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Research Article

# Studies on Physico - Chemical Characteristics of Fortified Burfi Prepared by Using Shredded Bottle Gourd (Lagenaria Siceraria), Carrot (Daucus Carota) and Beetroot (Beta Vulgaris)

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## Abstract

This research study was conducted to analyse physic chemical characteristics of fortified burfi prepared by incorporating shredded Bottle gourd, Carrot and Beetroot in varied proportion. The objective of study is to analyse physiochemical attributes of burfi prepared by fortifying Bottle gourd in ratio (15, 25, 30 and 35) with carrot (10, 15, 20, 25) and beetroot (10, 15, 20, 25). The control sample T0 was prepared using khoa: sugar 70:30. Other treatments were prepared (Bottle Gourd: Carrot: Beetroot: Sugar) as T1 (25:10:0:30), T2 (25:00:10:30), T3 (30:10:00:25), T4 ( 30:00:10:25), T5 (30:10:00:20), T6 (35:00:10:20), T7 (15:20:00:30), T8 (15:00:20:30), T9 (15:25:00:25), T10 (15:00:25:25), T11 (25:20:00:20), T12 (25:00:20:20), T13 (25:15:00:25) and T14(25:00:15:25). Khoa was kept constant @35g in each sample. The physicochemical characteristics moisture, carbohydrate, protein, ash content, fat and total solids were tested. Results showed that moisture and fibre increased while carbohydrate, protein, fat, and ash content decreased on increased incorporation of carrot, beetroot and bottle gourd. Treatments incorporating beetroot showed higher percentage of moisture, protein and fat when compared to treatments incorporating similar ratio of carrot whereas carbohydrate, ash and fibre decreased with same ratio of incorporation of beetroot and carrot to bottle gourd burfi. Laboratory prepared burfi revealed enhanced nutritive value. Highest moisture content was observed in treatment T2. Laboratory prepared burfi revealed enhanced nutritive value in comparison to traditional khoa burfi. Treatment T10 (15:00:25:25) was found to be of highest nutritive value with Moisture 13.61%, Carbohydrate 10.496, Protein 6.7305, Fat 13.003, Ash 1.685, Fibre 0.88% and Total Solids 86.39.

## Keywords

Burfi, Physico Chemical, Treatments

## 1. Introduction

India produces 239.3 million tons of milk ranking first in milk production and contributes 24% of total milk production in world. Annual production of khoa in India is approximately 600,000- tons which is 7% of country milk production [7]. Indian sweets popularly known as mithai hold key place in celebrations and rituals, thus is integral part of our life. Tra-

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ditional sweets like Gulab jamun, Rasgulla, Burfi, Jalebi, Gazar ka halwa, Peda, Kheer, Firni, Ladoo etc. The Indian sweets statistically reveal growing trend and are expected to grow substantially in upcoming years. Sweets are manufactured not only by Halwai at local level but also by dairy industries. Burfi is popular Indian Dairy based sweet with creamy and velvety texture and is highly nutritive. Burfi contains total solid in concentrated form and contains easily digestible carbohydrates. Different variety of burfi is available in market namely pista, chocolate, coconut and nuts etc. The basic ingredient in all these varieties is khoa and sugar in varied ratio [10]. Bottle gourd (Lagenaria siceraria) belongs to cucurbit family and is popularly known as lauki, doodhi and calabash in different parts of India. Largest producer of Bottle gourd are India, Sri Lanka, Malaysia, South Africa and Indonesia. Bottle gourd has been used as basic ingredient for herbal medicine. Bottle gourd juice is used to treat acidity, ulcer and also cures indigestion, asthma and pectoral disorder. Research have shown that bottle gourd prevents pre mature greying of hair and also good for diabetic patients. Bottle gourd has therapeutic value as well and help cure mental disorder. Dietician suggest bottle gourd to be used as part of daily diet to maintain good health. Bottle gourd is rich in fibre and vitamin C that help in digestion while zinc in juice regulates blood sugar [1].

Carrot (Daucus carota) belongs to Apiaceae family. During ancient time carrot was used for medicinal purpose. Later it became part of culinary. Carrot contains antioxidants mainly carotenoid and anthocyanin. Carrot contains falcarinol which is known to activate anti-cancer mechanism. Sesquiterpenoid in carrot seeds have suppressive effect on gastric cell lining. Besides carrot are rich in fibre and molybdenum which is rare in vegetables that help in fat and carbohydrates metabolism. Carrot contains potassium and minerals that help in movement of muscles and hydrates human skin. Carrot contains antioxidant in form of carotenoids, vitamins and polyphenols. Research show that carrot may play role in controlling blood sugar level [16]. Carrot stimulates saliva production which helps to restrict cavity forming microorganisms, Carrots exhibit antibacterial as well as antifungal properties. Vitamin C in carrot help keep skin healthy. Vitamin A in carrot have anti-ageing benefits and prevent wrinkles, discolouration and uneven skin tone. Beta carotene in carrot provides sun protection. Carrot juice improves hair health and has fertility benefits. Carrot seed extracts show anti-inflammatory properties and act as pain killer [15]. Carrots can be processed into highly nutritive products such as burfi, candy, juice, pickle, halwa etc. at commercial level. Carrot pomace contains 50% carotene and is incorporated in bakery to produce diverse products.

Beetroot has been basically consumed as food additive since long time. Beetroots are rich in betalains and nitrates thus making it highly nutritive. Betalains act as antioxidants, reduce nitrative stress. Also, beetroot help restrict development of tumour. Nitrate lowers blood lipid, sugar and pressure. It also improves sport person performance and lowers muscle cramp during exercise [5]. Beetroot is suggested to have important role in lowering blood sugar level, insulin homeostasis, circulatory system, kidney health and the possible effect on microbial growth [11]. Beetroot is used in food industry as natural food colour and is processed in form of jam, jelly, burfi, ice cream and beverages. Low in calorie and high in fibre content makes it a popular choice [12]. Beetroot is rich source of minerals Calcium, Magnesium, Iron, Copper and Phosphorus. Vitamin A, B, B2, B6 and C are found in abundance. Betalain is the root cause behind bright red colour in beetroot [8]. Beetroot is richest source of folate and can be commercially processed into value added product like curries, sweets, soups, sterilised beets or pickles [12]. Beetroot is used as colouring agent in ice cream, yoghurt etc. Thermal treatments affect colour of beetroot there by is added as colouring agent in confectionery and ice creams [6].

Incorporation of beetroot, carrot and bottle gourd in traditional burfi may result in highly nutritious product. The objective of work was to analyse the physio chemical properties of burfi prepared by incorporating Bottle gourd, carrot beetroot in comparison with khoa burfi.

*Material and Methods*

*Raw Materials*

Fresh vegetables Bottle gourd, Carrot and Beetroot were procured from local vendors of Prayagraj. Milk, ghee and sugar were bought from local shop in Naini, Prayagraj. The entire investigation was carried out in Warner College of Dairy Technology, Department of Food Science and Technology, SHUATS, Prayagraj. Vegetables selected were fresh, mature and disease free. Vegetables were cleaned, peeled and shredded to ensure uniform cooking. By incorporating beetroot and carrot into traditional khoa burfi the research explores the comparison between physio chemical properties and exploring their potential health benefits**.**

*Production of Experimental Burfi*

Milk was preheated at 35˚ C to 40˚C followed by filtration through clean muslin cloth. Milk was kept on flame and heated continuously till it looks semi duff. Control sample $T_0$ was prepared by measuring 70g of khoa and adding it to pan with ghee. It was scraped continuously at low flame till its colour changed slightly. 30g sugar was added and cooked till it mixed uniformly. The mixture was transferred on tray and set. It was cut into bars 2*4 cm. Fresh and disease-free vegetables were washed with plain water. Skin was peeled followed by shredding. Shredded vegetables were weighed as per the treatment's composition T1, T2, T3, T4. T5, T6, T7, T8, T9, T10, T11, T12, T13 and T14. Sugar was added accordingly and further heated till it solidifies. Mixture was transferred into trays and cooled. Rectangular bars 2*4 cm size were cut and kept at room temperature.

*Flow Chart for Experimental Developed Burfi*

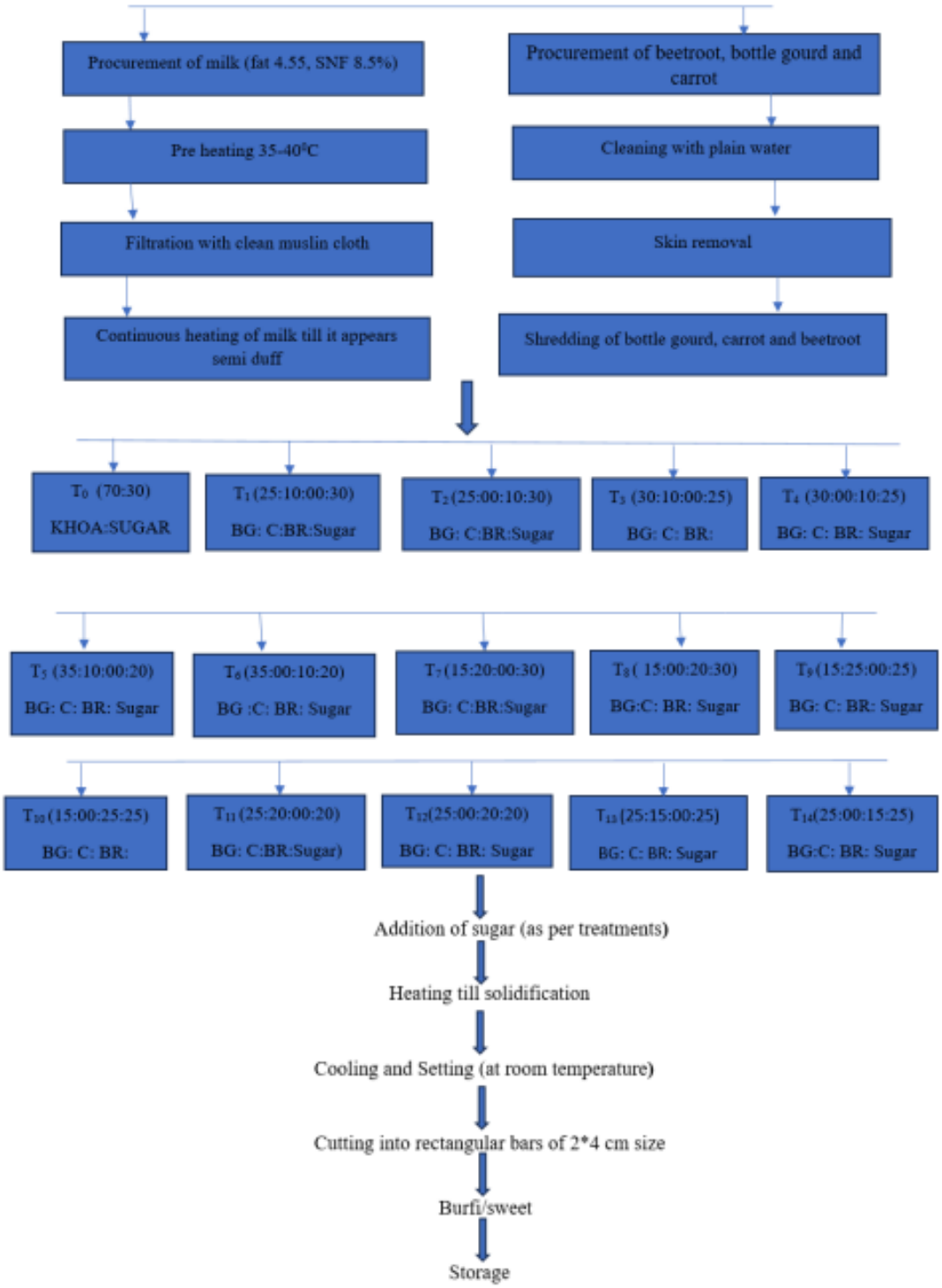


***Figure 1.*** *Chemical Evaluation.*

The sample of finished product obtained from various treatment combinations were chemically analysed for moisture, fat, protein, total solids and total sugar content. The fat content was determined as per method described in AOAC 2000, protein content as AOAC 2000, moisture content as per AOAC 2000, Carbohydrate as per AOAC 2000 total solids content as per AOAC 2000, fat as per AOAC 2000 and fibre content as per AOAC 2000 [2].

## 1.1. Physico Chemical Evaluation

The burfi prepared under various treatment were analysed for fat, ash, moisture, protein, carbohydrates and Total Solids of different level of incorporation of bottle gourd, carrot and beetroot presented in Table 1.

### 1.2. Statistical Analysis

Statistical Analysis of data obtained during research was done up to 5 replicas and reported as ±SD (Standard Deviation). One way Analysis of Variance Test was done to find Mean and Analysis of Variance with the assistance of Microsoft Excel Software and the difference between mean value were evaluated at $p<0.05$ using a 5% level of significance.

***Table 1.*** *Chemical composition of burfi prepared by incorporating Bottle gourd, Carrot and Beetroot.*

| Treatments BG:C:BR:Sugar | Moisture (%) | Carbohydrate (%) | Protein (%) | Fat (%) | Ash (%) | Fibre (%) | Total solids (%) |
|---|---|---|---|---|---|---|---|
| T0 (30:70) | 13.3 ±0.12 | 45.68 ±0.08 | 12.6 ±0.07 | 25.9 ±0.2 | 2.52 ±0.01 | Nil | 86.7 ±0.08 |
| $T_1$(25:10:00:30) | 13.83 ±0.06 | 9.99 ±0.03 | 6.55 ±0.01 | 12.95 ±0.01 | 1.48 ±0.03 | 0.69 ±0.01 | 86.17 ±0.02 |
| $T_2$(25:00:10:30) | 13.85 ±0.03 | 9.75 ±0.02 | 6.59 ±0.02 | 12.97 ±0.07 | 1.53 ±0.01 | 0.58 ±0.03 | 86.15 ±0.07 |
| $T_3$(30:10:00:25) | 13.77 ±0.05 | 10.11 ±0.18 | 6.58 ±0.07 | 12.97 ±0.13 | 1.51 ±.07 | 0.75 ±0.11 | 86.23 ±0.01 |
| $T_4$(30:00:10:25) | 13.80 ±0.01 | 9.87 ±0.07 | 6.62 ±0.08 | 13.27 ±0.06 | 1.56 ±0.16 | 0.64 ±0.07 | 86.20 ±0.03 |
| $T_5$(35:10:00:20) | 13.73 ±0.03 | 10.23 ±0.04 | 6.61 ±0.01 | 12.97 ±0.02 | 1.53 ±0.08 | 0.81 ±0.05 | 86.27 ±0.02 |
| $T_6$(35:00:10:20) | 13.76 ±0.01 | 9.99 ±0.02 | 6.65 ±0.12 | 12.98 ±0.09 | 1.58 ±0.03 | 0.7 ±0.06 | 86.24 ±0.07 |
| $T_7$(15:20:00:30) | 13.65 ±0.03 | 10.65 ±0.06 | 6.57 ±0.05 | 12.97 ±0.35 | 1.53 ±0.01 | 0.96 ±0.01 | 86.35 ±0.06 |
| $T_8$(15:00:20:30) | 13.71 ±0.11 | 10.17 ±0.03 | 6.63 ±0.18 | 12.99 ±0.17 | 1.62 ±0.03 | 0.74 ±0.12 | 86.29 ±0.01 |
| $T_9$(15:25:00:25) | 13.54 ±0.06 | 11.10 ±0.01 | 6.62 ±0.04 | 12.98 ±0.12 | 1.58 ±0.07 | 1.155 ±0.07 | 86.46 ±0.13 |
| $T_{10}$(15:00:25:25) | 13.61 ±0.03 | 10.50 ±0.07 | 6.73 ±0.01 | 13.00 ±0.02 | 1.69 ±0.01 | 0.88 ±0.02 | 86.39 ±0.11 |
| $T_{11}$(25:20:00:20) | 13.58 ±0.01 | 10.89 ±0.12 | 6.64 ±0.07 | 12.98 ±0.05 | 1.58 ±0.13 | 1.08 ±0.04 | 86.42 ±0.02 |
| $T_{12}$(25:00:20:20) | 13.64 ±0.07 | 10.41 ±0.01 | 6.73 ±0.11 | 12.99 ±0.01 | 1.67 ±0.17 | 0.86 ±0.05 | 86.36 ±0.21 |
| $T_{13}$(25:15:00:25) | 13.69 ±0.01 | 10.44 ±0.03 | 6.59 ±0.06 | 12.97 ±0.35 | 1.53 ±0.02 | 0.89 ±0.01 | 86.31 ±0.07 |
| T14(25:00:15:25) | 13.73 ±0.02 | 10.10 ±0.05 | 6.66 ±0.05 | 12.99 ±0.01 | 1.60 ±0.01 | 0.72 ±0.12 | 86.27 ±0.03 |

Where $T_0$ (Khoa: Sugar) 70:30 [Control], $T_1$ (Bottle gourd:Carrot:Beetroot:Sugar)= 25:10:00:30, $T_2$ (Bottle gourd: Carrot: Beetroot: Sugar) = 25:00:10:30, $T_3$ (Bottle gourd: Carrot: Beetroot: Sugar) = 30:10:00:25, $T_4$ (Bottle gourd: Carrot: Beetroot: Sugar ) = 30:00:10:25, $T_5$ (Bottle gourd: Carrot: Beetroot: Sugar ) = 35:10:00:20, $T_6$ (Bottle gourd: Carrot: Beetroot: Sugar) = 35:00:10:20. $T_7$ (Bottle gourd: Carrot: Beetroot: Sugar) = 15:20:00:30, $T_8$ (Bottle gourd: Carrot: Beetroot: Sugar) = 15:00:20:30, $T_9$ (Bottle gourd: Carrot: Beetroot: Sugar) = 15:25:00:25, $T_{10}$ ( Bottle gourd: carrot: Beetroot: Sugar) = 15:00:25:25, $T_{11}$ (Bottle gourd: Carrot: Beetroot: Sugar ) = 25:20:00:20, $T_{12}$ (Bottle gourd: carrot: Beetroot: Sugar) = 25:00:20:20, $T_{13}$ (Bottle gourd: Carrot: Beetroot: Sugar) = 25:15:00:25) and $T_{14}$ (Bottle gourd: Carrot: Beetroot: Sugar)= 25:00:15:25.

## 2. Result and Discussion

### 2.1. Moisture

The result of chemical analysis of sample is presented in Table 1 The moisture content of control sample T0 was found to be 13.3%. Moisture content increased with increase percentage of incorporation of bottle gourd, carrot and beetroot. Treatment containing beetroot showed higher moisture content when compared to treatment containing same percentage incorporation of carrot [15]. Results are also in accordance with [3] who studied change in properties of ice cream on addition of beetroot juice and carrot pulp. Results showed higher moisture in treatment containing Beetroot as compared to Carrot.

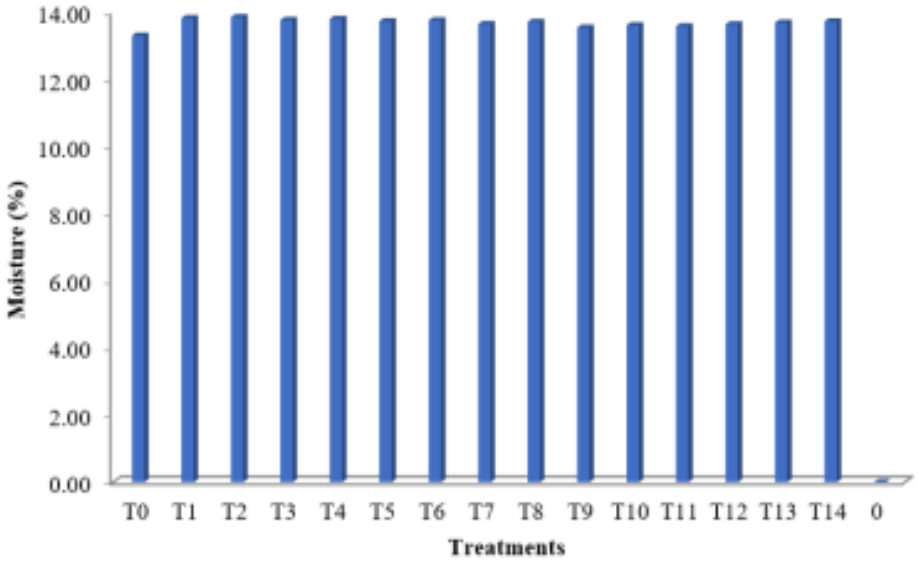


***Figure 2.*** *Percentage of Moisture content of different treatments.*

## 2.2. Carbohydrates

The highest carbohydrate content was observed in T0 45.68 which is probably due to incorporation of 70% khoa in it. Other treatments showed decrease in carbohydrates on incorporation of Bottle gourd, Carrot and Beetroot [13]. Results showed that treatment incorporating carrot showed higher percentage of carbohydrate as compared to treatment containing same percentage of beetroot when percentage incorporation of bottle gourd was kept constant [14]. Percentage of sugar incorporated changed carbohydrate percentage of burfi.

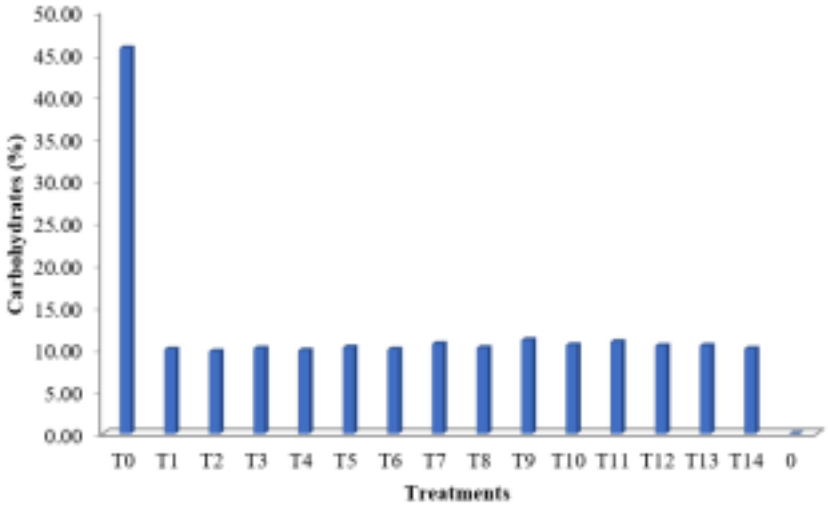


***Figure 3.*** *Percentage of carbohydrate content in different treatments.*

## 2.3. Protein

Protein content was found to be highest in T0 and it is due to presence of 70% khoa in burfi. Results showed increase in protein on decrease in percentage incorporation of Bottle gourd. Protein percentage in burfi containing beetroot was found to be higher when compared to treatment containing same percentage of Carrot while percentage incorporation of bottle gourd remained constant [9]. Results showed decrease in protein with increase in incorporation of beetroot pulp in burfi.

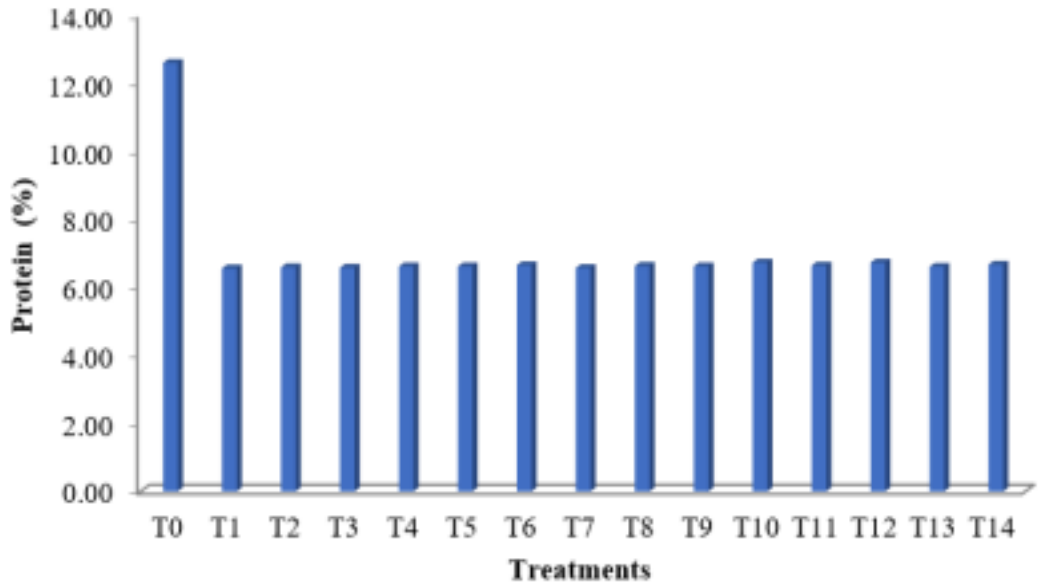


***Figure 4.*** *Protein percentage of different treatments.*

## 2.4. Fat

Fat percentage of control treatment T0 was found to be 25.9% which is possibly due to high percentage of khoa. Since all the three vegetables incorporated in making burfi contain very less fat so the value of fat ranged 12.95 to 13.27% which is approximately half of control sample [4]. Results also show that protein content of burfi containing Beetroot pulp is higher as compared to burfi containing same percentage incorporation of carrot.

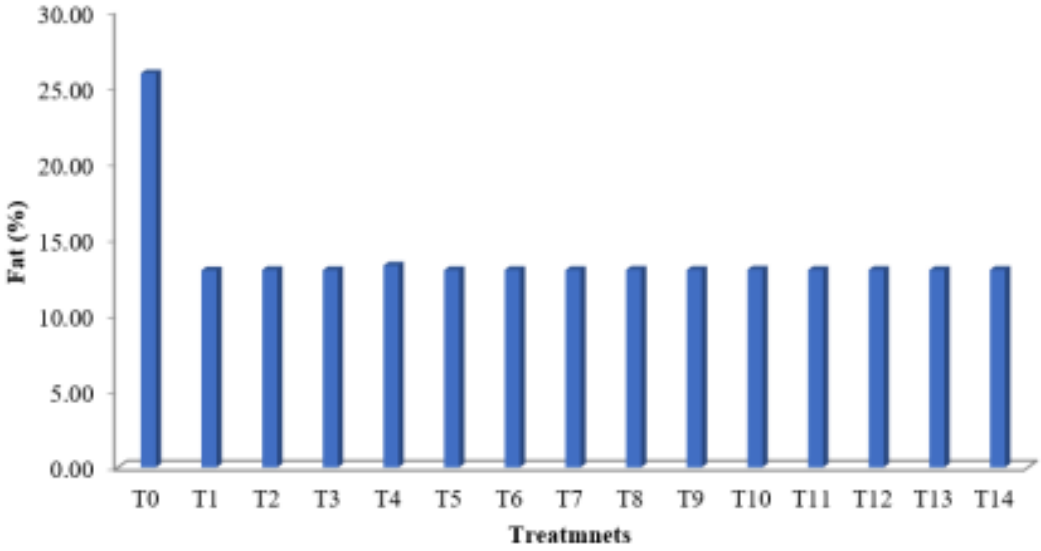


***Figure 5.*** *Percentage of fat in different treatments.*

## 2.5. Fibre

Fibre content was found to be nil for control sample T0 as it is mainly composed of khoa which does not contain fibre. Maximum fibre content was found to be 1.155 in treatment T9 which may be due to 25% incorporation of carrot shreds. Results showed higher amount of fibre in treatment incorporating carrot shreds as compared to beetroot shreds [3].

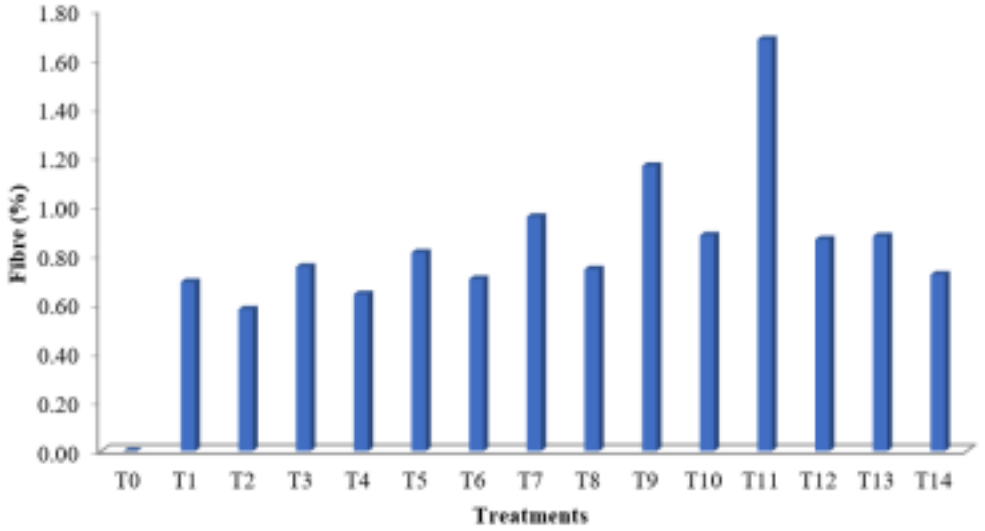


***Figure 6.*** *Percentage of Fibre in different Treatments.*

## 2.6. Ash

Ash content of control sample T0 was found to be highest 2.52. Treatment T10 showed highest ash content 1.685% due to higher percentage of beetroot incorporation and lower percentage bottle gourd incorporation. Results showed that treatments containing carrot showed lower ash content as compared to treatment containing same percentage of beetroot when percentage incorporation of bottle gourd remained unchanged [9, 15].

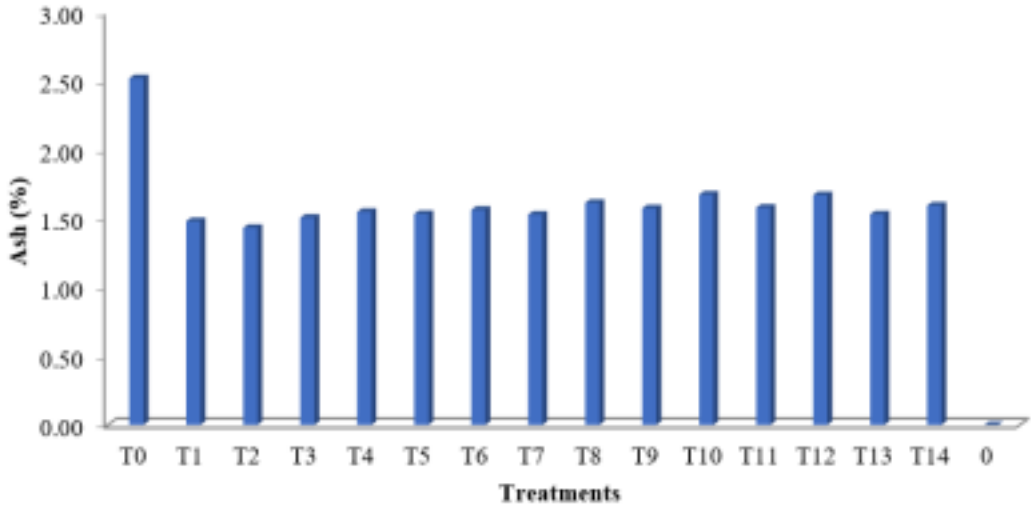


***Figure 7.*** *Percentage of ash in different treatments.*

## 2.7. Total Solids

Maximum Total Solids was observed in T0. Treatments containing carrot showed higher total solids as compared to treatment containing beetroot [3].

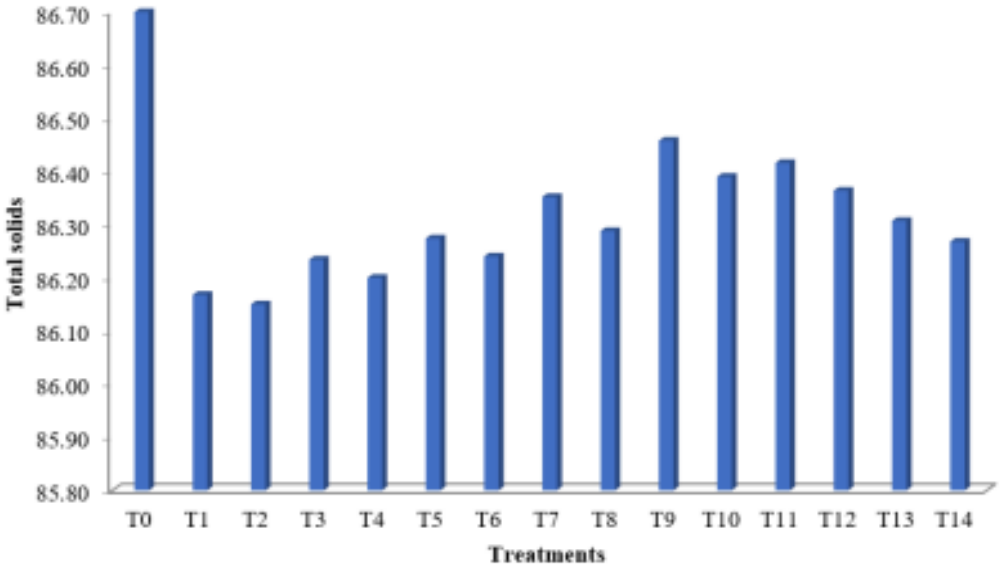


***Figure 8.*** *Percentage of Total Solids in different treatments.*

## 3. Conclusion

It may concluded that the superior quality of burfi enriched with beetroot can be prepared by addition of 15 part of bottle gourd 25 part of beetroot, 25 parts of sugar and 35 part of khoa as the overall acceptance for treatment combination T10 was highest in all parameters.

## Abbreviations

| | |
|---|---|
| AOAC | Association of Official Analytical Chemists |
| ANOVA | Analysis of Variance |

## Author Contributions

**Shalini Shukla:** Investigation, Methodology, Writing – original draft, Writing – review & editing

**Shanker Suwan Singh:** Project administration, Supervision

## Conflicts of Interest

The authors declare no conflicts of interest.

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