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Studies on Utilization of Adulsa extract, Basil extract and Mint extract based liquid Jaggery Lozenges

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ABSTRACT: The present investigation entitled "Studies on utilization of adulsa extract, basil extract and mint extract based liquid jaggery lozenges" was conducted at Food Engineering department, College of Food Technology, V.N.M.K.V., Parbhani. The treatments were T_0 (liquid jaggery without addition of extracts), T_1 (liquid jaggery with addition of 1% basil extract, 1% mint extract and 0.1 % adulsa extract), T_2 (liquid jaggery with addition of 2% basil extract, 2% mint extract and 0.2 % adulsa extract), T_3 (liquid jaggery with addition of 3% basil extract, 3% mint extract and 0.3 % adulsa extract), T_4 (liquid jaggery with addition of 4% basil extract, 4% mint extract and 0.4 % adulsa extract).All treatments products prepared and subjected to sensory evaluation, best sample was chosen and further analyze for proximate composition, mineral composition and phytochemicals composition. Increase of extracts content significantly affects the taste, flavour, colour and texture of lozenges. Increase in mint extracts to 4% dominates the basil and adulsa extracts and gives stronger taste and flavour of mint extract. Therefore, T_3 was selected and analyzed further. However, T_3 had higher phytochemical composition than control sample. Therefore, the presence of phytochemicals makes lozenges rich in therapeutic value and replacing sugar with liquid jaggery is a healthier option.

Keywords: Liquid jaggery, mint extract, adulsa extract, basil extract, lozenges, phytochemicals.

INTRODUCTION

Traditional medical practitioners frequently use medicinal plants to treat a variety of diseases in their daily work (Pattanayak *et al.,* 2010). Tulsi is a revered plant in Hinduism that is popular throughout India. Tulsi derived from Sanskrit word which means "incorporable one" or "matchless one" (Jain, 2015). In the ayurveda tulsi is known for its healing powers and treat many different illnesses hence it is often referred to as an Elixir of Life (Patel, 2020). Tulsi consists of bioactive substances such methyl chavicol (15–27%), linalool (30–40%), and eugenol (8–30%) (Zhelijazkov *et al.,* 2008). *Adhatoda vasica*, commonly known as Vasaka in Ayurveda, belongs to the family Acanthaceae. The plant adulsa is a good source of pyrroloquinazoline alkaloids, the primary components of which include vasicine, vasicol, adhatonine, vasicinone, vasicinol, and other extracts. The plant *Adhatoda vasica* has been used to treat a variety of chest and respiratory diseases (Maikhuri and Gangwar 1993).

Mentha piperita (Mentha, or mint) belongs to the *Lamiaceae* family and has been used commercially in a variety of fields, including food, medicine and ornamental uses (Nieto, 2017). It has been shown to be effective in battling intestinal parasites and digestive problems. (Hanafy, 2018). It is also recognized as a common herbal medicine for anorexia, ulcerative colitis, nausea, and anorexia nervosa because of its many therapeutic characteristics. (Brahmi *et al.,* 2017). It has also been demonstrated that many Mentha species essential oils and extracts have antibacterial and antioxidant effects. Its two main constituents are menthol (40.7% of the extract's contents) and menthone (23.4%). Peppermint oil is commonly used as a flavoring in foods and drinks (Khanal, 2019).

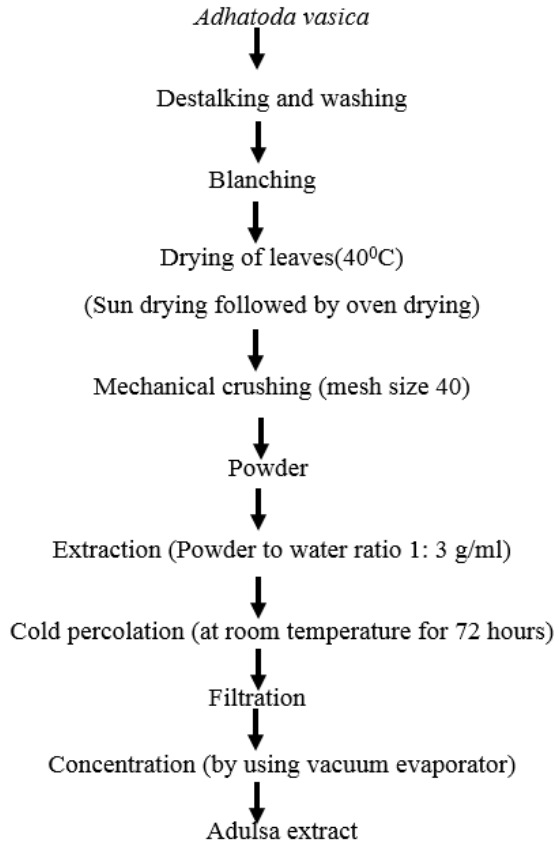
Jaggery is considered to be very beneficial in Indian culture. A multitude of health benefits come from eating jaggery. Natural sweeteners like jaggery are well-known. In our modernized day, sugar has mostly taken the role of jaggery, especially in cities, however almost every household in our countryside still consumes it. Sugar is not as good for us as jaggery. (Vijayvargiya, 2021). After being clarified, sugarcane juice is condensed to produce Liquid Jaggery, a semi-liquid substance. Many ayurvedic medicines have

employed liquid jaggery from the beginning of time (Hunsigi, 2001). Lozenges are solid medications meant to dissolve or disintegrate gradually in the mouth. Different lozenges are regularly used to treat coughs and sore throats. Lozenges are slowly dissolved in the mouth to stop coughing, ease throat irritation, and provide a soothing effect (Kumar *et al.*, 2019).

METHODOLOGY

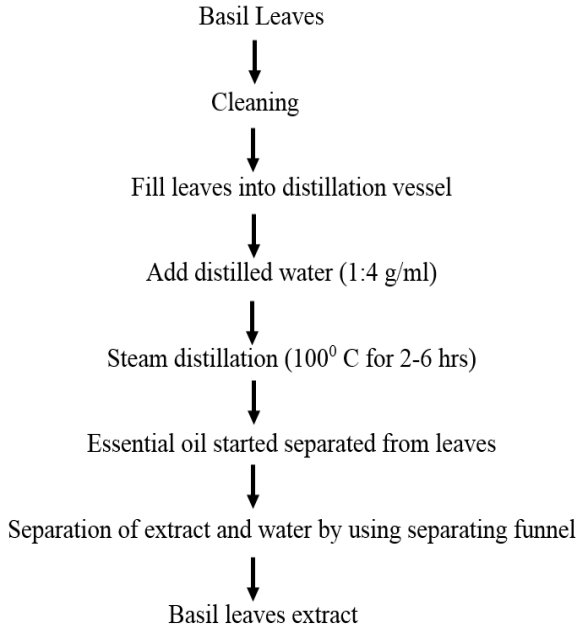
The present investigation was carried out in Department of Food Engineering, College of Food Technology, VNMKV, Parbhani during year 2022-2023. Fresh adulasa leaves were obtained from the Dept of Botany, College of Agriculture, VNMKV, Parbhani. Other raw materials like liquid jaggery, basil leaves and mint leaves were procured from the local market.

Preparation of adulsa leaves extract. Adulsa leaves extraction were carried out by Cold percolation method. Fresh leaf samples of *Adhatoda vasica* (adulasa) were cleaned, dried in the sun, and then drying in an oven at 40^0C. Finally, the samples were crushed and turned into powder. The leaf was mechanically crushed (mesh size 40), extracted with water in the proportion of 1:3 g/ml at room temperature for 72 hours, and then filtered. Adulsa leaves extract prepared as per the method given by Gedam *et al*. (2017).



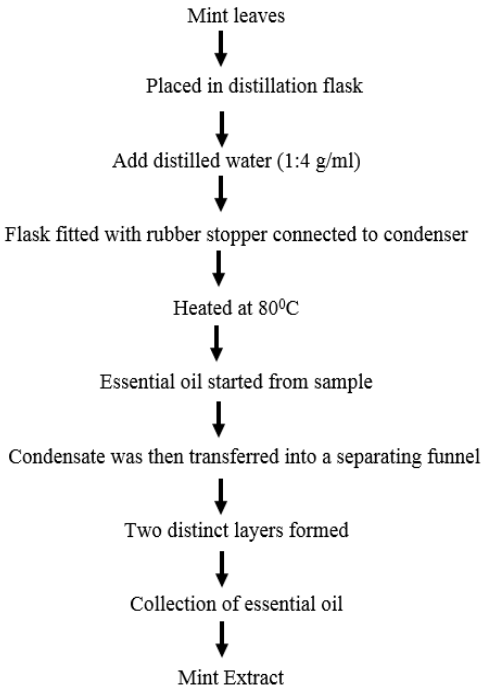
Flow sheet 1: Preparation of adulsa leaves extract.

Preparation of basil leaves extract. Basil leaves were sorted, after being sorted, basil leaves were cleaned with potable water to get rid of any dirt. The extraction of basil leaves was made using the steam distillation procedure. Basil leaves and distilled water were added to the distillation vessel in the ratio of 1:4g/ml. For 2 to 6 hours, heating was done at 100^0C. A separating funnel was used to separate the essential oil from the leaves. Basil leaves extract prepared as per the method given by Thombre and Sapkal (2019) and Nguyen *et al*. (2022).



Flow sheet 2: Preparation of basil leaves extract.

Preparation of Mint extract. Mint leaves extract was carried out by using steam distillation process. Mint leaves were added to the distillation flask, followed by distilled water in the proportion of 1:4 g/ml. Heating took place at 80^0C. Extract and water molecules were then separated using a separating funnel after the essential oil was extracted from the leaves. Mint leaves extract prepared as per the method given by Ibrahim *et al.* (2021).



Flow sheet 3: Preparation of mint leaves extract.

Methodology for preparation of jaggery lozenges. All of the ingredients were combined together for the

jaggery lozenges according to the specified ratio. The liquid jaggery served as the base for the jaggery lozenges, which further included varying concentrations of extracts from mint, basil, and adulsa. The formulation consisted of liquid jaggery, liquid glucose, gaur gum, tulsi extract, adulsa extract, and mint extract. As the combination heated to 110°C, it was continually mixed and put through a drop test. After turning off the heat, the mixture was poured into a mold in the shape of a lozenge. After that, the mold was allowed to cool and harden at ambient temperature. After cooling, the hard lozenges were coated with powdered sugar to prevent sticking in humid settings.

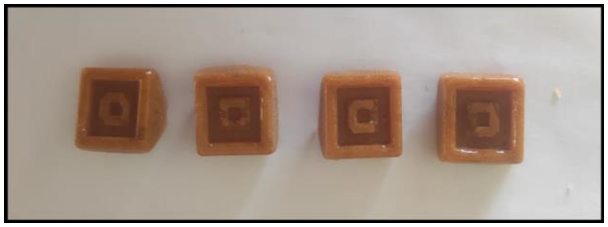


Fig. 1. Hard candy square shaped lozenges.

Formulation of treatments for lozenges

Control (T_0): 90% Liquid jaggery+ 9.8% liquid glucose+ 0.2% guar gum without addition basil extract, adulsa extract and mint extract**.**

T_1: 90% Liquid jaggery + 9.8% liquid glucose+ 0.2% guar gum+ 1% basil extract + 1%mint extract+ 0.1% adulsa extract

T_2: 90% Liquid jaggery+ 9.8% liquid glucose+ 0.2% guar gum+ 2% basil extract+ 2%mint extract+ 0.2% adulsa extract

T_3: 90% Liquid jaggery+ 9.8% liquid glucose+ 0.2% guar gum+ 3% basil extract+ 3%mint extract+ 0.3% adulsa extract

T_4: 90% Liquid jaggery+ 9.8% liquid glucose+ 0.2% guar gum+ 4% basil extract+ 4%mint extract+ 0.4% adulsa extract

On the basis of sensory evaluation the sample T_3 containing 3% basil extract, 3% Mint extract and 0.3% adulsa extract was found to be statistically significant over sample T_1, T_2 and T_4 samples.

Phytochemical analysis

Leaf extraction yield of basil extract, adulsa extract and mint extract

Determination of Percentage yield. The yield of extract of plant was calculated by using formula**:**

$$\text{Percentage yield} = \frac{\text{Weight of extract}}{\text{Weight of raw material taken}} \times 100$$

Table 1: Leaf extraction yield of basil extract, adulsa extract and mint extract.

Extracts	Extraction yield (%)
Basil	5
Adulsa	27.1
Mint	1.36

The extraction yield of the aqueous basil leaf extract, as seen in the table, was 5%. This result and the one published by Borah and Biswas (2018) were found to be more or less equivalent. The extraction yield of aqueous adulsa leaf extract was 27.1%, and Gedam *et al*.'s (2017) findings verify this. Aqueous mint leaf extract had an extraction yield of 1.36%. and this result was found less or more similar with result reported by Ibrahim *et al*. (2021).

Phytochemical screening of basil leaves adulsa leaves, mint leaves extracts and liquid jaggery. The plant extracts obtained by using different extraction process and it is subjected to different phytochemical tests to identify the plant constituents by using standard following methods Khandelwal (2005); Kokate (2011).

Test for Alkaloids.

Dragendorff's test: Taken a few mg of extracts sample and dissolved in 5ml water. Then 2 M hydrochloric acid added until an acid reaction developed. In this mixture,1ml of dragendorff's reagent (potassium bismuth iodine solutions) was added. If alkaloids present in sample extracts, it formed orange red precipitate.

Test for total phenols

Ferric chloride test: Take 3 ml of the given solution in a test tube and add freshly prepared neutral ferric chloride solution in it dropwise. If the colour of the solution becomes blue, green, violet, or red, this indicates the presence of a phenol group.

Test for Flavonoids

Shinoda test: Taken the alcoholic sample extract in the test tube and 5-10 drops of hydrochloric acid added in the sample. Then small pieces of magnesium added in tubes. Reddish pink or brown colour was indicated the presence of flavonoids.

Test of Saponins

Foam test: 1ml of alcoholic sample extract was taken and diluted with 20ml of distilled water. This solution was Shaked for 15 min in graduated cylinder. If saponins present in the extracts, it generates foam layer of 1cm.

Table 2: Phytochemical screening of basil leaves adulsa leaves and mint leaves extracts and liquid jaggery.

Phytochemical constituents	Basil extract	Adulsa extract	Mint extract	Liquid jaggery	Name of the test
Alkaloids	+	+	+	-	Dragendroff's test
Total Phenol	+	-	+	+	Ferric chloride test
Flavonoids	+	-	+	+	Shinoda test
Saponin	-	-	-	-	Foam test

Where + =Present and - = Absent

Basil extract, adulsa extract, mint extract, and liquid jaggery all showed either the presence or the absence of phytochemical elements by phytochemical testing. When extracts were screened for alkaloids using Dragendroff's method, alkaloids were found in every extract. Total phenols were detected in both basil extract, mint extract, and liquid jaggery using the ferric

chloride test, which was used to screen the extracts for total phenols. When extracts were subjected to the Shinoda test to check for flavonoids, flavonoids were found in the basil, mint, and liquid jaggery extracts; however, when the extracts were subjected to the Foam test to screen for saponin, saponin was not found in any of the extracts.

Quantitative phytochemical analysis of basil extract, adulsa extract and mint extract

Determination of total phenolic content. Total phenolic content was determined by the modified Folin-Ciocalteu colorimetric method based on the oxidation-reduction reaction. The stock solutions of hexane, chloroform, and methanol extracts were prepared by dissolving 100 mg in 1 mL of their mother solvents. Serial dilutions were carried out to get the concentrations of 0.125, 0.25, 0.5 and 1.0 mg/mL. 1.0 mL of each solution was taken in a test tube, and 5 mL of 10% Folin-Ciocalteu reagent was added on it. After five minutes, 4 mL of 7% Na_2 CO_3 was added to the mixture. The mixture was shaken well and allowed to incubate for 30 minutes at 40 ºC for blue color development. The absorbance was measured at 760 nm against blank using a double beam UV/Visible spectrophotometer (UV professional double beam, Shimadzu made). Total phenolic content was determined as mg/g of gallic acid equivalent (mg of GAE/g of dry extract) by using the equation obtained from a standard gallic acid calibration curve y=0.014x, R2 =0.9951.

Gallic acid calibration curve The Gallic acid calibration curve was prepared by the Folin-Ciocalteu reagent method with modification. Gallic acid (10 mg) was dissolved in methanol (1 mL). It was a concentration of 10mg/mL. It was diluted by adding methanol to prepare serial concentrations 10, 25, 50 and 100µg/mL. The above same procedure was followed for gallic acid standard. The absorbance was measured for all standard solutions by using UV spectrophotometer (UV professional double beam, Shimadzu made) at a constant wavelength of 760 nm. (Pathak and Niraula 2019).

Determination of total flavonoid content: The total flavonoid content of extracts was estimated by the aluminum chloride colorimetric method with some modifications. Stock solutions of all three extracts were prepared by dissolving each extract (100 mg) separately with their mother solvents. Serial dilutions were carried out to get the concentrations of 0.125, 0.25, 0.5 and 1.0 mg/ml. Different concentrations of different extracts (1 ml) were taken in different test tubes and added double distilled water (4.0 ml) and 5% sodium nitrate (0.3ml) then mixed. All the test tubes were kept in a dark place for 6 minutes. Then 10% aluminum chloride (0.3 ml) was added into the test tube and wait for 5 min in the dark for complete reaction. Finally, 2 mL of 1M NaOH was added to the mixture. Immediately, the volume of the mixture was made up to 10 ml by the addition of 2.4 mL double distilled water and mixed thoroughly. The absorbance of all samples was measured at a fixed wavelength of 510 nm using a UV/Visible spectrophotometer (UV professional double beam, Shimadzu made). Quercetin standard was used for the calibration curve. Total flavonoid content was determined as mg/g of quercetin equivalent (mg of QE/g of dry extract) by using the equation obtained from a standard quercetin calibration curve y=0.0081x, R2 =0.9744. (Pathak and Niraula 2019).

Determination of total alkaloid content: Exactly 1 g of the sample was weighed into a 250 ml beaker, and 40 ml of 10% acetic acid in ethanol was added and covered and permitted to stand for 4 h. This was filtered, and the extract was concentrated on a water bath to one-quarter of the original volume. Concentrated ammonium hydroxide was added dropwise to the extract until the precipitation was through. The whole solution was allowed to resolve, and the precipitate was collected and washed with dilute ammonium hydroxide and then filtered. The reaction mixture was incubated in the dark for 30 min and the absorbance read at 512 nm. Gallic acid was used as standard to produce the calibration curve. The average of three readings was used, and the total alkaloid content was articulated in milligrams of GAEs per g of the leaf extract. The filtrate is the alkaloid, which was dried and evaluated (Biney *et al*., 2021).

Basil extract had 1.8 mg of alkaloids overall per 100 g. These values are very similar to those stated by Vidhani *et al*. (2016). Basil extract had a total phenol level of 92.8 mg/100 g. These results are somewhat in line with the findings from Suanarunsawat *et al.* (2011). Basil extract contained 28.67 mg of flavonoids per 100g. These values are very similar to those stated by Vidhani et al. (2016). In mint extract, there were 78 mg of total alkaloids and 130 mg of total phenol per 100 grams. These values are fairly close to the results reported by Rashid *et al.* (2023). Mint extract has a flavonoid concentration of 297.4 mg/100g. These findings have been supported by Rababah et al. (2015). Additionally, the adulsa extract contained 300 mg of total alkoloids per 100 g. These findings are supported by Gedam *et al*. (2017). 220 mg GE/100 g of total phenols and 60 mg/100 g of flavonoids are present in liquid jaggery. These numbers roughly align with the findings given by Singh and Sharma (2022) and Rao and Singh (2022).

Table 3: Phytochemical analysis of basil extract, adulsa extract and mint extract.

Phytochemicals	Basil extract	Adulsa extract	Mint extract	Liquid jaggery
Total alkaloid (mg/100 g)	1.8	300	78	-
Total Phenols (mg GE /100 g)	92.8	-	130	220
Flavonoids (mg/100 g)	28.67	-	297.4	60

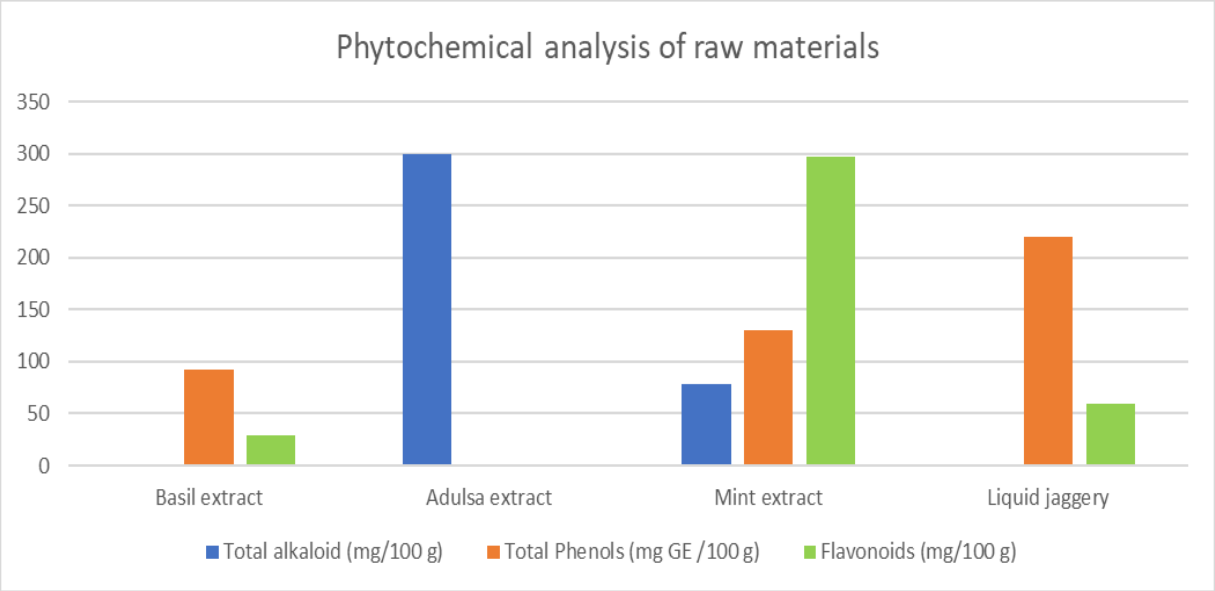


Fig. 2. Phytochemical analysis of raw materials.

Phytochemical analysis of control and final product

Table 4 shows that the total alkaloids in the T3 sample are 2 mg per 100 g, but the alkaloids in the control sample were absent because the control sample contained liquid jaggery. Due to mint extract and basil extract's high levels of total phenols and flavonoids, T3 sample's total phenol content was 200 mg GE/100 g, which was higher than control sample's total phenol content of 170 mg GE/100 g. Due to the high flavonoid concentration of mint extract and basil extract, which was 71 mg/100 g in the T_3 sample against 51 mg/100 g in the control sample, flavonoid content was also higher in the T_3 sample.

Table 4: Phytochemical analysis of final product.

Phytochemical	Control	T_3
Total alkaloids (mg/100g)	-	2
Total phenols (mg GE/100g)	170	200
Flavonoids (mg/100g)	51	71

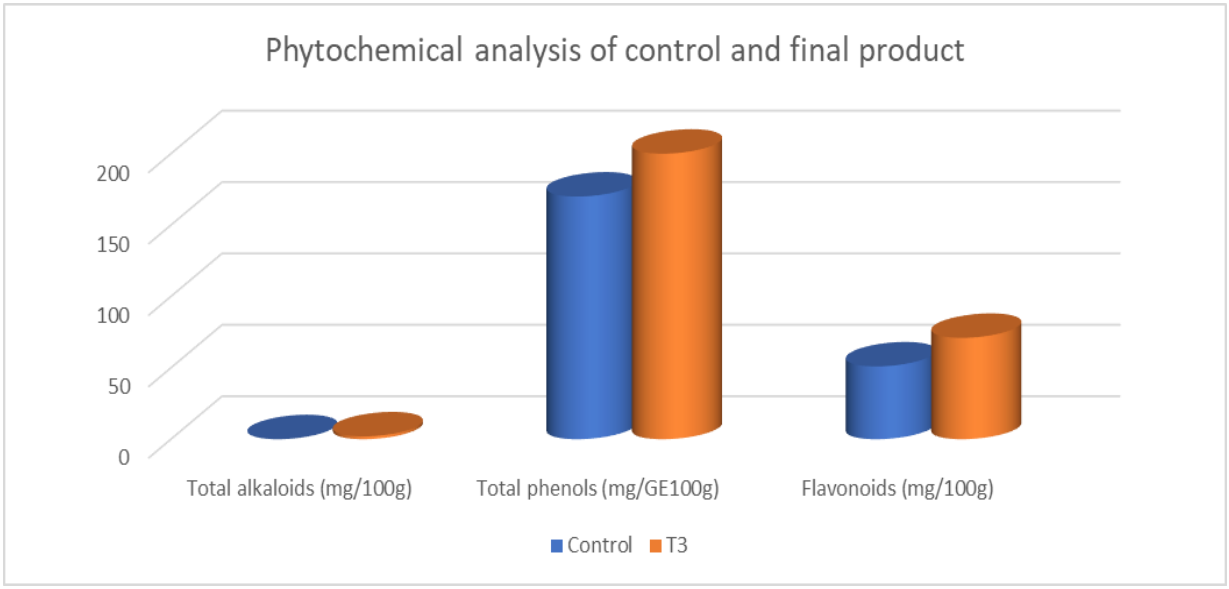


Fig. 3. Phytochemical analysis of control and final product.

Table 5. Proximate composition of final product and control sample.

Parameters (%)	**Results**	
	Control(T_0)	**T_3**
Moisture	3.6 ± 0.01[a]	3.9 ± 0.2[a]
Fat	0.13 ± 0.01[b]	0.30 ± 0.1[a]
Protein	0.63 ± 0.02[b]	1.15 ± 0.11[a]
Carbohydrates	93.76 ± 1.25[a]	92.67 ± 1.14[a]
Ash	1.872 ± 1.01[a]	1.98 ± 0.58[a]

Moisture content in the T_3 sample was high (3.9 ± 0.2[a] %) while it was low (3.6 ± 0.01[a] %) in the control sample. Due to the addition of extracts, the T_3 sample's fat content was more than that of the control sample. The percentage of fat in the control and T_3 samples was 0.13 ± 0.01[b] % and 0.30 ± 0.1 [a] %, respectively. The percentage of protein in the control and T_3 samples was 0.63 ± 0.02[b] and 1.15 0.11[a], respectively. The percentage of carbohydrates in the control and T_3 samples was 93.76 ± 1.25[a] and 92.67 ± 1.14[a], respectively. Ash concentration was 1.872 ± 1.01[a] percent and 1.872 ± 1.01[a] percent, respectively, in the control and T_3 samples.

Minerals Composition of final product and control sample

The results of the mineral content of the control and finished product samples are shown in Table 6 as mg/100g. The calcium level of the T_3 sample was more than the T_0 sample; it was 220 ± 2.54 [a] mg/100 g and 70 ± 2.36 [b] mg/100 g, respectively. Copper level in the T_0 and T_3 samples was lower at 0.05 ± 0.01 [a] mg per 100g and 0.2 ± 0.02 [a] mg per 100g, respectively. Zinc content in T_0 and T_3 was 0.36 ± 0.02 [b] mg per 100 g and 0.82 ± 0.01 [a] mg per 100 g, whereas iron content was 9.198 ± 1.36 [a] mg and 12.45 ± 1.58 [a] mg per 100 g, respectively. Phosphorus concentration in T_0 and T_3 was 0.35 ± 0.02 [b] mg and 0.59 ± 0.03 [a] mg per 100 g, respectively, and magnesium content was 64.35 ± 1.26[a] mg and 66.50 ±1.15 [a] mg per 100 g, respectively. Minerals are present in aqueous extracts; hence the final product has a higher mineral content than the control sample (T_0).

Table 6: Minerals Composition of final product and control sample.

Minerals (mg/ 100 g)	Results	
	Control (T_0)	T_3
Calcium (Ca)	70.00 ± 2.36[b]	220.20 ± 2.54[a]
Phosphorous (P)	0.35 ± 0.02[b]	0.59 ± 0.03[a]
Potassium (K)	34.93 ± 0.25[b]	68.46 ± 1.35[a]
Magnesium (mg)	64.35 ± 1.26[a]	66.50 ± 1.15[a]
Iron (Fe)	9.198 ± 1.36[a]	12.45 ± 1.58[a]
Zinc (Zn)	0.36 ± 0.02[b]	0.82 ± 0.01[a]
Copper (Cu)	0.05 ± 0.01[a]	0.2 ± 0.02[a]

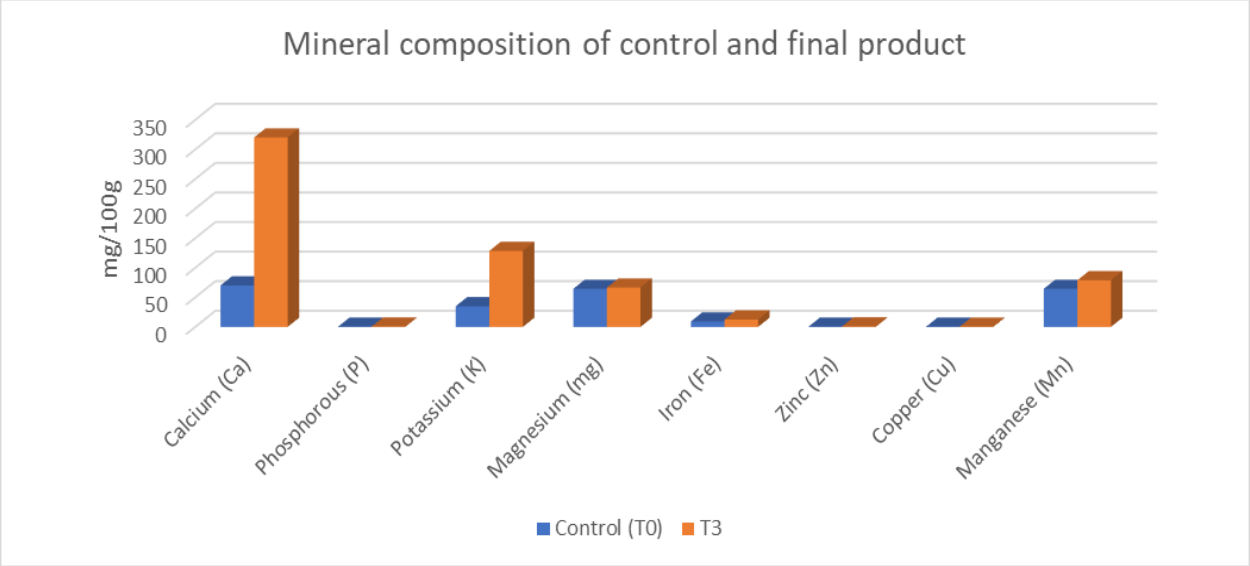


Fig. 4. Mineral composition of control and final product.

CONCLUSIONS

The research study for the development of jaggery lozenges showed to be rich in all nutrients, a source of phytochemicals, and the best substitute for sugar for liquid jaggery. The product achieved good sensory review and was standardized using various combinations. Typically, lozenges are used to treat cough and sore throat. They slowly dissolve in the mouth to stop coughing and provide soothing relief for sore throats. Extracts of basil, mint and adulsa are included because of their high phytochemical qualities and excellent organoleptic capabilities.

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