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PHYSICO-CHEMICAL, PROXIMATE, SENSORY AND STORAGE QUALITY ATTRIBUTES OF VITIS VINIFERA INCORPORATED CHICKEN KABAB FROM SPENT HEN MEAT

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The present study was undertaken to develop convenience meat product viz. Kabab using spent hen meat with incorporation of grape (Vitis vinifera) pulp. Effects of Grape pulp (Vitis vinifera) on physico-chemical, proximate, sensory and storage quality characteristics of chicken seekh kabab made from spent hen meat were evaluated. Chicken kabab could be suitably prepared with incorporation of Vitis vinifera pulp at 10% levels (replacing lean meat w/w). Incorporation of 10% Vitis vinifera pulp significantly ($P<0.05$) decreased the emulsion stability, cooking yield, protein, fat and ash values however there is significant ($p<0.05$) increase in the moisture and crude fibre scores. Sensory attributes though decreased but were comparable to control. The sensory scores of chicken kabab up to 10% added Vitis vinifera pulp showed no significant difference from control. These chicken kabab could be conveniently stored in aerobic packaging for a period of 21 days at refrigeration temperature (4±1 °C) as physico-chemical, microbiological and sensory parameters were within the acceptable range. Thus, chicken kabab with good acceptability were developed utilizing spent hen meat.

Keywords: Chicken kabab, Crude fibre, Grape (Vitis vinifera) pulp, Sensory attributes

INTRODUCTION

Due to the phenomenal expansion of poultry and layer farming in India, availability of culled and spent hens has increased immensely and these spent hens are considered as poor meat because of more toughness and less juiciness attributed to high collagen content and high degree of cross linkages (Bailey, 1984) in comparison to broilers. Thus the proper disposal of the layer stock at the end of their production is a real problem for the poultry farmer. Kabab especially Seekh Kabab is an emulsion based meat cuisine which is widely relished in our country particularly in J&K. The perishability of meat and meat products due to lipid oxidation is a major factor responsible for the deterioration of shelf life of all muscle foods. Fruit pulps offer a practical and economic source of potent antioxidants that could replace synthetic preservatives. Grapes (*Vitis vinifera*) are an important source of bioactive compounds, which possess enormous antioxidant activity (Famyima and Ough, 1986). Thus efficient utilization of these wastes (fruit extracts residues) and spent hen, i.e., layer stock at the end of their reproductive life can help in preserving the vital nutrients of our food and bringing down the cost of production. Thus the present study is envisaged to evaluate the effects of grape (*Vitis vinifera*) on quality characteristics of chicken kabab made of spent hen meat.

MATERIAL AND METHODS

Source of Materials

Chicken Meat: Spent hens of the age group of over 72 weeks were purchased from Belicharana Poultry Farm,

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Jammu. The birds were slaughtered using Halal method in the Division of Livestock Products Technology. The body fat was trimmed and deboning of dressed chicken was done manually removing all tendons and separable connective tissue. The lean meat was packed in polythene bags and frozen at -18±2 ^{0}C until use.

Condiment Mixture: Condiments used in the study were onion, garlic and ginger in a ratio of 3:2:1 and ground in a mixer to the consistency of fine paste.

Fruit Pulp: The fruit pulp viz. Grape (*Vitis vinifera*) pulp were obtained after the extraction of juice from local market of Jammu and were incorporated at 0%, 5%, 10% and 15% levels in the formulation replacing lean meat.

Spice Mixture: All spices were dried in an oven at 50 ^{0}C for overnight and then ground in grinder to powder.

Chemicals: All the chemicals used were of analytical grade.

Packaging Material: Low-density polyethylene films procured from M/s Hit-kari Industries Ltd. New Delhi was used for aerobic packaging.

Methodology of Preparation of Kabab from Meat of Spent Hen: Lean meat from spent hen was cut into smaller chunks and minced in a Sirman mincer (MOD-TC 32 R10 U.P. INOX, Marsango, Italy) with 6mm plate. The common salt, vegetable oil, refined wheat flour (maida), nitrite, sodium tripolyphosphate, spice mixture and condiment mixture were added to weighed meat according to formulation. Meat emulsion for chicken kababs was prepared in Sirman Bowl Chopper [MOD C 15 2.8G 4.0 HP, Marsango, Italy]. Minced meat was blended with salt, sodium tripolyphosphate and sodium nitrite for 1.5 minute. Water in the form of crushed ice was added and blending continued for 1 minute. This was followed by addition of refined vegetable oil and blended for another 1 to 2 minutes. This was followed by addition of spice mixture, condiments and other ingredients and again mixed for 1.5 to 2 minutes to get the desired emulsion. Adequate care was taken to keep the end point temperature below 18 ^{0}C by preparing the emulsion in cool hours of morning, by addition of meat and other ingredients in chilled/partially thawed form and by addition of crushed ice or ice water.

Molding of Kabab: It was done on steel skewers in case of oven roasting. The steel skewers of 10 mm diameter and of length sufficient to fit in the hot air oven were used for oven roasting purpose. Holding the skewer in one hand, an accurately weighed quantity (60 g) of meat mix/emulsion, in the form of a ball, was taken in the other hand, pierced through the pointed end and pressed on to middle of the skewer. With the help of moistened palm and fingers, it was gently spread evenly and molded into a cigar shaped kabab. The length of the kabab was determined by the graduated scale of glass pipette and averaged 18 cm.

Cooking of Kabab: Kabab was placed longitudinally on the two edges of a perforated oven tray in a convection oven (Yorco sales Pvt. Ltd. India, Model-YS1-431, S. No. 02B2843). The molded raw *kabab* were smeared with vegetable oil and cooked in a preheated hot air oven at 180±2 ^{0}C for a total time of about 12 minutes. The internal temperature of kabab was monitored by a thermometer and cooked to an internal temperature of 78±2 ^{0}C. The kabab were removed from the skewers, cooled to room temperature and weighed. Pooled sample of each treatment was assigned for analysis.

Analytical Procedures

pH: The pH of raw mix/emulsion soon after its preparation and cooked kababs was determined by the method (Keller *et al.*, 1974) using digital pH meter (Systronics Digital pH Meter 802, Serial No. 603).

Cooking Yield: The weight of each kabab was recorded before and after cooking. The cooking yield was calculated and expressed as percentage by a formula:

$$Cooking\ \ yield\ \ percent = \frac{Weight\ of\ \ cooked\ kababs}{Weight\ of\ \ raw\ kababs} \times 100$$

***Emulsion Stability*:** It was determined as per procedure described (Townsend et al., 1968).

Moisture Protein Ratio: It was calculated by simple division of moisture percent by protein percent for both raw and cooked kabab.

Proximate Composition: The moisture, fat, ash and protein and crude fibre content of chicken kabab, raw and cooked were determined by standard methods (AOAC, 1995).

Thio Barbituric Acid: During storage, it was determined using the method (Witte *et al.*, 1970).

Free Fatty Acid (FFA): It was determined by method (Koniecko, 1979). FFA was calculated and expressed as follows:

$$FFA\left(\%\ Oleic\ acid\right) = \frac{\left(0.1 \times ml\ \ 0.1N\ \ alcoholic\ \ KOH \times 0.282 \times 100\right)}{Wt.\ of\ \ fat}$$

Microbiological Profile: Total plate count, psychrotrophic count and Coliform count in the sample were determined by method (APHA, 1984). Readymade media (Hi-Media) were used for the analysis.

Sensory Evaluation: A semi-trained experienced sensory panel consisting of scientists evaluated the sensory attributes viz: appearance, flavour, juiciness, texture and the overall acceptability of fresh and stored samples using 8 point descriptive scale (Seman *et al.*, 1987).

Statistical Analysis: Means and standard errors were calculated for different parameters. Factorial design of experiment was fallowed. Analysis of variance was performed. In significant effects, least significant differences were calculated at appropriate level of significance for a pair wise comparison of treatment means (Snedecor and Cochran, 1980).

RESULTS AND DISCUSSION

Physico-Chemical and Proximate Attributes of Vitis vinifera Pulp Incorporated Chicken Kabab Meat Emulsion

The pH showed a significant difference ($p<0.05$) between control and the treated products and was lower in treated products. However among treated products it was comparable. The emulsion stability decreased with increase in the level of *Vitis vinifera* pulp. There was a significant difference ($p>0.05$) in the moisture percent between control and *Vitis vinifera* pulp inclusion. However moisture percent of the treated products increased concomitantly with the increase in the levels of *Vitis vinifera* pulp and significant effect ($p<0.05$) was observed at 10 and 15% levels of incorporation. A significantly lower ($p<0.05$) protein percent was observed in treated products when compared to control and it further decreased with the increasing levels of *Vitis vinifera* pulp. A lower protein percent among treated products in the present study might be due to replacement of lean meat by *Vitis vinifera* pulp. Fat percent showed a significant decline ($p<0.05$) at 15% incorporation level as compared to control while others had comparable values. This may be attributed to the dilution effect caused by incorporation of *Vitis vinifera* pulp which is particularly low in fat content. Ash percent showed a significant decline ($p<0.05$) at all incorporation levels as compared to control whereas at 10% level it was comparable to 15% level. It may be attributed to the lower mineral content of pulp in comparison to lean meat. Moisture to protein ratio showed an increasing trend and was significantly higher ($p<0.05$) at 10 and 15% incorporation level as compared to control, whereas at 5% level it was comparable to control as well as 10% while as latter, it was comparable to 15% (Table 1). These results were in agreement with lemon incorporated meat emulsion (Saricoban *et al.*, 2008).

Table 1: Effect of *Vitis vinifera* Pulp on Physico-Chemical and Proximate Composition of Raw Chicken Kabab (Mean±SE)*

Parameters	Levels of Grape Pulp (%)			
	0	5	10	15
pH	$6.14^{a}\pm0.03$	$6.10^{ab}\pm0.03$	$6.07^{ab}\pm0.03$	$6.03^{b}\pm0.02$
Emulsion Stability (%)	$90.72^{a}\pm0.42$	$90.00^{ab}\pm0.39$	$89.42^{ab}\pm0.52$	$88.54^{b}\pm0.58$
Moisture (%)	$65.06^{b}\pm0.37$	$65.69^{ab}\pm0.31$	$66.32^{a}\pm0.32$	$66.71^{a}\pm0.51$
Protein (%)	$16.02^{a}\pm0.54$	$15.06^{ab}\pm0.46$	$14.04^{bc}\pm0.53$	$13.41^{c}\pm0.29$
Fat (%)	$11.78^{a}\pm0.29$	$11.27^{ab}\pm0.35$	$10.94^{ab}\pm0.43$	$10.26^{b}\pm0.32$
Ash (%)	$2.73^{a}\pm0.06$	$2.48^{b}\pm0.04$	$2.33^{bc}\pm0.06$	$2.17^{c}\pm0.05$
Moisture: Protein	$4.08^{c}\pm0.13$	$4.38^{bc}\pm0.13$	$4.75^{ab}\pm0.18$	$4.98^{a}\pm0.12$

Note: *Mean±SE with different superscripts in a row differs significantly ($P<0.05$). n = 6.

Physico-Chemical and Proximate Attributes of Vitis vinifera Pulp Incorporated Cooked Chicken Kabab

A significant ($p<0.05$) influence on pH and cooking yield was recorded. The pH showed a significant ($p<0.05$) difference between control and the treated products and was lower in treated products. However, among the treated products it was comparable. There was significantly higher ($p<0.05$) cooking yield of control than treated products, however, among treated products cooking yield did not differ ($p>0.05$). Lower emulsion stability among treated products might have attributed to reduced cooking yield. There was no significant difference ($p>0.05$) in the moisture percent between control and 5 and 10% *Vitis vinifera* pulp inclusion. However the moisture percent of the treated products increased concomitantly with the increase in the levels of *Vitis vinifera* pulp and significant effect ($p<0.05$) was observed at 15% level of incorporation. An increase in moisture percent among treated products with increasing levels of *Vitis vinifera* pulp could be due to comparatively higher moisture content in the latter. Protein percentage showed a significant decrease ($p<0.05$) in alternate succession. Fat percent showed a significant decline ($p<0.05$) at 15% incorporation level as compared to control

while others had comparable values. Ash percent showed a significant decline ($p<0.05$) at all incorporation levels as compared to control. The crude fibre content increased significantly ($p<0.05$) at all incorporation levels as compared to control. This may be due to compositional variation between *Vitis vinifera* pulp and lean meat. Increasing level of *Vitis vinifera* pulp improves the fibre contents, which was expected, as *Vitis vinifera* pulp contains on an average 0.9 grams of dietary fibre on fresh weight basis. Moisture to protein ratio was significantly better ($p<0.05$) than control at all levels of incorporation, however at 5% it was comparable to control. These findings were in congruence with reports (Mendoza *et al.*, 2001; Fernandez-Gines *et al.*, 2004; Lin and Lin, 2004; and Arun *et al.*, 2010).

Sensory Attributes of Vitis vinifera Pulp Incorporated Cooked Chicken Kabab

Mean sensory scores revealed significant differences ($p<0.05$) in flavour, texture and overall acceptability scores between control and treatment products. Appearance and juiciness scores showed a gradual decline but were comparable to control at all incorporation levels. A comparable general appearance and juiciness scores between control and treatment products could be attributed to attractive colour and higher moisture content in *Vitis vinifera* pulp, respectively. The lower flavour scores among treatment products observed in present study could be due to mild sweet fruity flavour attributed by *Vitis vinifera* pulp at higher levels. There was no literature data in respect of addition of *Vitis vinifera* pulp in development of meat products. However literature data on other fibers (apple, peach or orange) indicated a negative correlation between fibre contents and texture. Such a decline in texture was also supported[16]. Overall acceptability of kabab was an indirect reflection of flavour, texture and juiciness scores. Overall acceptability of product was significantly less ($p<0.05$) at 15% incorporation as compared to control. Such a trend in overall acceptability was reflective of change in scores

Table 2: Effect of *Vitis vinifera* Pulp on Physico-Chemical and Proximate Composition of Cooked Chicken Kabab (Mean±SE)*

Parameters	Levels of Grape Pulp (%)			
	0	5	10	15
pH	$6.27^{a}\pm0.02$	$6.23^{ab}\pm0.02$	$6.20^{bc}\pm0.01$	$6.16^{c}\pm0.02$
Cooking Yield (%)	$88.78^{a}\pm0.55$	$87.85^{ab}\pm0.43$	$87.52^{ab}\pm0.27$	$87.03^{b}\pm0.38$
Moisture (%)	$62.72^{b}\pm0.28$	$63.08^{ab}\pm0.35$	63.58^{ab}	$63.86^{a}\pm0.19$
Protein (%)	$18.08^{a}\pm0.53$	$16.96^{ab}\pm0.35$	15.96^{bc}	$15.37^{c}\pm0.23$
Fat (%)	$12.12^{a}\pm0.25$	$11.75^{ab}\pm0.30$	11.54^{ab}	$10.91^{b}\pm0.18$
Crude Fibre (%)	$0.56^{a}\pm0.04$	$1.23^{c}\pm0.06$	$1.87^{b}\pm0.06$	$2.39^{a}\pm0.06$
Ash (%)	$2.89^{a}\pm0.05$	$2.59^{b}\pm0.04$	$2.45^{bc}\pm0.05$	$2.31^{c}\pm0.05$
Moisture: Protein	$3.48^{b}\pm0.11$	$3.72^{b}\pm0.07$	$3.99^{a}\pm0.11$	$4.15^{a}\pm0.07$

Note: *Mean±SE with different superscripts in a row differs significantly ($P<0.05$). n = 6.

Table 3: Effect of *Vitis vinifera* Pulp Incorporated Cooked Chicken Kabab (Mean±SE)*

Sensory Atributes	Levels of Grape Pulp (%)			
	0	5	10	15
Appearance	7.10±0.12	6.97 ±0.10	6.90 ±0.12	6.82 ±0.10
Flavour	$7.07^{a}\pm0.11$	$6.95^{a}\pm0.14$	$6.76^{ab}\pm0.12$	$6.50^{b}\pm0.12$
Juiciness	7.16 ±0.04	7.07 ±0.13	6.93 ±0.12	6.83 ±0.12
Texture	$7.04^{a}\pm0.11$	$6.94^{a}\pm0.10$	$6.89^{ab}\pm0.10$	$6.64^{b}\pm0.09$
Overall acceptability	$6.99^{a}\pm0.11$	$6.88^{ab}\pm0.10$	$6.72^{ab}\pm0.13$	$6.54^{b}\pm0.13$

Note: *Mean±SE with different superscripts in a row differs significantly ($p<0.05$). Mean values are scores on 8 point descriptive scale where 1-extremely poor and 8-extremely desirable. n = 21.

Table 4: Effect of Refrigerated Storage on Physico-Chemical Characteristics of Aerobically Packaged Cooked Chicken Kabab Incorporated with *Vitis vinifera* (Mean±SE)*

Treatments	Storage Period (Days)			
	0	7	14	21
pH				
C	6.27 ± 0.02^{Aa}	6.20 ± 0.02^{ABa}	6.15 ± 0.02^{BCa}	6.07 ± 0.03^{Ca}
GP (10%)	6.20 ± 0.02^{Ab}	6.15 ± 0.01^{Bab}	6.09 ± 0.02^{Cab}	6.05 ± 0.02^{Ca}
FFA (% Oleic acid)				
C	0.0025 ± 0.00^{Da}	0.016 ± 0.00^{Ca}	0.030 ± 0.00^{Ba}	0.049 ± 0.00^{Aa}
GP (10%)	0.0022 ± 0.00^{Db}	0.014 ± 0.00^{Ca}	0.024 ± 0.00^{Bb}	0.041 ± 0.00^{Ab}
TBA (mg malonaldehyde/Kg)				
C	0.32 ± 0.02^{Da}	0.47 ± 0.02^{Ca}	0.64 ± 0.03^{Ba}	0.75 ± 0.03^{Aa}
GP (10%)	0.26 ± 0.01^{Db}	0.35 ± 0.01^{Cb}	0.42 ± 0.01^{Bc}	0.60 ± 0.01^{Ab}

Note: *Mean±SE with different superscripts in a row wise (Upper case alphabet) and column wise (lower case alphabet) differ significantly ($p<0.05$). n_1 (pH) = 3, n_2 (FFA and TBA) = 6 for each treatment. C = Control, GP = Grape (*Vitis vinifera*) pulp incorporated in chicken kabab.

Table 5: Effect of Refrigerated Storage on Proximate Composition of Aerobically Packaged Cooked Chicken Kabab Incorporated with *Vitis vinifera* (Mean±SE)*

Treatments	Storage Period (Days)			
	0	7	14	21
Moisture (%)				
C	62.72± 0.28^{Aa}	61.43 ±0.36^{Bb}	60.45 ±0.41^{BCa}	59.79± 0.27^{Ca}
GP (10%)	63.58± 0.30^{Aa}	62.49 ±0.22^{ABa}	61.51 ±0.41^{BCa}	60.46 ±0.59^{Ca}
Protein (%)				
C	18.08 ± 0.53^{Aa}	18.34± 0.50^{Aa}	18.58± 0.56^{Aa}	18.89 ± 0.67^{Aa}
GP (10%)	15.96± 0.37^{Ab}	16.28 ± 0.33^{Ab}	16.71 ± 0.45^{Ab}	17.12 ± 0.51^{Ab}
Fat (%)				
C	12.12±0.24^{Ba}	12.39 ±0.28^{ABa}	12.69 ± 0.26^{ABa}	13.00 ± 0.29^{Aa}
GP (10%)	11.54± 0.34^{Ba}	11.90 ± [illegible]^{ABa}	12.26 ± 0.28^{ABa}	12.64± 0.31^{Aa}
Ash (%)				
C	2.89 ± 0.05^{Ca}	3.08± 0.06^{BCa}	3.26 ±0.09^{ABa}	3.51 ± 0.13^{Aa}
GP (10%)	2.45± 0.05^{Cc}	2.63 ± 0.05^{Bc}	2.82 ± 0.06^{Ab}	2.98 ± 0.07^{Ab}

Note: *Mean±SE with different superscripts in a row wise (Upper case alphabet) and column wise (Lower case) differ significantly ($p<0.05$). n = 6, C = Control, GP = Grape (*Vitis vinifera*) pulp incorporated in chicken kabab.

Table 6: Effect of Refrigerated Storage on Microbiological Characteristics of Aerobically Packaged Cooked Chicken Kabab Incorporated with *Vitis vinifera* (Mean±SE)*

Treatments	Storage Period (Days)			
	0	7	14	21
Total Plate Count (log cfu/g)				
C	2.42 ±0.04^{Da}	3.23±0.05^{Cb}	4.29 ± 0.04^{Bb}	4.99± 0.03^{Ab}
GP (10%)	2.49 ± 0.07^{Da}	3.61 ±0.04^{Ca}	4.37± 0.03^{Ba}	5.26± 0.03^{Aa}
Psychrotrophic Count (log cfu/g)				
C	Not detected	Not detected	1.92 ± 0.06^{Aa}	2.97± 0.05^{Bb}
GP (10%)	Not detected	Not detected	2.05 ± 0.06^{Aa}	3.19± 0.04^{Ba}
Coliform Count (log cfu/g)				
C	Not detected	Not detected	Not detected	Not detected
GP (10%)	Not detected	Not detected	Not detected	Not detected

Note: **Mean±SE with different superscripts in a row wise (Upper case alphabet) and column wise (lower case alphabet) differ significantly ($P<0.05$). n = 6, C = Control, GP = Grape (*Vitis vinifera*) pulp incorporated in chicken kabab.

of flavour and texture with increased incorporation levels. The sensory scores of *kabab* for all attributes at 10% incorporation were quite comparable to control (Table 3). Hence, 10% incorporation with *Vitis vinifera* pulp was taken as optimum incorporation level for the formulation

Table 7: Effect of Refrigerated Storage on Sensory Attributes of Aerobically Packaged Cooked Chicken Kabab Incorporated with Incorporated with *Vitis vinifera* (Mean±SE)*

Treatments	Storage Period (Days)			
	0	7	14	21
Appearance				
C	6.97 ±0.11^{Aa}	6.49 ± 0.08^{Ba}	5.85 ± 0.07^{Ca}	5.40 ± 0.13^{Da}
GP (10%)	7.04 ± 0.12^{Aa}	6.45 ± 0.13^{Ba}	5.87 ±0.08^{Ca}	5.32 ±0.15^{Da}
Flavour				
C	6.97 ± 0.11^{Aa}	6.52 ± 0.11^{Ba}	6.10 ±0.09^{Ca}	5.52 ±0.14^{Da}
GP (10%)	6.92 ± 0.13^{Aa}	6.48 ± 0.12^{Ba}	6.22 ±0.08^{Ba}	5.60± 0.14^{Ca}
Texture				
C	7.04± 0.11^{Aa}	6.59 ± 0.11^{Ba}	6.20 ±0.07^{Ca}	5.78 ±0.08^{Da}
GP (10%)	6.88 ± 0.10^{Aa}	6.42 ± 0.12^{Ba}	6.06 ±0.06^{Ca}	5.38 ±0.15^{Db}
Juiciness				
C	7.04 ± 0.12^{Aa}	6.50 ± 0.10^{Ba}	6.39 ±0.06^{Ba}	5.82 ±0.09^{Ca}
GP (10%)	6.92 ± 0.13^{Aa}	6.31 ± 0.13^{Aa}	5.90 ±0.07^{Cb}	5.42 ±0.12^{Db}
Overall Acceptability				
C	7.02 ± 0.14^{Aa}	6.26 ± 0.10^{Ba}	5.91 ±0.12^{Ca}	5.57 ±0.11^{Da}
GP (10%)	6.95 ± 0.11^{Aa}	6.13 ± 0.09^{Ba}	5.71 ±0.09^{Ca}	5.05 ±0.14^{Db}

Note: *Mean±SE with different superscripts in a row wise (Upper case alphabet) and column wise (lower case alphabet) differ significantly ($p<0.05$). n= 21, C = Control, GP = Grape (*Vitis vinifera*) pulp incorporated in chicken kabab.

of incorporated chicken kabab and selected for further storage study at refrigeration temperature (4±1 ^{0}C).

Storage Quality of Vitis vinifera Pulp Incorporated Chicken Kabab at Refrigeration Temperature (4±1 ^{0}C).

The different Proximate (Table 4) physico-chemical (Table 5), microbiological (Table 6) and sensory properties (Table 7) of kabab incorporated with 10% *Vitis vinifera* pulp respectively along with control kabab were aerobically packaged in low density polyethylene (LDPE) pouches and were analyzed at a regular interval of 0, 7, 14 and 21 days during refrigerated storage at 4±1 ^{0}C.

Physico-Chemical Characters

The effect of storage was obvious as the pH of chicken kabab followed a decreasing trend at progressive storage intervals. The mean pH values of *Vitis vinifera* pulp products were comparable to each other on all days of storage whereas the mean pH values of treated products varied significantly ($p<0.05$) with control on all days of storage except on day 21. The decrease in pH might be attributed to

the availability of more readily utilizable carbohydrate molecules by the microbes and thereby formation of lactic acid. A similar decrease in pH of low-fat dry fermented sausages prepared with cereals and fruit fibres (Garcia *et al.*, 2002). Further, a similar trend was reported in pH in bologna sausages made with citrus fibre (Fernández-Ginés *et al.*, 2003). FFA followed a significant ($p<0.05$) linear increasing trend from day 0 to 21 in treated products as well as control. Kabab incorporated with *Vitis vinifera* pulp (10%) had comparable FFA values with each other on all days of storage except on day 21. However a significant ($p<0.05$) difference in FFA values was observed between control and the *Vitis vinifera* pulp treated products on day 0, day 14 and day 21 but were comparable on day 7. These results are in good agreement with those reported in dry fermented sausages (Zanardi *et al.*, 2004; and Marco *et al.*, 2006). Similar trend was observed in chicken patties (Nayak, and Tanwar, 2004; and Nagamallika *et al.*, 2006) and in fermented sausages (Valeria *et al.*, 2008). TBA followed a significant ($p<0.05$) linear increasing trend from day 0 to 21 in case of both control and treated product. A difference among the treatments also existed as the TBA value of control kabab varied significantly ($p<0.05$) with other treated products on all days of storage except on day 0. The increase in TBA values on storage might be attributed to oxygen permeability of packaging material that led to lipid oxidation. An increase in TBA values was observed with increasing storage period (Dushyanthan *et al.*, 2000; and Kumar, 2001). In fact, the presence of fibre content reduces the free fat and thereby decreased the rate of oxidation. Antioxidant property of some fruits and vegetables may also be responsible for reduced TBA value in meat products (Serdaroglu *et al.*, 2005). Addition of red grape fibre delayed lipid oxidation in minced horse mackerel muscle during frozen storage (Sanchez-Alonso *et al.*, 2007).

Proximate Composition

The mean moisture values of *Vitis vinifera* pulp treated products were comparable on day 0 and day 7 also. However in case of control and treated products, the mean moisture values on day 7 were comparable to day 14 which in turn were comparable to day 21. The mean protein values of control and *Vitis vinifera* pulp treated kabab showed a non-significant increasing trend throughout the period of storage. However mean protein values of control were significantly ($p<0.05$) different from *Vitis vinifera* pulp treated kabab throughout the storage period. The mean fat values of treatment products as well as control were comparable to each other on all days of storage. The values showed a non-significant ($p>0.05$) increasing trend throughout the period of storage. The mean ash values of *Vitis vinifera* pulp treated products on day 0 were significantly different from the mean ash values on day 7 which in turn varied significantly from the mean ash values on day 14. However on day 14 and day 21 these values were comparable. The mean ash values of all treatments were significantly ($p<0.05$) different from each other on all days of storage except on day 21. On day 14 and 21 the mean ash values of both the treated products were comparable. Similar trends was found out in physico-chemical and proximate quality with increasing storage period (Valeria *et al.*, 2008).

Microbiological Characters

Total plate count followed a significant ($p<0.05$) linear increasing trend from day 0 to 21 in treatment products and control. A difference among the treatments also existed. TPC of treatment products were higher than control during entire period of storage. Later on, the counts became significantly higher ($p<0.05$) for treatment products than control. This could be due to availability of the nutrients favourable for microbial growth. Similar findings were reported in chicken meat patties and according to them Total Plate Count (TPC) increased at each storage interval both in control and extended patties (Kumar *et al.*, 2007). Psychrotrophs were not detected on day 0 and 7 of storage in the treated products and control. But, it was observed on day 14 and day 21 of storage in all treated groups as well as control. The counts for various kabab, both treated and control were comparable on day 14 of storage; however the counts for control kabab varied significantly ($p<0.05$) from treated products on day 21 of storage. The coliforms were not detected throughout the period of storage in both control and treated products. It could be due to the destruction of these bacteria during cooking. Further, hygienic practices followed during the preparation and packaging of kabab could also be one of the reasons for the absence of coliforms. similar microbiological profile was reported in meat products (Kumar, 2001).

Sensory Parameters

A progressive and significant decline for all sensory attributes was observed during the period of storage. The sensory attributes were significantly affected during 21 days of storage. All the sensory parameters viz., appearance, flavour, juiciness, texture and overall acceptability of control as well as treated kabab followed a significant ($p<0.05$)

descending trend with increase in storage days. The decrease in appearance scores might be due to pigment and lipid oxidation resulting in non-enzymatic browning. A gradual decline of flavour might be due to the expected loss of volatile flavour components from spices and condiments on storage of meat products. Juiciness scores followed a decreasing trend in chicken kabab prepared with selected fibre sources as well as control during the period of storage. It could be due to some loss of moisture from the products during storage. The lower textural scores found in control and treated products might be due to increased loss of water in them and subsequent reduction of pH and denaturation of proteins at low pH and degradation of muscle fibre protein by bacterial action which resulted in decreased water binding capacity. The overall acceptability of control and both the treated kabab decreased significantly ($p<0.05$) after 7th day of storage. A significant ($p<0.05$) decrease in scores during last phase of study might be reflective of the decline in scores of flavour, juiciness and texture attributes. These observations indicated that chicken kabab prepared with 10% *Vitis vinifera* pulp retained fair to good overall acceptability up to day 21 under refrigerated storage at 4±1 ^{0}C in low density polyethylene pouches (LDPE). The findings were similar and supported (Patil, 2000; Kumar, 2001; and Thomas *et al.*, 2006).

CONCLUSION

The chicken kabab from meat of spent hen can be successfully incorporated with grape (*Vitis vinifera*)pulp, on the basis of analysis of different physico-chemical, proximate and sensory parameters. 10% *Vitis vinifera* pulp was found optimum for oven roasting as method of cooking. The chicken kabab from meat of spent hens could be conveniently packed in LDPE for a period of 21 days in refrigerated (4±1 ^{0}C) condition without any marked loss of physico-chemical, microbial and sensory quality.

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