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Quality Changes in Chevon Harrisa (Meat Based Product) During Refrigerated Storage

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ABSTRACT

Harrisa is a popular indigenous ready to eat meat based product of Jammu and Kashmir. An attempt was made to standardize the processing technology by optimizing the basic formulation and processing conditions for the preparation of Harrisa from chevon meat. Harrisa developed from chevon was aerobically packed in LDPE pouches and evaluated for various physicochemical, microbiological and sensory attributes for a shelf life of 1 week at refrigeration temperature (4±1°C). The storage of chevon Harrisa resulted in significant ($p<0.05$) decrease in almost all the quality attributes and sensory scores, but all the parameters were well within the limits of acceptability. The mean values of various observed physico-chemical and proximate parameters of the product viz., pH, protein percent, fat percent and ash percent showed a significant ($p<0.05$) increasing trend whereas the moisture percent values of the product decreased significantly ($p<0.05$) during refrigerated storage. The mean sensory scores indicated that chevon Harrisa was highly acceptable although all the sensory parameters showed a significant ($p<0.05$) decline with storage. Texture and flavour seemed to have decided the overall palatability of the product. The mean values of the total plate count and psychrophillic count increased significantly ($p<0.05$) whereas the coliforms were not detected throughout the period of storage. The highest values for total plate count (2.37±0.008) and psychrophillic count (1.68±0.018) were observed on day 7 of storage. Free Fatty Acid (FFA) and thiobarbituric acid (TBA) values also increased significantly ($p<0.05$) with storage period. Thus, Harrisa standardized from chevon meat and packed aerobically in LDPE pouches is acceptable up to one week of refrigerated (4±1°C) storage without much decline in the quality of the product.

Key words: Harrisa, formulation, physicochemical properties, shelf life

INTRODUCTION

Harrisa is an indigenous meat based product of Jammu and Kashmir which is very much relished by people of Jammu and Kashmir and many other states of India particularly in winter months during early morning hours. It is easy to prepare and could be served to a large number of people in relatively short time, thus it comes under the category of convenience ready to eat meat

products. Harrisa is usually made from mutton, chevon or beef but particular styles of Harrisa could be prepared from other meat animals like chicken, fish etc. It has a pasty consistency with a particular spice rich flavour. It is prepared throughout the state, at homes and commercially at Harrisa corners using different ingredients and processing conditions. As such there seems to be no standard method of preparation and control over the quality. Furthermore, information is seldom available in the literature on the processing and quality of Harrisa. Thus, there is an immediate need of scientific standardization and evaluation of the product so that literature will be generated and further research could be conducted on the product.

The rich heritage of India contributes to wide range of traditional foods and has a role to play in health foods. Indigenous meat products are unique in their spicy flavour, simplicity and ease of preparation. They have the potential of becoming value added convenience products of good palatability. The raising cost of broiler and mutton in India coupled with requirement to develop traditionally versatile and easily prepared meat items have also created a need for alternatives (Bhat and Pathak, 2009). Moreover, due to rapid development in meat based fast food industry with preference for processed products, the scope for production of traditional meat products has increased immensely, creating a need for developing technologies for manufacturing indigenous products on large commercial scale to meet the demands of growing population.

Due to the phenomenal expansion of farming, availability of culled and spent animals has increased immensely and the meat from these culled stocks at the end of their active productive and reproductive life is considered as poor meat or secondary grade meat because of higher toughness and less juiciness attributed to high collagen content (Abe-Hirta *et al*., 1996) and high degrees of cross linkages (Wenham *et al*., 1973; Bailey, 1984). Thus the proper disposal of the culled stock at the end of their production is a real problem for the farmer. Development of further processed convenient products like Harrisa is considered a potential solution to these concurrent problems which may show a promising outlet for such tough meats and is an ideal way of the profitable disposal of culled/spent animals whose demand is on decline. Processing of meat from spent animals to different value added products open the avenues for not only its judicious utilization but a readily accessible animal protein sources for poor. Emphasis over food processing and economic formulation has made it necessary to do the needful work in this direction.

Therefore, the problem of poor utilization can be resolved by development of further processed convenience meat products (Kondaiah, 1990; Choudhury *et al*., 1992). But the meat products prepared from spent animals have comparatively poor sensory properties and lower yield (Kondaiah *et al*., 1992). The emulsion with inferior emulsifying capacity due to high proportion of connective tissue and less salt soluble proteins (Huspeth and May, 1969), higher cooking loss because of high fat content and poor water binding capacity (Acton and Dick, 1978; Buyck *et al*., 1982), low emulsion stability due to low concentration of salt soluble proteins (Hargus *et al*., 1970) are the shortcomings that can be overcome by suitable food additives or extenders like starch and milk proteins (Chung *et al*., 1989; Tarte *et al*., 1989). Rice being the traditional ingredient of the Harrisa can thus help to overcome these shortcomings of spent/culled animal's meat which could be attributed to gelatinizing property of increased starch component on heating, which stabilizes the emulsion and results in higher moisture and fat retention of Harrisa.

Furthermore, chevon has some market advantage due to its low fat and cholesterol compared to red meat. With this in view, the present study was envisaged to standardize the basic formulation and processing conditions for the preparation of Harrisa from chevon meat and to study its various physico-chemical, sensory and microbiological properties for a shelf life of 1 week at refrigeration temperature.

MATERIALS AND METHODS

Chevon meat: The chevon meat from gluteus, semitendinosus, semimembranosus, gracialis and quadratus femoris muscles was obtained from spent males of more than 5 years of age within 5 h of their being slaughtered from the local market of Jammu in 2007. The separable fat and connective tissue was removed manually removing all tendons and separable connective tissue. The lean meat was packed in LDPE (low density polyethylene) bags and frozen at -20°C until use.

Spice mixture: The various ingredients used in spice mix in the preparation of Harrisa (Table 1) are Anise (45%), green cardamom (6%), black cardamom (8%), cinnamon (21%), clove (2%), red chilli (5%), coriander (10%), coloured chilli (1%) and black pepper (2%). The spices were purchased from local market. After removal of extraneous matter, all spices were dried in an oven at 50°C for overnight and then ground in grinder to powder. The coarse particles were removed using a sieve (100 mesh) and the fine powdered spices were mixed in required proportion to obtain spice mixture for chevon Harrisa. The spice mixture was stored in plastic airtight container for subsequent use.

Rice paste: Being an essential ingredient of the traditional meat based product, a rice paste was added in different proportions to standardize the basic formulation and an optimum level of 8% rice paste was incorporated. Rice and water mixture in the ratio of 1:2 was cooked until a fine paste of rice in water was obtained.

Condiments: Harrisa being popular spice rich indigenous meat based product, a high level of condiments is traditionally used for its preparation. Different levels of condiments were used to optimize a final level of 9% in the standardized product. Condiments were prepared by making a fine paste of onion and garlic in the ratio of 3: 1 in a mixer-grinder.

Preparation of harrisa: The different ingredients used for preparation of Harrisa (Table 2) are rice paste (8%), condiments (9%), spice mixture (6.4%), salt (1.6%), refined oil (9%) and chevon meat (66%).

For 1 kg of product, 2 kg of water was taken in a pressure cooker i.e., in a proportion of 1:2. Meat, salt and spice mix were added to the water and cooked until a clear paste was obtained i.e., no intact muscle fibers were visible. Subsequently rice paste and condiments were also added and the paste was simmered for 15 min keeping the lid over the pressure cooker. There after refined oil (preheated) was added and the mixture was again simmered (nearly for 15 min) for a time till a product with thick consistency was obtained. The product so developed was aerobically packaged

Table 1: Ingredients of spice mixture

Ingredients	Percentage
Anise (Soanf)	45
Green Cardamom (Choti elaichi)	6
Black Cardamom (Badi elaichi)	8
Cinnamon (Dalchini)	21
Clove (Loang)	2
Red chilli	5
Coriander	10
Coloured chilli	1
Black pepper	2

Table 2: Ingredients used for preparation of chevon Harrisa

Ingredients	Amount (g kg^{-1} product)	Percentage
Rice paste	80	8.0
Condiments	90	9.0
Spice mix	64	6.4
Salt	16	1.6
Refined oil	90	9.0
Meat (Chevon)	600	66.0

in low density polyethylene (LDPE) pouches and was analyzed at a regular interval of 0, 4 and 7 days during refrigerated storage at 4±1°C for physico-chemical, sensory and microbiological parameters.

Analytical procedures: The pH of Harrisa soon after its preparation was determined by the method of Keller *et al.* (1974) using a digital meter (Systronics Digital pH Meter 803, serial No. 603). Proximate composition i.e., moisture, fat, protein and ash percent of the Harrisa were estimated. Method of Witte *et al.* (1970) was used for measuring 2-thiobarbituric acid (TBA) values. Method of Koniecko (1979) was used for measuring free fatty acid values.

Psychrophilic count, coliform count and total plate count of the samples was determined as per the methods described by Speck (1984).

Sensory evaluation: The Harrisa was served warm to a semi-trained panel of scientists and postgraduate students to determine its sensory characteristics. The preference of chevon in the preparation of the product. sensory evaluation was aimed at estimating the subjective The organoleptic attributes namely appearance and colour, flavour, juiciness, texture and overall acceptability were evaluated using an 8-point hedonic scale, where 8 = extremely desirable for the sensory attribute and 1 = extremely undesirable (Keeton, 1983).

Statistical analysis: The experiment was replicated six times and the values/data generated up to seven days of storage were expressed as Mean±SE. The statistical difference between the means was assessed by ANOVA-one way classification (Snedecor and Cochran, 1980). A difference at $p<0.05$ was considered statistically significant.

RESULTS

Physico-chemical characters: The average pH values of the chevon Harrisa increased during refrigerated storage. The value observed at 0 day (6.09), 4 day (6.21) and 7 day (6.28) increased significantly ($p<0.05$) (Table 3).

The moisture values of the product decreased significantly ($p<0.05$) with storage period although, the moisture percent of the product on day 4 (73.73%) was comparable with moisture percent on the day 0 (74.15%) and day 7 (72.98%). The mean protein values of the product showed a significant ($p<0.05$) increasing trend throughout the period of storage. The mean protein percentage values on day 0, 4 and 7 are 12.27, 12.73 and 13.23, respectively. The average fat percent values of the chevon Harrisa increased during refrigerated storage. The value observed at 0 day (10.91), 4 day (11.38) and 7 day (11.75) increased significantly ($p<0.05$). The mean ash values of the product also showed an increasing trend throughout the period of storage and the value observed at 0 day (2.32), 4 day (2.46) and 7 day (2.65) increased significantly ($p<0.05$).

Table 3: Influence of refrigerated storage (4±1°C) on physico-chemical properties of chevon Harrisa (Mean±SE)*

	Storage days		
Parameters	0	4	7
pH	6.09±0.01^{A}	6.21±0.02^{B}	6.28±0.02^{C}
Moisture (%)	74.15±0.27^{A}	73.73±0.30^{AB}	72.98±0.48^{B}
Fat (%)	10.91±0.25^{A}	11.38±0.14^{AB}	11.75±0.27^{B}
Protein (%)	12.27±0.23^{A}	12.73±0.16^{AB}	13.23±0.18^{B}
Ash (%)	2.32±0.08^{A}	2.46±0.03^{AB}	2.65±0.06^{B}

*Means with different superscripts in each row differ significantly ($p<0.05$)

Table 4: Influence of refrigerated storage (4±1°C) on sensory parameters of aerobically packaged chevon Harrisa (Mean±SE)*

	Storage days		
Parameters	0	4	7
Appearance and colour	7.09±0.07^{A}	6.97±0.08^{A}	6.74±0.08^{B}
Flavour	7.14±0.07^{A}	7.07±0.08^{A}	6.80±0.09^{B}
Juiciness	7.21±0.08^{A}	7.14±0.09^{A}	6.85±0.10^{B}
Texture	7.25±0.04^{A}	7.10±0.05^{B}	6.85±0.04^{C}
Overall acceptability	7.09±0.07^{A}	7.02±0.08^{A}	6.76±0.08^{B}

*Means with different superscript capital letters in a row for each quality characters differ significantly ($p<0.05$). Hedonic scale 1-8 where 1: Extremely poor, 8: Extremely good

Sensory parameters: Mean sensory scores of aerobically packaged chevon Harrisa during storage at 4±1°C are shown in Table 4, the mean values for sensory characteristics of chevon Harrisa estimated at different intervals of refrigerated storage decreased significantly ($p<0.05$). The mean values for appearance and colour of the product showed a declining trend and the values observed at 0 day (7.09), 4 day (6.97) and 7 day (6.74) decreased significantly ($p<0.05$). The mean values for flavour of chevon Harrisa estimated at day 1, 4 and 7 were 7.14, 7.07 and 6.80, respectively. The mean values for juiciness estimated at day 1 (7.21), day 4 (7.14) and day 7 (6.85) decreased significantly ($p<0.05$). The mean values for texture showed a significant decline with storage and the estimated values at day 1, 4 and 7 were 7.25, 7.10 and 6.85, respectively. The overall acceptability of the product also showed a similar declining trend and the values at day 1, 4 and 7 were 7.09, 7.02 and 6.76, respectively

Microbiological and physico-chemical characteristics: Mean microbiological scores and physico-chemical characteristics of aerobically packaged chevon Harrisa during storage at 4±1°C are shown in Table 5. Almost all the parameters showed a significant ($p<0.05$) increase with the storage period.

Total plate count: The mean values of total plate count showed an increasing trend throughout the period of storage and the value observed at 0 day (1.43 $\log_{10}$ cfu g^{-1}), 4 day (1.86) and 7 day (2.37) increased significantly ($p<0.05$).

Psychrophilic count: The mean values of the psychrophilic count increased significantly ($p<0.05$) from day 4 to 7 of the storage period whereas on day 1, psychrophiles were not detected. The mean values observed at day 4 and 7 was 1.27 and 1.68 $\log_{10}$ cfu g^{-1}, respectively.

Table 5: Influence of refrigerated storage (4±1°C) on microbiological and physico-chemical characteristics of aerobically packaged chevon Harrisa (Mean±SE)*

	Storage days		
Quality attributes	0	4	7
Total plate count (Log_{10} cfu g^{-1})	1.43±0.076^{A}	1.86±0.045^{B}	2.37±0.008^{C}
Psychrophillic count (Log_{10} cfu g^{-1})	Not detected	1.27±0.058^{A}	1.68±0.018^{B}
Coliform count (Log_{10} cfu g^{-1})	Not detected	Not detected	Not detected
FFA (% Oleic acid)	0.015±0.001^{A}	0.025±0.00^{B}	0.047±0.001^{C}
TBA value (mg malonaldehyde per kg)	0.29±0.019^{A}	0.43±0.015^{B}	0.58±0.018^{C}

*Means with different superscripts in a row for each quality characters differ significantly ($p<0.05$). n = 6 for all parameters

Coliform count: The coliforms were not detected throughout the period of storage.

Free Fatty Acid (FFA): The mean values of the free fatty acids increased significantly ($p<0.05$) throughout the storage period. The mean values observed at 0, 4 and 7 day were 0.015, 0.025 and 0.047 (% oleic acid), respectively.

Thiobarbituric Acid (TBA) value: The TBA values of the chevon Harrisa also rose with increase of storage period. The mean values observed at 0 day (0.29), 4 day (0.43) and 7 day (0.58) increased significantly ($p<0.05$).

DISCUSSION

Physico-chemical characters: The average pH values of the chevon Harrisa increased during refrigerated storage. This increase in product pH during storage might be due to accumulation of metabolites of bacterial action on meat and meat products and deamination of meat proteins (Bachhil, 1982; Jay, 1986). Nag (1994) also observed a gradual increase in pH of LDPE packed extended chicken nuggets stored at 4±1°C. Further Sunki *et al.* (1978), Murthy and Bachhil (1980) and Prabhakara-Reddy and Narhari (1990) have also reported a progressive increase in pH of refrigerated stored meat products.

The moisture values of the product decreased significantly ($p<0.05$) with storage period. Rao and Reddy (2000) and Sharma and Rao (1996) have also reported a similar decrease in moisture values of the meat products with increasing storage period under refrigeration. This loss of percent moisture of chevon Harrisa on refrigerated storage may be due to the surface loss of moisture by evaporation and due to the poor moisture barrier offered by the packaging material. The mean protein values of the product showed a significant ($p<0.05$) increasing trend throughout the period of storage. Similar increasing trend was observed by Rao and Reddy (2000) and Sharma and Rao (1996). The mean fat values of the product also showed a significant ($p<0.05$) increasing trend throughout the period of storage and similar increasing patterns were presented by Rao and Reddy (2000) and Sharma and Rao (1996). The mean ash values also showed a significant ($p<0.05$) increasing trend throughout the period of storage and similar increase was observed by Rao and Reddy (2000) and Sharma and Rao (1996) in meat products under refrigerated storage.

The loss of percent moisture of aerobically packaged chevon Harrisa during refrigerated storage had reflected in significant ($p<0.05$) increase in fat, ash and protein percentage values.

Sensory parameters: The mean values for sensory characteristics of chevon Harrisa estimated at different intervals of refrigerated storage decreased significantly ($p<0.05$). The decrease in appearance scores might be due to pigment and lipid oxidation. A decrease in appearance and colour score of meat products with increase in storage period was also reported by Kalaikannan (1998), Nag *et al.* (1998) and Patil (2000). Fat oxidation as indicated by increased TBA values in aerobically stored Harrisa might be the reason for getting lower flavour and colour scores (Tarladgis *et al.*, 1960). Nag *et al.* (1998) and Sharma *et al.* (1988) also reported a decrease in flavour scores of meat product during aerobic storage. Juiciness scores followed a decreasing trend during the period of storage. It could be due to some loss of moisture from the products during storage. Also the material used for packing, i.e., low density polyethylene which has poor moisture barrier would have added to the above said cause. The results were in accordance with findings of Sharma *et al.* (1988), Nag *et al.* (1998) and Kalaikannan (1998), who also observed a decline in the juiciness of the meat products under refrigeration storage. A significant ($p<0.05$) decrease was recorded in texture scores which might be attributed to some dehydration and also due to breakdown of fat as well as protein. The findings were similar to those of Patil (2000) and Chatli (2001), who also presented a decline in texture values of meat products in refrigerated storage. Similar results were also presented by Reddy and Rao (1997) in chicken and duck meat patties during refrigerated storage respectively. The scores for overall acceptability also decreased significantly ($p<0.05$) during storage. This decrease in overall palatability scores during refrigerated storage might be reflective of the decline in scores of flavour, juiciness and texture attributes. The results of the study were in agreement with the findings of Reddy and Rao (2000) and Awonrin (1993) who also reported a reduction in overall palatability scores in chicken loaves and chicken sausage upon storage at refrigerated temperature.

Microbiological and physico-chemical characteristics: Almost all the parameters showed a significant ($p<0.05$) increase with the storage period but the increment in all the storage parameters was within the limits of acceptability.

Microbiological studies indicated that the samples had significantly lower aerobic counts as cooking is reported to have pronounced effect in reducing bacterial load if done for longer times at higher temperature (Bryan *et al.*, 1980).

Total plate count: The mean values of the total plate count increased significantly ($p<0.05$) throughout the storage period. Reddy and Rao (2000) observed a similar increase of total plate counts while studying the effects of binders and precooked meat on quality of chicken loaves at refrigeration temperature. Nag *et al.* (1998) also observed the similar increase in total plate count while studying the quality attributes and shelf life of chicken nuggets extended with rice flour.

Psychrophilic count: The mean values of the psychrophilic count increased significantly ($p<0.05$) throughout the storage period which was in agreement of Rao and Reddy (2000), who observed a similar increase of psychrophilic counts while studying the effects of binders and refrigeration storage on the quality of chicken loaves. Sen (1993) and Kalaikannan (1998) also reported a similar increase in psychrophilic count in chicken products under refrigerated storage. Cremer and Chipley (1977) described permissible level of psychrophilic count as 4.6 log cfu g^{-1} in cooked meat and meat products.

Coliform count: The coliforms were not detected throughout the period of storage. It could be due to the destruction of these bacteria during cooking at high temperature, much above their death point of 57°C. Further, hygienic practices followed during the preparation and packaging of Harrisa could also be one of the reasons for the absence of coliforms. Dawson *et al.* (1975) and Chatli (2001) also reported zero count of coliform for the meat products heated to such a high temperature.

Free Fatty Acid (FFA): The mean values of the free fatty acids increased significantly ($p<0.05$) throughout the storage period and a similar increasing trend was observed by Anand *et al.* (1991), Nayak and Tanwar (2004) and Nagamallika *et al.* (2006) in chicken patties during refrigerated storage.

Thiobarbituric Acid (TBA) value: The TBA values of the chevon Harrisa also rose significantly ($p<0.05$) with increase of storage period. This increase in TBA values throughout the storage period might be due to the lipid oxidation attributed to oxygen permeability of packaging material (Brewer *et al.,* 1992). This was in agreement with the findings of Reddy and Rao (1997), Thompson *et al.* (1983) and Nag *et al.* (1998), who also found an increase in TBA values during the storage period.

CONCLUSIONS

Based on the studies it was observed that Harrisa prepared from chevon meat was highly acceptable to the panelists at all periods of refrigerated storage and had good physico-chemical properties showing aerobic counts in acceptable range during 7 days of refrigerated storage at 4±1°C. Almost all the quality attributes and sensory scores showed a significant decline with storage but all parameters were within the limits of acceptability. The mean values of various physico-chemical and proximate parameters of the product showed a significant ($p<0.05$) increasing trend except the moisture percent values of the product which decreased significantly ($p<0.05$) during refrigerated storage. The mean sensory parameters showed a significant ($p<0.05$) decline with storage. The mean values of the total plate count, psychrophillic count, free fatty acids and TBA values increased significantly ($p<0.05$) whereas the coliforms were not detected throughout the period of storage. After 7 days of refrigerated storage there were some considerable spoilage changes observed in the product and as such there is much scope for the improvement of the shelf life of the product using some approved food grade preservatives and antioxidants. Harrisa has a potential scope to be used as a meat spreader by improving its shelf life and thus there is an immense scope for further research in this area regarding the product's shelf life. Being a popular and spice rich meat based product of Jammu and Kashmir, the product has a great market potential. Thus, it may be concluded that chevon meat can be successfully utilized for preparation of Harrisa which is well acceptable upto 7 days of storage at 4±1°C.

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