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Storage Stability of Vacuum Packaged Chevon Tikkis (Traditional Patties) at Refrigeration Temperature (4±1°C)

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A B S T R A C T

Chevon *tikkis* were prepared by improved method; vacuum and aerobically packaged and stored at 4±1°C under refrigeration temperature. The storage stability of vacuum packaged (VP) *tikkis* was evaluated, against aerobic packaged (AP) *tikkis.* Physicochemical properties, microbiological studies and sensory properties were evaluated on 0, 7, 14 and 21 days of storage. The VP product showed a significantly (P<0.01) lower TBA value than AP product throughout the observation period. Microbiological studies revealed that in VP and AP products TVC, anaerobic count, proteolytic count, yeast and mold count and lipolytic count increased significantly (P<0.01) with the advancement of storage period, with significantly lower (P<0.01) microbial counts observed for VP product throughout the observation period. Significantly (P<0.01) higher scores for appearance, color, flavor, texture and overall acceptability were noticed throughout the storage period for VP product. Sensory attributes decreased significantly (P<0.01) with advancement of storage period. The study demonstrated that vacuum packaging was effective to preserve the physicochemical, microbiological and sensory attributes of the chevon *tikki* up to 14 days of storage at refrigeration temperature (4±1°C).

Introduction

Nearly 60% of the population of India is non vegetarian. There has been rapid growth of meat industry due to increasing affluence among the consumers. In the rapidly growing globalized world with substantively altered life style, the ready to eat, ready to cook, convenience food products are being increasingly available in the super market shelves of metropolitan cities. Indian culinary custom evolved over several thousands of years with liberal use of spices without use of chemical additives make it superior to

western products (Bedeker, 2006). Market of Indian heritage food product is estimated to be around Rs.120000 crores. But scientific studies on traditional meat products are few as compare to western meat products.

Meat is a perishable commodity and need to be properly packaged and preserved during storage and distribution. A good packaging enhances shelf life of product and increase safety. Vacuum packaging in commonly employed technology to extend shelf life of

fresh meat and processed meat products under refrigerated storage. But studies on the effect of vacuum packaging on Indian meat products like biryani, tikka etc. are very few. Hence, the present study was proposed with objective to document the traditional methods of preparation of chevon *tikkis*, preparation of chevon *tikkis* in laboratory and to study the effect of vacuum packaging on the storage stability at refrigeration (4±1°C) temperature.

Materials and Methods

All experiment was conducted in Department of Livestock Product Technology, College of Veterinary and Animal Sciences, Govind Ballabh Pant University of Agriculture and Technology, Pantnagar.

Material

Fresh boneless meat, spices, condiments, refined oil, packaging material for vacuum and aerobic packaging, table salt and other material were obtained from local market. All the chemical and media used in the study were of analytical grade and obtained from Hi media® Mumbai and Merck® Mumbai.

Method

Documentation of chevon tikki

A preliminary survey was conducted in the local market regarding method of preparation of chevon *tikki*. Based on the preliminary survey a questionnaire was prepared for personal interview with the shopkeepers around five major cities of Uttarakhand and Uttar Pradesh, *viz.*, Rudrapur, Haldwani, Bareilly, Moradabad and Rampur.

On the basis of response a critical idea for preparation of chevon *tikki* was identified for adoption in the laboratory.

Composition

Boiled dal 39%, boiled chevon 39%, condiments 6% (3:1:1:1 of onion: garlic: ginger: coriander), egg white 9%, spices 4.5% and salt 2.5% were used.

Preparation of tikki

Boneless chevon was collected and cut into 2 inches cubes and pressure cooked for 20 min with water till all free water evaporated. Gram dal was boiled with water in pressure cooker for 30 min. Equal amount of boiled dal and boiled minced meat were ground separately in meat mincer (Hobert® model 4812, USA) using 4mm plate. Condiment were weighed in proportion and chopped finely. Then meat, gram dal, spices, condiments, egg white and salt were added, mixed thoroughly in to uniform dough and kept for 30 min. The dough was then hand molded in to round shaped *tikkis* weighted approximately 30 gm.

Packaging of tikkis

The packaging materials were sterilized by exposing to UV light for 30 min. A total of 32 *tikkis* were prepared for a trial, of which 16 were vacuum packaged in multilayer barrier bags (Zipouch®) and rest packaged aerobically in low density poly ethylene (LDPE) bags. The packaged *tikkis* were stored at refrigeration temperature (4±1°C).

The storage stability of vacuum packaged *tikkis* was evaluated on 0, 7, 14, 21 days of storage against aerobic packaging. For assessing the storage stability of *tikkis* physicochemical, microbiological and sensory evaluation was done.

Physicochemical properties

pH was recorded as per the procedure of Egbert *et al.,* (1992) Water holding capacity

(WHC) was determined by modified method of Hughes *et al.,* (1997) as out lined by Cengiz and Gokoglu (2007). Dimensional shrinkage of *tikki* was determined by method of El-Magoli *et al.,* (1996). To evaluate cooking yield tikki were weighed before and after deep frying. Then percent cooking yield was estimated by the ratio of the weight of cooked chevon *tikkis* to the raw chevon *tikkis*.

$$\text{Percent cooking yield} = \frac{\text{Weight of cooked chevon patties}}{\text{Weight of raw chevon patties}} \times 100$$

Thiobarbituric acid value was estimated as per procedure given by Tarladgis *et al.,* (1960).

Microbiological analysis

Preparation of samples: Samples were prepared according to APHA (1992). Ten grams of sample was aseptically transferred to 90mL of normal saline solution and serial dilutions were prepared (10^{-1} to 10^{-6}).

Microbiological count: Total plate count, proteolytic count, anaerobic count, yeast and mould count and lipolytic count was determined by the method of APHA (1992), using plate count agar, molten skim milk agar, anaerobic count agar, potato dextrose agar and tributyrin agar, respectively.

Sensory evaluation: The sensory quality of samples was evaluated using 8 point descriptive scale (Keeton *et al.,* 1984), where 8 denotes extremely desirable and 1 denotes extremely poor. A sensory panel evaluated the product for different quality attributes like, color and appearance, texture, juiciness, flavor, and overall acceptability.

Statistical analysis:-Statistical analysis was done using ANOVA technique according to the method described by Snedecor and Cochran (1989).

Results and Discussion

Documentation: Mainly three methods of chevon *tikki* preparation were observed in interview Minced meat and gram dal were taken in equal amount and pressure cooked boiled simultaneously in same pan

Ground meat and dal were boiled in different pan and boiled meat was also fried with onion.

Dal was boiled but ground meat was only fried with onion and then mixed with other ingredients and covered with roasted *channa* powder.

Along with this variation some other variants were observed

Boiling of meat with cinnamon, cassia, cardamom.

Extract of condiment used in place of condiments.

Roasted channa dal flour was used for binding in place of egg white.

Raw meat was used without boiling or frying.

Corn flour was used as binder.

Some times *tikkis* were enrobed by coating with beaten egg white.

The results of AP and VP chevon tikki are depicted in Table 1.

Physicochemical properties

pH- The pH of aerobic packaged *tikki* and vacuum packaged *tikki* decreased over storage period. The storage mean pH of AP samples decrease from 6.411 ±0.007 on 0 day to 5.292± 0.02 on day 21, while pH of VP samples decreased from 6.411±0.007to 5.432±0.043 on day 21. Water holding

capacity (WHC) - No significant difference (p>0.05) in the WHC was observed between treatment whereas a highly significant difference in WHC of chevon *tikki* was observed between storage periods. Mean WHC value of AP samples were decreased from 34.097±0.029 on day 0 to 32.508±0.218 on day 21 and of VP samples decreased from 34.096±0.029 on day 0 to 33.237±0.232 on day 21.

TBA value- Mean TBA value of AP sample was increased from 0.157±0.018 on day 0 to 1.9994±0.040 on day 21. Mean TBA value of VP sample was increased from 0.157±0.018 on day 0 to 1.1608±0.020 on day 21. Highly

significant difference (p<0.01) in TBA value was observed between treatment and storage period. Cooking yield- There is no significant difference in percentage cooking yield between AP and VP samples. Mean cooking yield value of AP sample and VP sample were observed 88.754±0.770 and 88.742±0.874 respectively.

Dimensional shrinkage (%) - AP chevon *tikki* showed mean value of percentage shrinkage 8.446±0.346 and 8.743±0.282 on day 0 and day 21 respectively. VP sample of chevon *tikki* showed mean percentage shrinkage value of 8.446±0.346 and 10.11±0.444 on day 0 and day 21 respectively.

Table.1 Effect of vacuum packaging on physicochemical properties, microbiological properties and sensory score of chevon *tikkis* stored at refrigeration temperature 4±1ºC

Traits		0day	7 day	14 day	21day
Water holding capacity	AP	34.097±0.296	33.595±0.406	33.348±0.246	32.506±0.218
	VP	34.097±0.296	34.102±0.405	33.796±0.327	33.237±0.232
TBA value	AP	0.157±0.018	0.3067±0.032	0.6061±0.007	1.9994±0.040
	VP	0.157±0.018	0.1876±0.016	0.3664±0.005	1.1608±0.020
pH	AP	6.411±0.007	6.063±0.087	5.995±0.092	5.292±0.047
	VP	6.411±0.007	6.124±0.061	6.086±0.053	5.432±0.043
Cooking yield	AP	89.276±0.472	85.563±1.556	89.714±0.726	90.463±0.326
	VP	89.276±0.472	86.617±0.545	90.793±0.383	88.284±1.099
Dimensional shrinkage	AP	8.446±0.346	8.095±0.397	8.708±0.414	8.743±0.282
	VP	8.446±0.346	8.840±0.224	9.071±0.220	10.11±0.444
TVC	AP	4.443±0.033	6.268±0.033	7.076±0.017	10.722±0.124
	VP	4.443±0.033	5.059±0.144	5.883±0.105	9.065±0.004
Anaerobic count	AP	3.073±0.037	3.978±0.022	4.595±0.181	7.868±0.166
	VP	3.073±0.037	4.313±0.089	4.439±0.174	7.471±0.165
Proteolytic count	AP	3.944±0.062	4.096±0.168	5.274±0.086	7.372±0.141
	VP	3.944±0.062	4.103±0.043	4.739±0.134	6.305±0.173
Yeast and mold count	AP	ND	3.196±0.069	3.485±0.205	6.010±0.026
	VP	ND	ND	2.914±0.160	4.802±0.024
Lipolytic count	AP	ND	3.531±0.112	3.466±0.048	3.819±0.170
	VP	ND	2.183±0.093	1.955±0.032	2.700±0.087
Appearance and colour	AP	6.872±0.179	4.545±0.172	4.046±0.082	3.500±0.101
	VP	6.872±0.179	6.501±0.090	5.765±0.091	5.318±0.100
Flavor	AP	6.573±0.164	4.457±0.139	3.910±0.132	3.333±0.193
	VP	6.573±0.164	6.351±0.140	5.877±0.095	4.670±0.236
Texture	AP	6.643±0.180	5.758±0.107	4.595±0.139	4.082±0.080
	VP	6.643±0.180	6.304±0.121	5.972±0.098	5.193±0.153
Juiciness	AP	6.513±0.238	5.128±0.154	4.456±0.139	3.840±0.146
	VP	6.513±0.238	6.018±0.098	5.642±0.072	4.554±0.135
Overall acceptability	AP	6.887±0.096	4.497±0.111	4.018±0.130	3.115±0.102
	VP	6.887±0.096	6.485±0.102	6.004±0.058	4.694±0.229

Mean±SE Abbreviation: AP- aerobic packaging, VP- vacuum packaging, TBA- thio barbituric acid, TVC- total Viable Count, ND- not detected

Microbiological studies

Total viable count (TVC) - Highly significant (p<0.01) difference in TVC value was observed between treatment and storage period. Mean value of TVC of AP sample was 4.443±0.033, 6.268±0.033, 7.076±0.017 and 10.722±0.124 on day 0,7,14 and 21 respectively while VP sample showed increased value of TVC from 4.443±0.033 on day 0 to 9.065±0.004 on day 21.

Anaerobic count- Anaerobic count value of AP and VP sample was increased with the storage period. AP sample showed increased mean anaerobic count value from 3.073±0.037 on day 0 to 7.868±0.166 on day 21. VP sample showed increased value of anaerobic count from 3.073±0.037on day 0 to 7.471±0.165 on day 21.

Proteolytic count- Both AP and VP sample showed increased value in proteolytic count over storage period. AP sample showed increased mean proteolytic count value from 3.944±0.062 on day 0 to 7.372±0.141 on day 21. VP sample showed increased mean proteolytic count value from 3.944±0.062 on day 0 to 6.305±0.173 on day 21. Highly significant (p<0.01) difference in proteolytic count between treatment and between storage.

Yeast and mold count- Highly significant (p<0.01) difference was observed between treatment and between storage. AP sample showed increased value of yeast and mold count from 0.000±0.000 on day 0 to 6.010±0.026 on day 21 while VP sample showed increased mean value of yeast and mold count from 0.000±0.000 on day 0 to 4.802±0.024 on day 21.

Lipolytic count- Highly significant (p<0.01) difference was observed between treatment and between storage period and increased value of lipolytic count was observed over storage period. AP sample showed mean lipolytic count increased from 0.000±0.000 on day 0 to 3.819±0.170 on day 21. VP sample showed mean lipolytic count increased from 0.000±0.000 on day 0 to 2.700±0.087 on day 21.

Sensory attribute

Appearance and colour- The overall appearance and colour score of AP and VP samples decreased over storage period. The AP sample showed a mean appearance and colour score decreased from 6.872±0.179 on day 0 to 3.500±0.101 on day 21 and VP sample showed mean appearance and colour score decreased from 6.872±0.179 on day0 to 5.318±0.100 on day 21. There is a highly significant difference (p<0.01) in appearance and colour score between treatment, between storage period and interaction between treatment and storage.

Flavor- AP sample and VP sample showed a mean flavor score decreased from6.573±0.164 on day 0 to 3.333±0.193 on day 21 and 4.670±0.236 on day 21 respectively. Highly significant difference (p<0.01) in flavor score between treatment, between storage period and interaction between treatment and storage.

Texture- Mean texture score of AP and VP samples decreased over storage period. The AP sample showed a mean texture score decreased from 6.643±0.180 on day 0 to 4.082±0.080 on day21. VP sample showed decreased mean texture score from 6.643±0.180 on day 0 to 5.193±0.153 on day 21. Highly significant difference (p<0.01) in mean texture score between treatment, between storage period and interaction between treatment and storage.

Juiciness- Mean juiciness score of AP and VP sample was decreased over the storage period.

AP sample showed decreased mean juiciness score from 6.513±0.238 on day0 to 3.840±0.146 on day 21. VP sample showed decreased mean juiciness score from 6.513±0.238 on day 0 to 4.554±0.135 on day 21. Highly significant difference (p<0.01) in mean juiciness score between treatment, between storage period and interaction between treatment and storage.

Overall acceptability- Mean overall acceptability score of AP and VP samples decreased over storage period. AP sample showed decreased mean overall acceptability score from 6.887±0.096 on day 0 to 3.115±0.102 on day21. VP sample showed decreased mean overall acceptability score from 6.887±0.096 on day 0 to 4.694±0.229 on day 21. Highly significant difference (p<0.01) in mean overall acceptability score between treatment, between storage period and interaction between treatment and storage.

The chevon *tikkis* were also known as Shami Kabab it the local market. The price of *tikki* varies from Rs.6-20 based on the size and standard of shop. Weight of *tikkis* varies from 20-35 gm. Survey revealed that there are three method of chevon *tikki* preparation. Coarsely chopped chevon was used for making *tikkis*. Incorporation of Bangal dal in making *tikkis* leads to better cooking yield because of its adhesive and thickening quality (Biswas and Kesari 2003). Soaked dal was used, as boiling of soaked dal take lesser time then unsoaked dal (Willium and Singh 1987). Pressure cooking of dal and meat together saved time and energy of cooking. Respondents also stated that complete evaporation of water in pan used for chevon boiling leads to better flavor and binding ability. Most respondents stated that incorporation of egg white in product resulted in better binding and increased sensory score due to its albumin content and emulsifying capacity (Randall *et al.,* 1984). As most of the product were sold

on same day so preservation of product is rare but due to change in socio-economic condition in society and for better commercialization and marketing the product need to be stored for longer period. Hygiene is directly related with the microbial quality of product. In the present study the product was prepared under hygienic conditions and with the use of machineries. Using of machineries under hygienic condition help to reduce cost of product, quality of product and improve self-life also.

Physicochemical properties

pH value of AP *tikki* showed lower value then compare to VP *tikki*. No significant effect was observed in interaction between treatment and storage period on pH of chevon *tikki*. These findings are in agreement with Babji *et al.,* (2000). WHC of AP *tikki* and VP *tikki* showed non-significant difference between treatment while WHC value of AP and VP *tikki* decreased over the storage period. Lin and Lin (2002) also reported decreased WHC of sausages at refrigeration after two week of storage. Naveen *et al.,* (2015) reported improved WHC of AP and VP emu meat over storage period. VP chevon *tikki* showed significantly lower TBA value when compare to AP chevon *tikki*. TBA value of VP *tikki* was marginally higher then acceptable level on 21 day of storage. In case of AP *tikki* TBA value were very high. TBA value increased significantly (p<0.01) with advancement of storage. Bhattacharyya *et al.,* (2013) observed increased trend in TBA value of duck sausages with the storage period under refrigeration. These results are in agreement with Rajkumar *et al.,* (2004), Maca *et al.,* (1997) and Lin and Lin (2002).

Microbiological properties

Total value count of VP *tikki* showed significantly lower value then AP *tikki* over

the period. AP *tikki* had higher value of TVC then acceptable level on 7 day of storage. However VP *tikki* showed TVC well within acceptable level on 14 day of storage. Bhattacharyya *et al.,* (2013) found increased trend in yeast and mold count of duck sausages with storage period under refrigeration storage 4±1℃. These finding are in agreement with Dharamveer (2007), Rajkumar *et al.,* (2004), Pawankumar *et al.,* (2003), and Maca *et al.,* (1997). Anaerobic count of AP and VP *tikki* showed no significant difference. Storage mean showed significantly increasing trend in anaerobic count. These results are in agreement with Rajkumar *et al.,* (2007). Proteolytic count of VP *tikki* showed significantly lower value then AP *tikki*. Storage mean showed significantly increasing trend in proteolytic count. These results are in agreement with Thomas *et al.,* (1991).Yeast mold count and lipolytic count of VP *tikki* showed significantly lower value then AP *tikki*. Storage mean showed significantly increasing trend in yeast mold count and lipolytic count. Bhattacharyya *et al.,* (2013) found increased trend in yeast and mold count of duck sausages with storage period under refrigeration storage 4±1℃. These results are in agreement with Dharamveer *et al.,* 2007, Babji *et al.,* (2000), Rajkumar *et al.,* (2004), Havas (1990) and Igbinedion (1981).

Sensory evaluation

Vacuum packaged chevon *tikki* showed significantly higher sensory score when compare with AP *tikki*. Storage mean showed significantly decreasing trend in sensory attributes of chevon *tikki*. Interaction between treatments and storage periods showed a significant difference in sensory score of chevon *tikki*. Highest sensory score was observed on day 0 and lowest on day 21. These results are in agreement with Rajkumar *et al.,* (2004) and Dharamveer *et al.,* (2007).

Bhattacharyya *et al.,* (2013) observed decreased in sensory score of duck sausages with increase in storage period at refrigeration temperature.

The study demonstrated that the physicochemical, microbiological and sensory quality of vacuum packaged chevon *tikkis* was better than aerobic packaged *tikkis*. Aerobically packaged *tikkis* have unacceptable level of microbial count and sensory score on day 7 while vacuum packaged *tikkis* have unacceptable level of microbial count and sensory score on day 21. Therefore chevon *tikki* can be preserved at refrigeration temperature 4±1℃ for 14 day under vacuum packaging with acceptable physicochemical, microbiological and sensory score.

Acknowledgement

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