International Journal of Chemical Studies

P-ISSN: 2349–8528
E-ISSN: 2321–4902
IJCS 2020; 8(1): 649-656

Received: 04-11-2019
Accepted: 06-12-2019

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Effect of different levels of green chickpea (*Cicer arientinum* L.) and sugar on physico-chemical constituents of Burfi

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DOI: https://doi.org/10.22271/chemi.2020.v8.i1j.8333

Abstract
The research work on effect of different combination of green chickpea and sugar on physico-chemical properties of burfi, was conducted during 2018-2019 in the Division of Animal Husbandry and Dairy Science, Rajarshee Chhatrapati Shahu Maharaj College of Agriculture, Kolhapur. The different levels of green chickpea were @2(H_1), 4(H_2) and 6(H_3) per cent and two levels of sugar viz., 25 (S_1) and 30 (S_2) per cent in the burfi. The data revealed that moisture, fat, protein, reducing sugar, non-reducing sugar and acidity of green chickpea burfi was increased with increase in level of green chickpea and decreased with increase in sugar level but only non-reducing sugar increased with increase in sugar level. The effect of sugar on acidity and pH was non-signifcant. Thus, it is inferred that a good quality green chickpea burfi can be prepared by using 4 per cent green chickpea and 25 per cent sugar of *khoa* (H_2S_1).

Keywords: Buffalo milk, Burfi, green chickpea, Khoa, Physico-chemical composition

Introduction
Milk is regarded as a complete food in a human diet. Milk and milk product occupy a very important place in the food sector and Indian economy. Milk supplies proteins, vitamins, fats, minerals and lactose. Milk and milk products constitute important nutritional components serve as the source of first-class proteins especially for children and vegetarians. It supplies most essential elements like calcium and phosphorus along with numerous other essential major and minor substance. There is a tremendous scope to enhance the profitability of dairy industry through product diversification and value addition.

Khoa is one of the most important heat desiccated product, it is used as the base material for burfi. Burfi is most popular *khoa* based sweet all over India and it contains a considerable amount of milk solids. *Khoa* retain more vitamin A (581.721 U/100 g) along with B2 (622.85 µg/100 g) B6 (85 µg/100 g), folic acid (0.68 µg/100 g) and vitamin C (5.42 µg/100 g). *Khoa* prepared from whole buffalo milk on an average contains total solid as 78.4 per cent, fat as 30.5 per cent, protein as 17.70 per cent, lactose as 30.90 per cent and ash 5.90 per cent (Aneja *et al.*, 2002) [4].

Among pulses chickpea (*Cicer arietinum* L.), is the premier pulse crop of India and consumed all over the world. The proximate composition of desi chickpea seed is: protein 16.7 to 30.57 per cent, fat 2.9 to 7.42 per cent, crude fiber 3.7 to 13 per cent, reducing sugar 2.61 to 4.77 per cent, non-reducing sugar 1.12 to 1.89 per cent and ash 2.04 to 4.2 per cent (Wood and Grusak 2007) [62]. Green chickpea is traditionally incorporated into many culinary creations because of their nut like flavor and versatile sensory application in food. They are high in fiber and protein quality is considered to be better than other pulses. Keeping in view the nutritive value of green chickpea, the effort has been made to preparation of burfi by using green chickpea.

Materials and Methods
Materials
The present investigation was carried out at the Division of Animal Husbandry and Dairy Science, Rajarshee Chhatrapati Shahu Maharaj College of Agriculture, Kolhapur. The whole fresh clean buffalo milk was obtained from the Dairy farm RCSM College of Agriculture, Kolhapur. Good quality cane sugar was procured in single lot from local market of Kolhapur

city. Green chickpea (Desi) was procured in single lot from local market of Kolhapur city (M.S.) and stored under refrigeration temperature for better keeping quality. Packaging material (Laminate paper board box) was procured from local market of Kolhapur city. Different equipments viz., Karahi, Stirrer,Tray, Cutting knife, Mortar and pestle, B.O.D. incubator, pH meter, Autoclave etc. were available in the department. Analytical reagent grade chemicals were used for the chemical analysis.

Analysis

Moisture content of green chickpea burfi was determined as per SP:18 (Part XI), 1981. Fat in green chickpea burfi sample was determined by Rose Gottlieb method for milk as described in SP: 18 (Part XI), 1981 with some modifications. Total protein in green chickpea burfi samples were determined by Micro-Kjeldhal method as described for canned *Rasogolla* in SP: 18 (Part XI), 1981. The reducing sugars of green chickpea burfi were estimated by method with slight modification suggested by Ranganna (1986) [44]. Non-reducing sugars of green chickpea burfi were determined by substracting reducing sugars from total sugars. The procedure used for inversion and estimation of total sugar was as under. Crude fiber content in green chickpea was determined by using standard method of A.O.A.C. (2000) [1]. The ash content of chickpea burfi was determined as per method IS: 1479 (Part II, 1961) for milk with slight modifications as under. A.O.A.C. (1975) method for cheese was adopted for burfi for determining acidity in terms of per cent lactic acid. The pH was measured by Oroion-3 star pH benchtop pH meter.

Methods

For this purpose, green chickpea was added at 2, 4, 6 per cent of the *khoa*, while sugar was added at 25 and 30 per cent of the *khoa*. Thus, in all six treatment combinations indicated below were formed and studied.

H_1S_1 - Green chick pea 2 per cent and sugar 25 per cent
H_1S_2 - Green chickpea 2 per cent and sugar 30 per cent
H_2S_1 - Green chickpea 4 per cent and sugar 25 per cent
H_2S_2 - Green chickpea 4 per cent and sugar 30 per cent
H_3S_1 - Green chickpea 6 per cent and sugar 25 per cent
H_3S_2 - Green chickpea 6 per cent and sugar 30 per cent

Procedure for preparation of green chickpea burfi

1) Preparation of green chickpea paste

Green chickpea was procured in single lot from local market of Kolhapur city (M.S.) and stored under refrigeration temperature. Green chickpea seeds were removed from the chickpea pods and washed under running tap water. The chickpea seeds were dried in open air and required quantity of green chickpea was crushed in mortar and pestle to get fine paste form. This green chickpea paste was used for preparation of green chickpea burfi.

2 *Preparation of green chickpea* burfi

The green chickpea burfi was prepared as per the method suggested by Aneja *et al*. (2002) [4] for preparation of plain burfi with certain modification. Initially buffalo milk was taken and filtered through muslin cloth, then the milk was standardized to 6 per cent fat.

The standardized milk was then transferred in open pan/*karahi* over a brisk fire. The milk was stirred continuously and side of *karahi* was also scrapped to avoid any scorching or charring of milk solids at the bottom of *karahi*. Vigorous stirring with the help of stirrer was accomplished by scrapping process till the product reached pasty consistency, then temperature was lowered. As the product reached pat formation stage (i.e. leaving the sides of *karahi*), the crushed green chickpea paste was added @ 2, 4 and 6 per cent and sugar @ 25 and 30 per cent of *Khoa*, respectively. The contents were properly mixed and worked on gentle heat for about 5 to 8 minutes to get desired consistency. The product was taken off the flame, transferred into a tray (30x30x1.5 cm) and was allowed to cool and set at room temperature in hygienic condition till it became slightly hard (Fig.1).

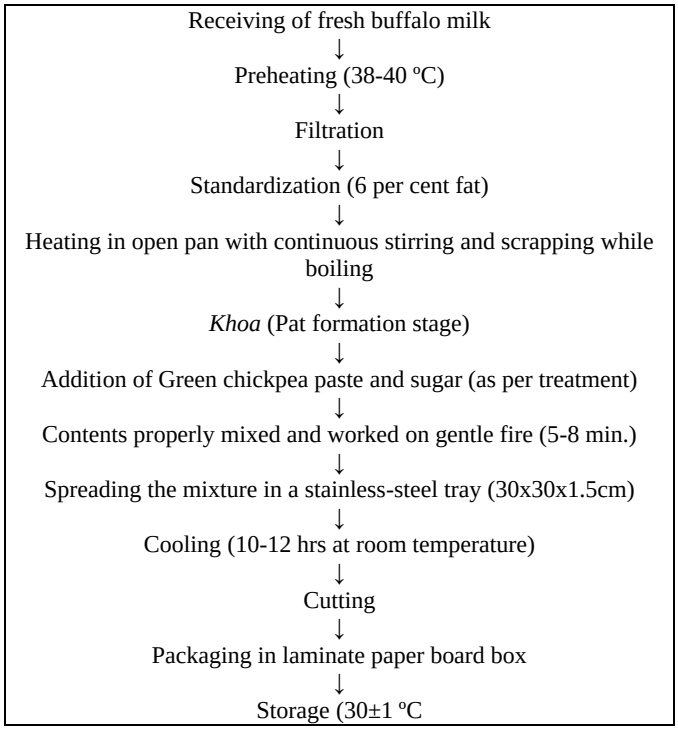

Fig 1: Flow diagram for preparation of Green chickpea burfi.

Result and Discussion

The results obtained from the present investigation as well as relevant discussion have been summarized under following heads:

Effect of Levels of Green Chickpea and Sugar on Physico-chemical Constituents of Burfi

Moisture

The result presented in Table 1 and graphically represented in Fig. 1, show that the average moisture content of green chickpea burfi varied from 16.20 to 15.21 per cent and it increased with increase chickpea level and decreased with increase in sugar level. Burfi with 6 per cent chickpea and 25 per cent sugar level had maximum moisture while, burfi with 2 per cent chickpea and 30 per cent sugar had minimum moisture content. Narwade (2003) [33] also reported that increased level of sugar content resulted in decreased moisture content of *peda*. Sakate *et al*. (2004) [51] reported the moisture content in the range of 15.59 to 19.70 per cent in wood apple burfi. Navale *et al*. (2014) [34] also reported that, increase in addition of wood apple pulp, there was increase in moisture content of burfi. Kamble (2010) [20-22] observed that, moisture content increased in burfi with increased level of pineapple pulp.

Fat

The result presented in Table 1 and graphically represented in Fig. 2, show that the average fat content of green chickpea burfi. The level of chickpea and sugar had significantly (P<0.05) affected the fat per cent of the burfi. The maximum fat content was recorded in burfi formulated with 6 per cent green chickpea and 25 per cent sugar (H3S1). Whereas, minimum was recorded in burfi containing 2 per cent green chickpea and 30 per cent sugar (H1S2). Increase the level of green chickpea increased the fat content in burfi. Kadam (2008) [19] also reported that, increase level of mango pulp the fat content in burfi also increased. This finding are in accordance with Patil *et al*. (2015) [42] who reported that increase in the level of date paste increase in fat content of burfi. These observations indicate that as chickpea level increases the fat increased and sugar level increased fat content decreased. These finding are in accordance with the finding of Sakate *et al*. (2004) [51] and Kotade (2001) [62] who reported fat in range of present finding. However, Sharma *et al*. (1992) [54] reported 26.28 per cent of fat in besan burfi, which was considerably higher than present finding.

Protein

The protein content (Table 1) was in the range of 14.16 to 16.41 per cent. Though variation in the protein content was in narrow range but the effect of chickpea and sugar was significant (P<0.05). The protein content is increased with increase in chickpea level and decreased with increase in sugar level. Jadhav (2015) [17] reported that increase in addition of besan level (chickpea flour) the protein content in burfi also increases.

This finding was in accordance with Kamble (2010) [20-22] who reported that increase in the level of fig level increased in protein content of burfi. Kamble (2010) [20-22] found that, increase the sugar level decrease the protein content in fig burfi.

Reducing sugar

Reducing sugar content in chickpea burfi (Table 1) under treatment H1S1, H1S2, H2S1, H2S2, H3S1 and H3S2 was 19.25, 19.21, 19.41, 19.04, 19.71 and 19.21 per cent, respectively. The content of reducing sugar in sample of green chickpea burfi prepared under various treatment differed significantly (P<0.05) due to variable level of sugar. The reducing sugar content in green chickpea burfi samples were inversely proportional to the level of sugar added. Statistically it was observed that the effect of green chickpea level had positive significant effect on increase in reducing sugar content of green chickpea burfi. The sugar also had significant effect on reducing sugar but in negative way. The typical trend observed for reducing sugar content of various treatment combination may be attributed to the fact that green chickpea contains reducing sugar. Wood and Grusak (2007) [62] reported that desi green chick pea seed contain reducing sugar 2.61 to 4.77 per cent. These reports support the present trend of increase in reducing sugar content with increase in chickpea level. Sakate *et al*. (2004) [51] also reported that increase the level of addition of wood apple pulp, the reducing sugar content was also increased in burfi. This finding was in accordance with Kadam (2008) [19] who reported that, increase level of mango pulp, increased in reducing sugar content of burfi. Kamble (2010) [20-22] also observed that, increase in sugar level there was decrease in reducing sugar content of burfi.

Non-reducing sugar

The non-reducing sugar content in the green chickpea burfi samples ranged from 22.68 to 27.32 per cent. Sample containing 2 per cent green chickpea and 25 per cent sugar had minimum content of non-reducing sugar.

Whereas, it was maximum in formulation with 6 per cent green chickpea and 30 per cent sugar. From the observed trend of non-reducing sugar, it is very clear that increase in sugar level resulted in increase in non-reducing sugar of green chickpea burfi. The present finding was accordance with reports of Sakate *et al*. (2004) [51] and Kotade (2001) [62] in burfi prepared by using fruits.

Crude Fiber

Crude fiber content in green chickpea burfi under treatment H1S1, H1S2, H2S1, H2S2, H3S1 and H3S2 was 0.15, 0.13, 0.30, 0.27, 0.45 and 0.41 per cent. The increase in green chickpea level increase in crude fiber content and increase in sugar level there was decrease in crude fiber content. The effect of green chickpea and sugar was significant. The desi green chickpea contains crude fiber 3.7 to 13 per cent. These reports support the present trend to increase in crude fiber content with increase in green chickpea level.

Ash

Ash is predominantly mineral compound in the product. The ash content in the green chickpea burfi was in the range from 2.59 to 2.75. The increase in the level of green chickpea resulted in significant increase in ash content of burfi. The highest ash content (2.75 per cent) was observed in burfi sample prepared using 6 per cent chickpea and 25 per cent sugar.

The effect of green chickpea and sugar was significant. The desi green chickpea contain ash 2.04 to 4.2 per cent. These reports support the present trend of increase in ash content with increase in green chickpea level. The increase in chickpea level increase in ash content and increase in sugar level decrease in ash content. The present finding are in accordance with the reports of Kamble (2010) [20-22] for fig burfi and Patil *et al*. (2015) [42] for date burfi.

Acidity

The acidity (%LA) of green chick pea burfi were ranged from 0.49 to 0.53. The lowest acidity in burfi added with 2 per cent green chickpea. The highest acidity was recorded in burfi with 6 per cent green chickpea. The effect of green chickpea was significant but sugar has non- significant effect. The interaction effect was non-significant. Patil (2012) was reported the titrable acidity of date burfi increased with increase in level of date. This finding are in accordance with Kadam (2008) [19] and Navale *et al*. (2014) [34] who reported that increase in level of mango pulp and wood apple pulp the acidity was increased in burfi, respectively.

PH

The pH of green chickpea added burfi was ranged from 6.23 to 6.18 (Table 1). The lowest pH was recorded for formulation which has 6 per cent green chickpea. The highest pH recorded for formulation which has 2 per cent green chickpea. The effect of sugar was non- significant.

Table 1: Combined effect of green chickpea and sugar level on physico-chemical constituents of burfi

Treatment	Physico-chemical constituents								
	Moisture (%)	Fat (%)	Protein (%)	Reducing sugar (%)	Non-reducing Sugar (%)	Crude fiber (%)	Ash (%)	Acidity (%LA)	PH
H1S1	16.20±0.01	20.30±0.01	14.16±0.02	19.25±0.01	22.68±0.02	0.15±0.01	2.59±0.01	0.49±0.04	6.23±0.01
H1S2	15.10±0.02	19.10±0.02	14.01±0.01	19.21±0.07	26.17±0.02	0.13±0.01	2.56±0.01	0.49±0.04	6.23±0.01
H2S1	16.23±0.02	20.32±0.01	15.21±0.02	19.41±0.02	22.84±0.01	0.30±0.01	2.67±0.01	0.51±0.01	6.20±0.01
H2S2	15.14±0.02	19.24±0.02	15.12±0.01	19.04±0.05	26.76±0.01	0.27±0.01	2.65±0.02	0.51±0.01	6.20±0.01
H3S1	16.27±0.01	20.34±0.01	16.45±0.01	19.71±0.04	22.87±0.03	0.45±0.03	2.75±0.04	0.53±0.04	6.18±0.02
H3S2	15.21±0.02	19.31±0.02	16.41±0.02	19.21±0.06	27.32±0.03	0.41±0.01	2.70±0.02	0.53±0.04	6.18±0.02

Means ± SE of three replications

Table 2: ANOVA for Physico-chemical constituents of burfi using different level of chickpea and sugar

Chemical Constituents (%)	Sources of variation	D.F.	MSS	F value	CD
Moisture	Between chickpea level (H)	2	0.012	2.64	NS
	Between Sugar level (S)	1	5.260	1127.33	0.07*
	Interaction (H×S)	2	0.001	0.16	NS
	Error	10	0.018	--	--
Fat	Between chickpea level (H)	2	0.025	11.92	0.05*
	Between Sugar level (S)	1	5.424	2600.43	0.04*
	Interaction (H×S)	2	0.012	5.76	0.08*
	Error	10	0.002	--	--
Protein	Between chickpea level (H)	2	6.772	157784.28	0.008*
	Between Sugar level (S)	1	0.084	1948.65	0.006*
	Interaction (H×S)	2	0.026	605.19	0.01*
	Error	10	0.000	--	--
Reducing sugar	Between chickpea level (H)	2	0.107	82.50	0.04*
	Between Sugar level (S)	1	0.411	318.07	0.03*
	Interaction (H×S)	2	0.083	64.52	0.06*
	Error	10	0.001	--	--
Non- reducing sugar	Between chickpea level (H)	2	0.682	11110.06	0.01*
	Between Sugar level (S)	1	70.302	1145193.07	0.008*
	Interaction (H×S)	2	0.338	5504.60	0.01*
	Error	10	0.000	--	--
Crude Fiber	Between chickpea level (H)	2	0.128	1493.40	0.01*
	Between Sugar level (S)	1	0.004	51.95	0.009*
	Interaction (H×S)	2	0.000	4.18	0.01*
	Error	10	0.000	--	--
Ash	Between chickpea level (H)	2	0.036	1300.66	0.006*
	Between Sugar level (S)	1	0.006	199.70	0.005*
	Interaction (H×S)	2	0.000	15.03	0.009*
	Error	10	0.000	--	--
Acidity (%LA)	Between chickpea level (H)	2	0.002	219.03	0.004*
	Between Sugar level (S)	1	0.000	0.00	NS
	Interaction (H×S)	2	0.000	0.00	NS
	Error	10	0.000	--	--
pH	Between chickpea level (H)	2	0.003	79.37	0.007*
	Between Sugar level (S)	1	0.000	0.00	NS
	Interaction (H×S)	2	0.000	0.00	NS
	Error	10	0.000	--	--

*P<0.05 NS= Non-significant

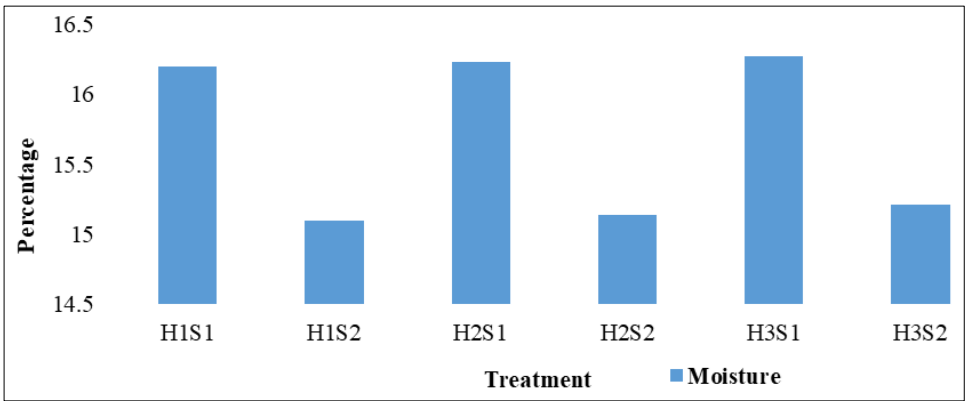

Fig 1: Effect of levels of green chickpea and sugar on moisture content of burfi

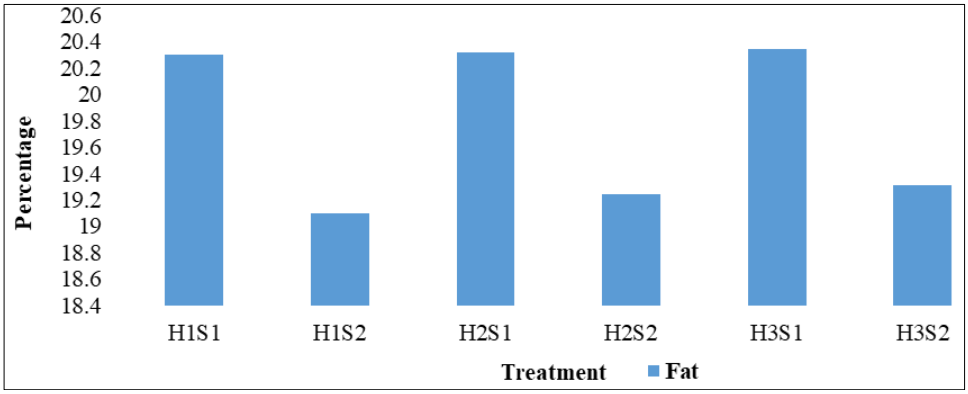

Fig 2: Effect of levels of green chickpea and sugar on fat content of burfi

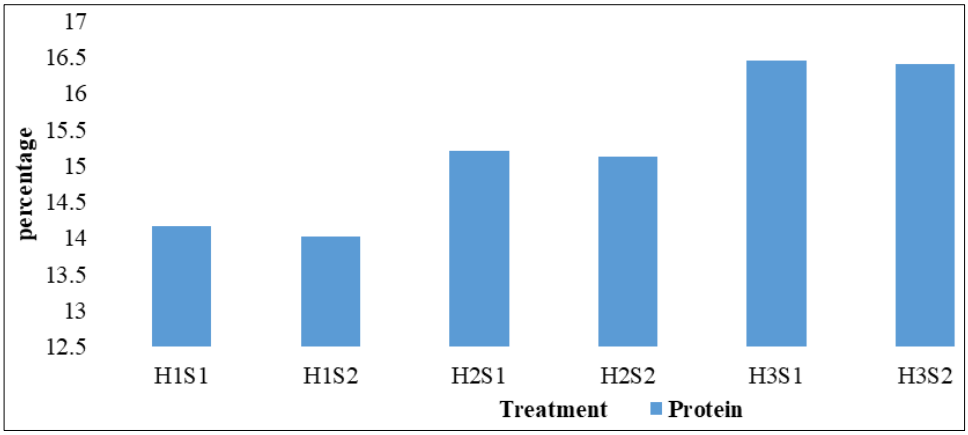

Fig 3: Effect of levels of green chickpea and sugar on protein content of burfi

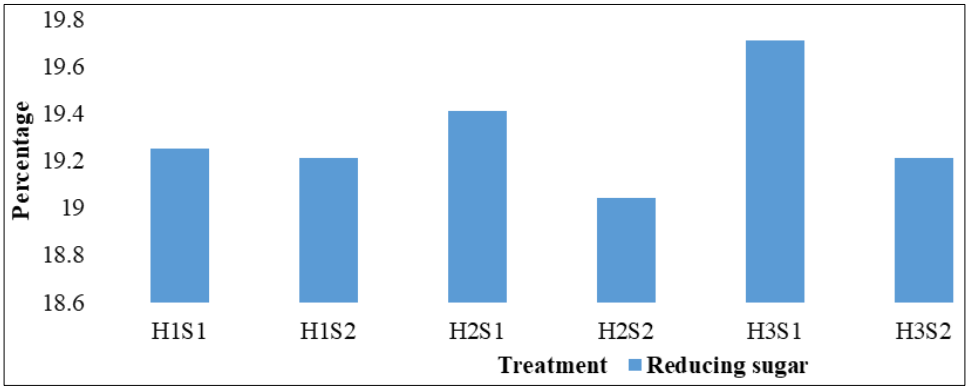

Fig 4: Effect of levels of green chickpea and sugar on reducing sugar content of burfi

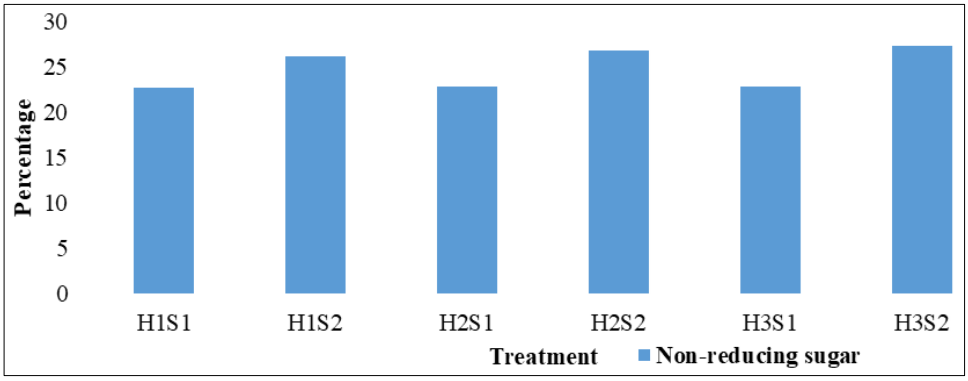

Fig 5: Effect of levels of green chickpea and sugar on non-reducing sugar content of burfi

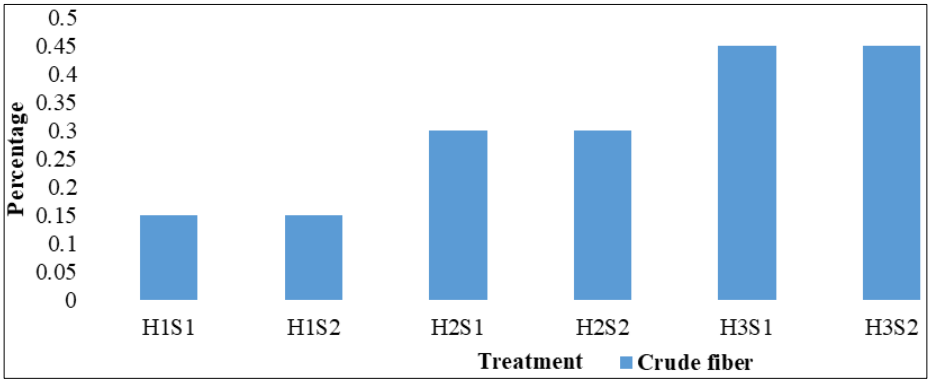

Fig 6: Effect of levels of green chickpea and sugar on crude fiber content of burfi

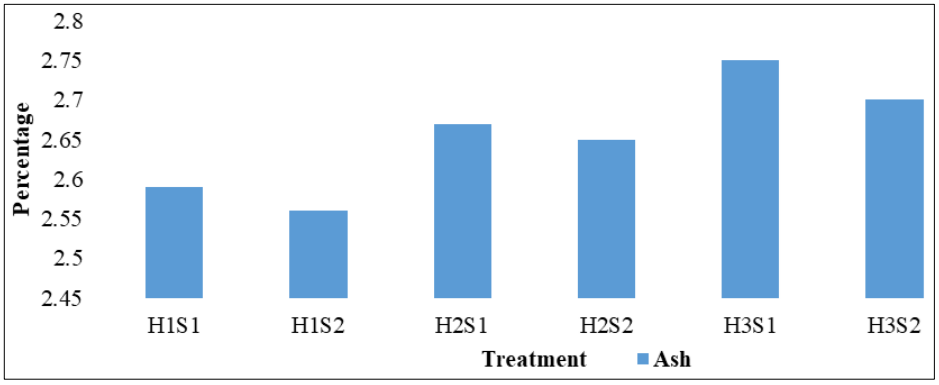

Fig 7: Effect of levels of green chickpea and sugar on total ash content of burfi

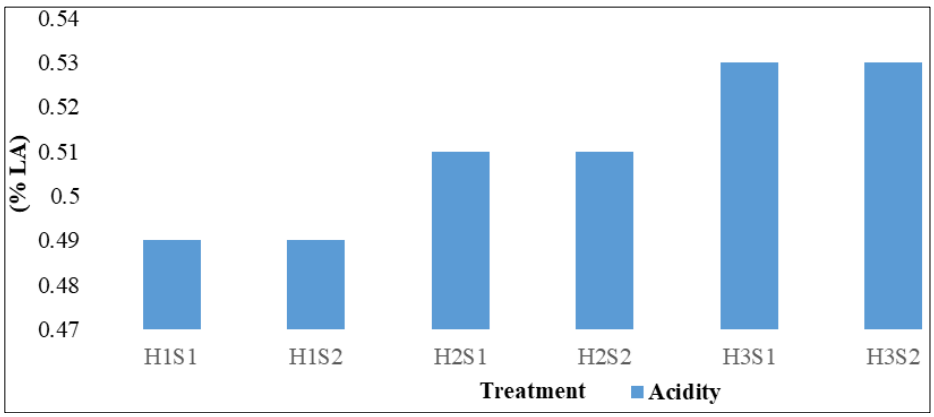

Fig 8: Effect of levels of green chickpea and sugar on acidity (%LA) content of burfi

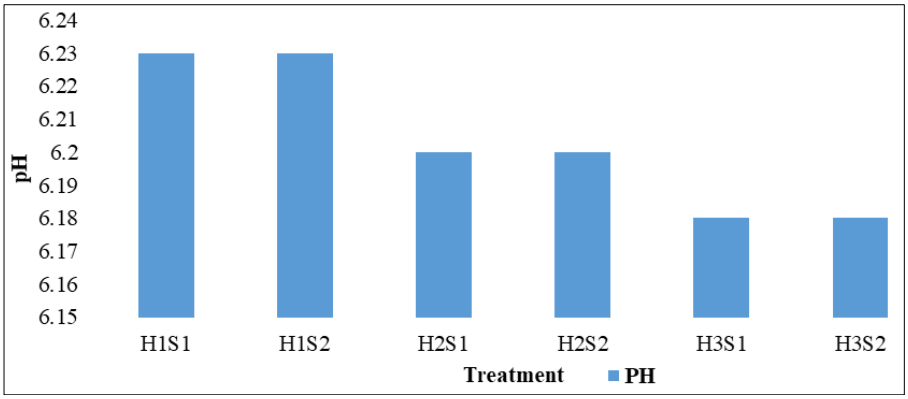

Fig 9: Effect of levels of green chickpea and sugar on pH content of burfi

Conclusion

From the present study it was concluded that, moisture, fat, protein, reducing sugar, non-reducing sugar and acidity of green chickpea burfi increased with increase in level of green chickpea and decreased with increase in sugar level but only non-reducing sugar increased with increase in sugar level. The effect of sugar on acidity and pH was non-signifcant. Thus, it is inferred that a good quality green chickpea burfi can be prepared by using 4 per cent green chickpea and 25 per cent sugar of *khoa* (H_2S_1).

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