Genes*, 11 (10) (2020) 1208.
- [23] M. Gabay, “Galactagogues: Medications That Induce Lactation,” *J Hum Lact*, 18 (2) (2002) 274-279.
- [24] C. Turkyilmaz, E. Onal, I. Hirfanoglu, O. Turan, E. Koç, et al., “The Effect of Galactagogue Herbal Tea on Breast Milk Production and Short-Term Catch-Up of Birth Weight in the First Week of Life,” *J Altern Complement Med.*, 17 (2) (2011) 139-142.
- [25] S. Sreeja, VS. Anju & S. Sreeja, “In vitro estrogenic activities of fenugreek *Trigonella foenum graecum* seeds,” *Indian J Med Res*, 131 (6) (2010) 814.
- [26] AK. Nadkarni, “Indian Materia Medica,” Vol. 1, (Popular Book Depot), 1954, p.153-155.
- [27] PB. Sabnis, BB. Gaitonde and M. Jetmalani, “Effects of alcoholic extracts of *Asparagus racemosus* on mammary glands of rats,” *Indian J. Exp. Biol.*, 6 (1) (1968) 55-7.
- [28] ML. Sholapurkar, “Lactare-for improving lactation,” *Indian Pract.*, 39 (11) (1986) 1023-6.
- [29] M. Gupta and B. Shaw, “A Double-Blind Randomized Clinical Trial for Evaluation of Galactagogue Activity of *Asparagus racemosus* Willd,” *Iran. J. Pharm. Sci.*, 10 (1) (2011) 167.
- [30] F. Vafaei, S. Valizadeh & Y. Javadzadeh, “The effect of fennel syrup on prolactin levels of blood serum in newly delivered mothers: A triple-blind randomized controlled trial,” *Ann. Trop. Med. Public Health*, 16 (2018) S44389.
- [31] Drugs and Lactation Database (LactMed) [Internet]. Bethesda (MD): National Library of Medicine (US); 2006-. Fennel. [Updated 2022 Jan 18]. Available from: <https://www.ncbi.nlm.nih.gov/books/NBK501793/>
- [32] B. Şahin, N. Kaymaz and Ş. Yıldırım, “Herbal remedies for perceived inadequate milk supply are perhaps not as safe as women think: A brief case report,” *Women Birth*, 29 (6) (2016) e133.
- [33] PO. Anderson, “Herbal use during breastfeeding,” *Breastfeeding Medicine*, 12 (9) (2017) 507-9.
- [34] AL. Silverman, A. Kumar and ml. Borum, Re: “Herbal Use During Breastfeeding” by Anderson (*Breastfeed Med* 2017; 12 (9): 507–509), *Breastfeed Med*, 13 (4) (2018).
- [35] S. Choudhary, H. Kaurav and G. Chaudhary, “Gokhru (*Tribulus Terrestris* and *Pedaliium Murex*): Medicinal Importance of Chota Gokhru And Bada Gokhru In Ayurveda And Modern Science,” *Asian J. Pharm. Clin. Res.*, 14 (6) (2021) 6-13.
- [36] V. Gogte, “Ayurvedic pharmacology and therapeutic uses of medicinal plants” in Dravyagunavignyan, Mumbai: Bharatiya Vidya Bhavan, 2000.