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# Development of Low Fat *Goshtaba* with Sodium Alginate

**Heena Jalal*, Syed Arshad Hussain, M. Mansoor Bhat, Mir Salahuddin and Asif H. Sofi**

*Division of Livestock Products Technology, Faculty of Veterinary Sciences and Animal Husbandry, SKUAST-K, Srinagar, Jammu & Kashmir*

## ABSTRACT

A study was conducted with an objective to evaluate the effect of sodium alginate @ 0.1% (on weight basis) of batter on the quality of low fat *Goshtaba*. The raw emulsion was evaluated for physico-chemical parameters (pH, emulsion stability, proximate composition) while cooked product was evaluated for both physico-chemical and sensory parameters. All the physico-chemical parameters of raw emulsion except pH, protein and ash content showed significant ($P<0.05$) differences. However, in case of cooked product moisture, protein and fat content showed significant ($P<0.05$) differences. Similarly, in case of gravy, protein and fat (%) values showed significant ($P<0.05$) differences. Overall palatability scores were found significantly ($P<0.05$) better in low fat *Goshtaba* formulated with sodium alginate as compared to control samples. It was concluded that incorporation of sodium alginate improved quality and acceptance of low fat *Goshtaba* with 10% fat.

***Keywords :*** *Fat replacers, Low fat Goshtaba, Meat product, Sodium alginate*

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## INTRODUCTION

*Goshtaba* is a fat rich emulsion based meat product prepared by pounding meat along with fat on a smooth surfaced stone. Fat plays a vital role in sensory properties by binding with heat induced gel, formed of salt extractable proteins in comminuted meat products. However, the dietary fat has been implicated in the development of cardiovascular diseases, hypertension and obesity (Wylie and Judith 2002). Alginates are polysaccharides extracted from anionic red or brown seaweed, *Phaeophycase* and also from giant kelp *Macrocystis* (Pomini 1973). Various workers used alginates as thickening agent (Hughes *et al.*1980), binding agent (Means and Schmidt 1986) enrobing (El- Ebzary *et al.* 1981) and as fat replacer (Kumar and Sahoo 2006) in meat products. Hence, keeping in view the importance of *Goshtaba* and associated health risks, a study was conducted with the objective of formulating low fat *Goshtaba* (10% fat) with sodium alginate (@ 0.1%) and its effect on the quality and acceptance of *Goshtaba* evaluated.

## MATERIAL AND METHODS

Lean mutton and fat obtained from young and tender male lambs in the age group of 6-9 months, was purchased from the local market and used for the preparation of the products within 2 hours of slaughter. Dry spices, Leek (*Allium cepa var. viviparum*), ready-to-use Garlic (*Lehsan*) paste, fresh curd of desired consistency, table salt and vegetable oil were purchased from local market. The fat replacer sodium alginate (in powder form) procured from HiMedia Laboratories Pvt. Ltd. Mumbai, was used in the study as per the experimental requirement.

The products were prepared following the standardized procedure and recipes of Samoon (1988) with slight modifications. The general formulation of *Goshtaba* was: Boneless mutton–90%, mutton fat-10%, common salt-2.50%, chilled water/ice flakes-10% and large cardamom seeds-0.20%. The basic formulation, without any modification, served as control ($T_0$) and batter supplemented with sodium alginate @ 0.1% served as Treatment-1 ($T_1$). Meat emulsion was prepared by pounding hot boned meat manually on a flat and smooth stone called "*Maz-Kaene*" (*Maz*-meat; *Kaene*-stone) with a wooden hammer called "*Goshpare*' (*Gosh*-meat; *Pare*-hammer) along with mutton fat, first individually and then in combination (Sofi *et al.* 2010).

Common salt and large cardamom seeds were added to it during beating. Periodical sprinkling of chilled water up to a predetermined level was done. Pounding of meat was continued until a proper dispersion of the lean and fat was obtained and the emulsion exhibited a characteristic cohesiveness, binding and fluidy consistency, traditionally called as "*Macchwor*". After addition of the fat replacer the emulsion was further subjected to pounding to ensure uniform mixing of the replacer. It was then moulded in the shape of spherical balls and kept in refrigerator. For preparing gravy (*Yakhni*), two parts of fresh curd was homogenized with 1 part of water (by weight) with a stirrer, transferred to a thick bottomed stainless steel vessel and heated rapidly over high heat on a gas stove for 10-15 min. During heating curd was constantly stirred until it reached the boiling point. Hydrogenated vegetable oil was added to it and boiling continued for 10 min. Then garlic paste was added followed

*Corresponding Author E-mail address : drhennajalal@rediffmail.com

by other spices i.e. large cardamom, small cardamom, cinnamon, cloves, dried ginger powder and aniseed powder respectively. Fried leek paste was added at the end. Boiling was continued until the added oil floated back. At this stage, the remaining water was added and *Yakhni* was cooked further for 10-15 min. to obtain a desirable consistency. The meat balls reshaped and removed from the refrigerator, were transferred to the boiling *Yakhni* and cooked for 30 min.

Samples were subjected to quality evaluation in terms of physico-chemical and sensory attributes. Moisture, protein, fat and ash content of raw emulsion, cooked product and gravy was estimated by following the method of Association of Official Analytical Chemists (AOAC 1995). The pH was determined by following the method of Keller *et al.* (1974). The emulsion stability of the raw samples was determined as per the method of Baliga and Madaiah (1970). The cooking yield percent was calculated by dividing the weight of cooked balls with weight of uncooked balls. Sensory quality was evaluated as per Seman *et al.* (1987) wherein the product chunks in their respective gravies at a temperature of 30-35$^0$C were assessed under incandescent light for their appearance, flavour, juiciness, texture and overall palatability by a group of not less than 8 experienced panel of judges. Water was provided between samples to cleanse the palate.The data obtained from three replications were analysed by ANOVA. Duncan's Multiple Range test and critical difference were determined at 5% significance level using SPSS-version 17.0.

## RESULTS AND DISCUSSION

The results of present study on the pH value of sodium alginate formulated low fat *Goshtaba* was in agreement with the findings of Kumar *et al. (*2007) who reported that there is no change in pH of sodium alginate treated and control patties. Low fat *Goshtaba* balls exhibited a lower pH than that of the *Goshtaba* emulsion which might be due to the added effect of curd used in the formulation of gravy in which the product was cooked.

The emulsion stability (expression of percent cooking loss) of $T_1$ raw emulsion was significantly ($P<0.05$) lower than that of the control ($T_0$). Indumathi *et al.* (2011) also reported a significant ($P<0.05$) increase in emulsion stability of low-fat chevon patties (<10% total fat) made with sodium alginate at 0.25, 0.5 and 0.75% level as compared to control with highest emulsion stability observed at 0.75% level. The possible reason might be that addition of sodium alginate to the product subsequently increased the viscosity leading to better emulsion stability. Our result was also in agreement with Trout *et al.* (1992) and Serdaroglu and Sapanci (2003).

The cooking yield of sodium alginate formulated low fat *Goshtaba* samples was significantly higher ($P<0.05$) than control. The higher cooking yields of sodium alginate formulated product could be attributed to their efficient emulsion stability thus lowering the cooking losses and consequently increasing the cooking yields. Jeon *et al.* (2004) also recorded higher cooking yield for low-fat chicken patties with sodium alginate.

Significant ($P<0.05$) difference was observed between the moisture content of $T_0$ and $T_1$ raw emulsion samples. Similar trend was observed in case of cooked product samples. Our result was in agreement with that of Grigelmo *et al.* (1999) who reported that the moisture content of low-fat high dietary fibre-frankfurters increased linearly with added water in all formulations and was inversely proportional to the fat content. Similar results were obtained by Serdaroglu (2006).

The mean value of percent protein content of sodium alginate formulated low fat *Goshtaba* samples was significantly higher than its control. The protein content of cooked samples was higher than their respective raw emulsion which was in agreement with Serdaroglu and Sapanci (2003) who observed that due to moisture losses during heat processing, the protein levels were higher in sausages than in uncooked batter. Mittal and Barbut (1994) also reported that protein levels increased on cooking which could be attributable to changes in total product mass during cooking. Significant differences ($P<0.05$) between the protein content of the *Yakhni* of control and treatment was observed. The value was highest for the *Yakhni* of control and lowest for that of the sodium alginate formulation. The higher emulsion stability of low fat *Goshtaba* samples formulated with sodium alginate might have caused better retention of protein in the product at the time of cooking and thus a relatively lower protein loss in the respective gravy. These findings were in agreement with Samoon (1988) who also reported increased protein contents in the *Yakhni* of those *Goshtaba* samples which exhibited higher emulsion stability values and thus lower losses in the respective gravies.

The percent fat values of *Yakhni* were higher than that of either the emulsion or the *Goshtaba* due to incorporation of vegetable oil in the *Yakhni* formulation. Desmond *et al. (*1999) in a study on low fat beef burgers reported that the end product fat levels between the beef burgers containing various blends did not differ significantly ($P>0.05$). Kumar *et al. (*2007) also reported that the constant fat content in cooked low fat ground pork patties may be attributed to moisture loss on processing and fat binding ability of sodium alginate which is in agreement with our findings.

Appearance, flavour, juiciness and texture scores of sodium alginate formulated *Goshtaba* samples were significantly higher ($P<0.05$) than those of the control samples. Better appearance of the sodium alginate formulated samples might

**Table 1: Effect of fat replacer on the physico-chemical quality of raw emulsion and cooked product for *low fat Goshtaba***

| Raw emulsion | | | Cooked Goshtaba | | |
|---|---|---|---|---|---|
| **Parameter**** | **Treatment** | | **Parameter**** | **Treatment** | |
| | **$T_0$** | **$T_1$** | | **$T_0$** | **$T_1$** |
| pH | 5.87 ± 0.01 | 5.88 ± 0.21 | pH | 5.59 ± 0.01 | 5.61± 0.02 |
| Emulsion stability | $8.88^b$ ± 0.11 | $6.90^a$ ± 0.20 | Cooking yield (%) | $93.89^a$ ± 1.11 | $98.64^b$ ± 0.60 |
| Moisture (%) | $70.43^a$± 0.36 | $72.89^b$ ± 0.25 | Moisture (%) | $69.65^a$ ± 0.10 | $71.53^b$ ± 0.28 |
| Protein (%) | 16.52 ± 0.15 | 16.95 ± 0.34 | Protein (%) | $17.22^a$ ± 0.16 | $18.35^b$ ± 0.25 |
| Fat (%) | 9.60 ± 0.10 | 9.75 ± 0.00 | Fat (%) | 9.88± 0.12 | 9.96 ± 0.05 |
| Ash (%) | 2.10± 0.04 | 2.13 ± 0.01 | Ash (%) | 2.24± 0.01 | 2.25 ±0.01 |

Means (±SE) with same superscripts row-wise do not differ significantly (P>0.05).
* n = 9/Treatment for pH and moisture; 6/Treatment for other parameters.
**$T_0$: Control; $T_1$: Sodium alginate @ 0.1%.

**Table 2 : Physico-chemical quality of low fat Goshtaba gravy (*Yakhni*)**

| Parameter** | Treatment | |
|---|---|---|
| | **$T_0$** | **$T_1$** |
| pH | 4.86 ± 0.01 | 4.85± 0.01 |
| Moisture (%) | 79.23 ± 0.12 | 79.00 ± 0.00 |
| Protein (%) | $3.66^b$± 0.07 | $3.21^a$± 0.20 |
| ) | $13.00^b$± 0.01 | $12.01^a$± 0.01 |
| Ash (%) | 2.44 ± 0.01 | 2.48 ± 0.01 |

Means (±SE) with same superscripts row-wise do not differ significantly (P>0.05).
* n = 9/Treatment for pH and moisture; 6/Treatment for other parameters.
: Control; $T_1$: Sodium alginate @ 0.1%.

be attributed to more desirable colour, better fat dispersion and better binding leading to a more uniform cross–sectional appearance as compared to the control *Goshtaba* samples. Similarly, better emulsion stability of the batter offered by the addition of sodium alginate might have been responsible for the better texture of sodium alginate formulated *Goshtaba* samples as compared to the control. Samoon (1988) also reported similar findings in hot boned and traditionally minced *Rista* and *Goshtaba* samples owing to their superior particle binding characteristics. Higher flavour, juiciness and texture scores were also reported by Kumar *et al.* (2007) in their study on low fat ground pork patties formulated with sodium alginate @1% of batter. It could probably be due to better texture modification and stabilization actions of sodium alginate at this particular level. The score for overall palatability of low fat *Goshtaba* formulated with sodium alginate ($T_1$) was statistically significant (P<0.05) than that of the control ($T_0$) *Goshtaba*. Kumar *et al.* (2007) reported that low fat ground pork patties formulated with 0.1% sodium alginate had maximum scores for overall acceptability, which was comparable to high-fat control patties and which was in agreement with our study.

**Table 3: Effect of fat replacer on the sensory quality of low fat *Goshtaba***

| Sensory attributes1* | Treatment | |
|---|---|---|
| | **$T_0$** | **$T_1$** |
| Appearance | $6.13^a$ ± 0.09 | $6.44^b$ ± 0.11 |
| Flavour | $6.00^a$ ± 0.07 | $6.30^b$ ± 0.08 |
| Juiciness | $6.10^a$ ± 0.01 | $6.46^b$ ± 0.08 |
| Texture | $6.10^a$ ± 0.05 | $6.33^b$ ± 0.08 |
| Mouth coating | 7.06 ± 0.05 | 7.00 ± 0.01 |
| Overall palatability | $6.13^a$ ± 0.06 | $6.40^b$ ± 0.08 |

Means (±SE) with same superscripts row-wise do not differ significantly (P>0.05).
1: 8-Point Descriptive Scale (8=extremely desirable; 1=extremely undesirable). * n = 30/Treatment.
** $T_0$: Control; $T_1$: Sodium alginate @ 0.1%.

## CONCLUSION

*Goshtaba* with an average fat content of 15-25% is having a high sensory appeal but is associated with a number of health risk factors including cardiovascular diseases, obesity and cancer etc. From the present study, it was concluded that the low fat *Goshtaba* formulated with sodium alginate @ 0.1% as fat replacer is having higher physico-chemical as well as sensory quality along with overall acceptability score than low fat @10% *Goshtaba;* therefore this combination is recommended to the processors.

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