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Exploring liquid jaggery as a novel ingredient for formulation of confectionery product lollipop

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Abstract
The present investigation entitled "Exploring liquid jaggery as a novel ingredient for formulation of confectionery product lollipop" was carried out at College of Food Technology, VNMKV University, Parbhani. The lollipop-making process involved heating liquid jaggery and liquid glucose, with the addition of spice combinations of dried ginger and turmeric for enhanced flavor and nutritional value. The resulting lollipop mixture taken for organoleptic evaluation for color, flavor, taste, texture, and overall acceptability. Furthermore, the organoleptic ally selected liquid jaggery lollipop sample (78.5 gm of liquid jaggery, 20 gm of liquid glucose, 0.75 gm of dry ginger powder and 0.75 gm of dry turmeric powder) along with the control sample (80 gm of liquid jaggery and 20 gm of liquid glucose) subjected to a detailed proximate analysis examining properties such as moisture, fat, protein, carbohydrate, ash, total sugar, reducing sugar, and non-reducing sugar content. The findings revealed favorable compositions, emphasizing its versatility of confectionery product liquid jaggery lollipop a product rich in potential health benefits.

Keywords: Liquid jaggery, confectionery, jaggery, nutritional

1. Introduction
In today's world, where the demand for healthier and more nutritious food options is increasing, the confectionery industry is undergoing a major transformation. Consumers are increasingly aware of the negative health effects of overconsumption of traditional confectionery products that are rich in sugar, fat and other additives. In response to this growing trend, there is growing interest in exploring alternative sweeteners and incorporating functional ingredients that offer both taste and health benefits. India, as a global agricultural powerhouse, plays a key role in this paradigm shift. Through efficient use of land and water resources, the country not only feeds a large portion of the world's population but also becomes a major player in the production of key agricultural products, including sugar cane (Saxena, 2022) [7]. The versatility of sugarcane is not limited to sugar production as it can also produce jaggery, a non-centrifuged sugar rich in minerals and nutritional value (Manimozhi *et al*., 2021) [4]. The purpose of this research paper is to delve into the untapped potential of liquid jaggery as a new ingredient in the formulation of confectionary product, especially lollipops. The confectionery market was worth $1.64 billion in 2020 and is expected to reach $3.66 billion by 2026, with demand for healthier alternatives surging (Kumar *et al*., 2022) [3]. Liquid jaggery has unique composition and health benefits, providing exciting opportunities for innovation in the confectionery industry. The exploration of liquid jaggery as a key ingredient in lollipop recipes is not only timely but also holds the promise of meeting consumer expectations in terms of taste and nutritional value. Traditional candy products are often criticized for their impact on health issues such as diabetes, obesity and dental problems. In this context, liquid jaggery extracted from sugarcane juice processing stands out as a potential solution that not only provides sweetness but also has a range of health benefits, including immune support, anti-toxic properties (Rao *et al*., 2007) [8]. As the world grapples with the challenges posed by the COVID-19 pandemic, there is an increasing focus on health and wellness. This research seeks to contribute to the ongoing discussion on healthier food alternatives by proposing a confectionery product that utilizes the rich nutrition of liquid jaggery, complemented by natural flavors such as ginger and turmeric. The research aimed to develop a lollipop that not only tantalizes the taste buds, but also aligns with contemporary consumer preferences for functional and nutritious foods.

2. Materials and Methods

The present study entitled "Exploring liquid jaggery as novel ingredient for the formulation of the confectionery product lollipop" was carried out at the College of Food Technology, Vasantrao Naik Marathwada Krishi Vidyapeeth, Parbhani.

2.1 Raw Material Procurement

Raw materials such as Liquid glucose, dry ginger, and turmeric powder were procured from the local markets of the Parbhani district while Liquid jaggery was procured from the Jaggery Processing unit, near Parbhani.

2.2 Methodology for preparation of liquid jaggery lollipops

The entire lollipop-making process involved heating liquid jaggery (70° Brix) and liquid glucose. Various combinations of spices, including ginger and turmeric, were employed to enhance the lollipops' value and flavor. The dried ginger powder and turmeric powder were added to the mixture, which was continuously boiled and stirred until it reached 110 °C for 15-20 minutes, achieving the desired consistency. The endpoint was identified using the drop test method. Subsequently, the mixture was taken off the heat and poured into candy lollipop molds, with lollipop sticks inserted, and left to set for an additional 20 minutes.

Table 1: Standard Recipe for liquid jaggery lollipops

Ingredients	Quantity (%)			
	CL	SL_1	SL_2	SL_3
Liquid jaggery	80	79	78.5	78
Liquid glucose	20	20	20	20
Ginger powder	-	0.5	0.75	1.0
Turmeric powder	-	0.5	0.75	1.0

2.3 Organoleptic evaluation of liquid jaggery lollipops

Organoleptic evaluation of lollipops for color, flavor, taste, texture and overall acceptability was carried out using hedonic scale rating test Deepthi *et al*., (2022) [1].

2.4 Proximate analysis of liquid jaggery lollipops

The proximate composition of liquid jaggery lollipops were analyzed by the methods described by Sairagul *et al*., (2020) [6] and FSSAI Manual (2015) [2].

3. Results and Discussion

Table 2: Organoleptic evaluation of liquid jaggery lollipops

Code	Color	Taste	Flavor	Texture	Overall acceptability
CL	8.0	7.7	7.7	8.3	7.9
SL_1	7.9	8.2	7.9	8.1	8.1
SL_2	7.8	8.6	8.3	7.9	8.2
SL_3	7.6	8.4	8.5	7.6	8.0
SE					0.0136
CD @ 5%					0.0399

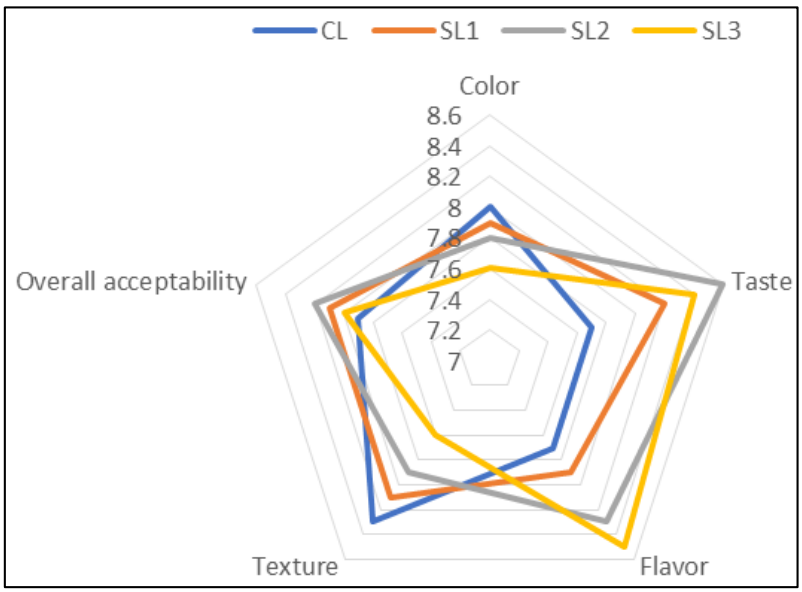

Fig 1: Organoleptic evaluation of liquid jaggery lollipops

Table 3: Proximate analysis of liquid jaggery lollipops

Property	CL	SL_2
Moisture	2.48±0.02	2.76±0.01
Fat	0.30±0.01	0.32±0.03
Protein	0.75±0.05	0.92±0.05
Carbohydrate	95.46±0.08	93.62±0.05
Ash	0.98±0.02	1.24±0.04
Total sugar	76.02±0.8	77.54±0.02
Reducing sugar	20.57±0.4	19.87±0.04
Non-reducing sugar	55.45±0.02	57.67±0.08

The data from Table 3 indicates that the experimental control liquid jaggery lollipop (CL) and the selected liquid jaggery lollipops (SL_2) exhibited moisture contents of 2.48±0.02% and 2.76±0.01%, as well as the ash contents of 0.98±0.02% and 1.24±0.04%, respectively. The variation in moisture content may be attributed to processing and environmental conditions and the addition of ginger and turmeric powder might be the reason for slight increase in the ash content. The findings for liquid jaggery lollipops closely align with those reported by Sairagul *et al*. (2020) [6], for hard-boiled jaggery

candy moisture content of 3.6% and 0.4% ash content.

The fat and protein content of the experimental control liquid jaggery lollipop (CL) and the selected liquid jaggery lollipops (SL_2) showed that the fat contents of 0.30±0.01% and 0.32±0.03%, as well as protein contents of 0.75±0.05% and 0.92±0.05%, respectively. Notably, there was no significant change in the fat content of both liquid jaggery lollipops. The carbohydrate content of the control liquid jaggery lollipop (CL) and selected liquid jaggery lollipops (SL_2) was 95.46±0.08% and 93.62±0.05%, indicating a carbohydrate-rich product.

Furthermore, the outcomes for total sugar, with values of 76.02±0.8% and 77.54±0.02% for control liquid jaggery lollipop (CL) and selected liquid jaggery lollipops (SL_2) respectively. Similarly, the percentages for reducing sugar, measuring 20.57±0.4% and 19.87±0.04%, and non-reducing sugar, indicating 55.45±0.02% and 57.67±0.08%, in the same order for CL and SL_2.

5. Conclusions

The exploration of liquid jaggery as a novel ingredient in formulating confectionery lollipops has given promising results. The organoleptic evaluation revealed positive scores across color, flavor, taste, texture, and overall acceptability, indicating its overall consumer appeal for the developed lollipops. Proximate analysis of the selected lollipop variant, containing liquid jaggery, liquid glucose, dry ginger powder, and turmeric powder, demonstrated favorable compositions as a nutrient rich product.

6. References

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