International Journal of Science, Environment and Technology, Vol. 5, No 3, 2016, 1520 – 1529

ISSN 2278-3687 (O)
2277-663X (P)

Review paper

EVALUATION OF VARIOUS COOKING METHODS ON THE NUTRITIONAL AND BIOCHEMICAL ATTRIBUTES AND CONSUMER APPEAL OF CHEVON: A REVIEW

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Abstract: Chevon (goat meat) is most popular meat of ruminant species and is accepted by all communities in India. Its keeping has been a traditional activity in India and a primary source of livelihood for people below the poverty line. Goats have a number of characteristics, such as high reproductive potential, ability to thrive on shrubs, bushes, and tree leaves, and less susceptibility to infectious diseases, that make them suitable as meat producing livestock in developing countries, Raghavan [1] opined chevon is obtained from goat of different genotypes like Black Bengal, Jamunapuri, Ganjam, Sirohi, Beetal etc. in India. Black Bengal is a dwarf animal producing about 6.0 kg carcass. Abedin *et al*. [2] proposed that it is a predominant goat in West Bengal and is famous for its prolificacy, meat and skin quality. The present review envisage on the influence of different cooking methods on the quality and acceptability parameters of chevon.

Keywords: Biochemical attributes, Chevon meat, Cooking methods, Nutritional parameters.

Introduction

Chevon is a delicious red meat compared with other red meats which can be eaten stewed, baked, grilled, barbequed or made into sausage. Chevon can be eaten from any age of goat, depending upon our preference. According to Jamal [3] the molecular structure of goat meat is different and as a result goat meat is more easily digested. Chevon is popular because it is low in fat, saturated fatty acids and cholesterol, Johnson [4] and is a good source of desirable fatty acids, Banskelieva *et al*. [5], Mahgoub *et al*. [6]. The fatty acid composition and cholesterol levels in meat have received increasing attention owing to their implications in human health and product quality, Orellana *et al*. [7] because diet rich in unsaturated fatty

*Received May 1, 2016 * Published June 2, 2016 * www.ijset.net*

acids is correlated with a reduced risk of stroke and coronary diseases. Chevon has a salubrious fatty acid profile and therefore suggested that this meat is ideal for the health conscious consumers, Hogg *et al*. [8], Mahgoub *et al*. [6]. In addition to their silent role, fatty acid also influences flavour and keeping quality of meat. Unsaturated fatty acids (UFA) are very important in terms of keeping quality of meat. The higher the proportion of UFA, the more prone the meat is to oxidation & Spoilage. The basic fatty acid profile of chevon is therefore an indication of not only the potential nutritive value of the meat but also its organoleptic & storage related properties. The plus point about chevon is that it is leaner than beef and lamb, and contains less marbling and less subcutaneous fat, Zygoyiannis *et al*. [9] and thus is preferred in the world market. The continuing demand for goat meat in the domestic market limits the availability of chevon for export.

Goat meat (Chevon) is the most popular meat from ruminant species and is accepted by all communities in India and is an excellent source of animal protein but with low in fat, saturated fatty acids and cholesterol. With increased awareness regarding health and nutrition, the demand for chevon based meat products is increasing day by day. Moreover, the fast food outlets are coming up rapidly to cater the need of present generation whose life style is highly mechanized and food habits are quite different. Consumers' preference is gradually shifting towards meat based convenience products and accordingly, meat processors are also making continuous effort to manufacture chevon meat based value-added products through incorporation of suitable cooking methods that adversely affecting the quality of the product. Cooking method is one of the major factors which determine the meat palatability and the present study was thus aimed to evaluate the effects of cooking methods on chevon meat products.

Influence of different cooking methods on the quality and sensory attributes of meat

Normal cooking changes the composition of meat. There are various cooking methods to create tasty meat. Many methods can be applied to all type of meat: beef and veal, pork, lamb, chevon etc. The method used will often determine how flavourful the meat is as well as how tender. It might also determine how much it shrinks or how it retains the flavour for seasonings. So the method of cooking for meat is just as important as the type of seasoning and preparation. There are three main methods of cooking meat: dry heat, moist heat, and microwaving.

Weber *et al*. [10] and Turkkan *et al*. [11] suggested the minimal changes as a consequence of the water loss produced by these processes of frying chevon meat balls and showed great

changes in the fatty acid profile when compared to raw samples, probably due to oil absorption during the frying process. This was in agreement with Weber *et al*. [10] in silver fish fillet. Fried buffalo meat had the lowest saturated Fatty Acid content due to the incorporation of Mono-unsaturated Fatty acid (C18:1) from oil. Therefore, fried meat showed the highest levels of MUFA among all the studied types as stated by Juarez *et al*. [12]. Duckett and Wagner [13] also considered that changes in fatty acid composition that occur during cooking may be overlooked when only total lipid extracts are analyzed. In fact, the thermal hydrolysis, the migration of fatty acids from muscle to other locations, the loss of volatile fatty acids and the deactivation of enzymes occurred during heating may be responsible of many of the observed changes. Nurhan [14] found that cooking methods significantly affected fatty acid fractions; as total saturated fatty acid (SFA) content decreased and total monounsaturated fatty acid (MUFA) content increased. Pawar *et al*. [15] reported that chevon patties cooked by pan-frying also got significantly ($P<0.05$) higher scores for flavour by the panel members. Raj *et al*. [16] also reported that the absence of surface-drying and Maillard browning reaction in MO cooking might have resulted in low flavour. Sharma *et al*. [17] also reported that chicken meat patties cooked by microwave oven were hard and had low juiciness and other organoleptic characteristics than convection oven cooked patties. Pawar *et al*. [15] and Gosai [18] who found higher overall acceptability score for pan-fried products than from microwave oven cooked products. Nath *et al*. [19] also reported low scores for overall acceptability of microwave oven cooked patties than that from oven cooked method. Sharma *et al*. [17] also reported that chicken meat patties cooked by microwave oven method were hard, less juicy and poor in overall acceptability in comparison to that prepared by hot air oven method.

Rai *et al*. [20] studied on the influence of different cooking methods like pan fried (PF) and microwave cooking by baking (MO) methods on the proximate parameters (moisture, protein, fat and ash), pH, cooking yield, cooking losses and sensory quality of the raw (R) and cooked chevon meatballs. Significant ($P<0.01$) difference was noticed in moisture content and raw meat was found to be highest moisture content than other cooked meat ball. Non-significant difference was found in protein and fat content of different cooking methods (PF and MO) as well as raw (R) meat. MO had higher protein content than PF due to more cooking losses during pan fried cooking. Whereas, higher fat content in PF than MO as after frying due to the incorporation of fat from oil. Highly significant difference in ash content of different cooking method (PF and MO) as well as in R meat was observed. Samples from

different cooking methods contained more ash than raw meat balls and was higher after frying due to loss of water. On the basis of the above-mentioned data conclude that the method of cooking had considerable effect on the proximate composition. The moisture and protein were better in microwave cooked products. However, the sensory panelists graded higher scores for pan frying cooked meat ball than microwave cooking method.

Rai *et al*. [21] investigated on the effects of different cooking processes (pan fried and microwave cooking) on microbiological quality of the raw and cooked chevon meat balls. Microbial flora of the raw meatballs was as follows: total plate count, 5.98±0.235 (log cfu/g); yeast and mould, 4.80±0.328 (log cfu/g); coliforms, 3.05±0.433 (log cfu/g). Highly significant ($P<0.01$) difference was noticed in microbiological quality of chevon meat balls. The cooking processes decreased the microbial flora approximately 2–3 log cycles, and pan frying was the effective cooking process for reducing microbial numbers compared to the microwave oven. The temperature of the Pan fried (150-160°C for 5-7 min) was higher than the Microwave oven (70 $\pm$ 2°C for 25 min) cooking techniques, and most of the microbial flora was destroyed. In conclusion, it is advised to use slightly higher temperatures than used in the microwave oven cooking procedures to increase microbial quality of the meatballs studied in this research.

Xuetong *et al*. [22] investigated the effect of antioxidants, *viz*., rosemary extract, sodium erythorbate and sodium nitrite, on Turkey bologna and found that rosemary extract and sodium nitrite inhibited oxidation while erythorbate increased TBARS values. Djenane [23] evaluated the effects of rosemary extracts and Vitamin-C combination on the shelf life of beef steaks packaged under modified atmospheric packaging and found them to significantly extend the chilled shelf life of the product from around 10 to 20 days by inhibiting metmyoglobin formation, microbial growth and lipid oxidation as also increasing the intensity of red colouration. Sanchez-Escalante *et al*. [24] evaluated the effects of rosemary, oregano, ascorbic acid and borage on the oxidative stability of beef patties during modified atmosphere storage at 2±1°C for 24 days and reported that all antioxidants, except ascorbic acid, significantly reduced TBARS formation, myoglobin oxidation and colour fading. Sensory analysis of beef patties revealed that rosemary, borage and oregano extended the shelf life of beef patties from 8 to 12 days, whereas a combination of rosemary and ascorbic acid prolonged shelf life for a further 4 days. Arneth and Muench [25] found that formation of cholesterol oxides in heated meat products can be decreased or slowed by presence of nitrite, ascorbate, rosemary or modified atmospheric packaging/vacuum packaging. Armitage

[26] studied the effect of egg albumin coatings containing natural antioxidants, *viz*., fenugreek, rosemary and Vitamin E on the oxidative stability of raw and cooked poultry meat and found that coatings containing rosemary and vitamin-E improved the oxidative stability of raw samples. Yu *et al*. [27] reported that 250 and 500 ppm water-soluble rosemary extracts (WSRE) significantly decreased TBARS formation in cooked turkey rolls prepared from fresh, ground turkey breast during storage at 4°C.

Carthy *et al*. [28] evaluated the antioxidant activities of aloevera, fenugreek, ginseng, mustard, rosemary, sage, soya protein, tea catechins and whey protein concentrate in pork patties prepared from both fresh and previously frozen (-20^{o}) pork and reported tea catechins, rosemary and sage as being the most effective antioxidants with the potency order as tea catechins > rosemary > sage. Formanek *et al*. [29] found that the oxidative stability of alpha-tocopheryl acetate supplemented beef patties was improved by addition of commercial rosemary extracts to samples stored under aerobic packaging conditions or modified atmospheres with elevated oxygen levels, during refrigerated storage. Sanchez-Escalante *et al*. [30] reported that rosemary powder with or without ascorbic acid were the most effective antioxidants in inhibition of oxidation of lipids and myoglobin and in extending shelf life of packaged beef patties stored at 2°C in the dark for up to 20 days. Kim *et al*. [31] investigated the effects of water extracts of 22 different spices (WES) on the sensory quality of kimchi and reported that all WES improved kimchi flavour, but that basil, celery and rosemary had the greatest flavour-enhancing effect. It was also reported that the addition of 1% (w/v) basil, celery and rosemary to kimchi stored at 10°C for 28 days resulted in increased pH after 21 days. Karpinska *et al*. [32] found that the addition of rosemary extract delayed the oxidation of fried meat balls (made from poultry mince) during 5 months of frozen storage. Karpinska *et al*. [32] investigated the influence of addition of rosemary extracts at 1 or 1.5% on the sensory quality of fried meat balls (made from poultry mince) during 5 months of frozen storage and found that the products containing rosemary extract were less susceptible to development of sour and rancid taste and aroma. Chang and Chen [33] studied the factors affecting the hotness stability of chicken hot-wing products and concluded that application of antioxidants, *viz*., BHA, BHT or sodium nitrite and rosemary oleoresin, reduced the rate of rancidity development and loss of hotness during refrigerated storage. Langourieux and Escher [34] studied the effect of addition of citric acid and de-aromatized rosemary extract on the development of strong sulfurous off flavour in heat sterilized pork and concluded that rosemary extract as a primary antioxidant lessened both H_2S and ethane formation for a

limited storage period. Vareltzis *et al*. [35] found that the natural antioxidant properties of rosemary retarded oxidation of filleted and minced frozen (-18°C) fish samples throughout storage period of 120 days with rosemary treated samples containing significantly less malonaldehyde compared with controls. Lee *et al*. [36] investigated the effect of rosemary powder and rosemary extract on the sensory quality of chicken sausage stored at 4±1°C for 10 days and -20±1°C for 6 months and found that flavour intensity, texture, and colour were maintained for all treatments, and no significant off-flavours were detected through 8 days and 6 month storage. Ho *et al*. [37] evaluated the effects of various antioxidants and packaging systems on the storage stability and sensory properties of reduced-fat fresh pork sausage products during frozen storage and found rosemary extract to be equally effective as BHT/Propyl gallate/citric acid in antioxidant properties. Guentensperger [38] reported that the addition of rosemary extract before or after precooking inhibited oxidative changes over a longer period of storage at 20 or 37°C in retorted pork. Ma-Edmonds *et al*. [39] found that use of rosemary oleoresin (0.2%) controlled warmed-over flavour in precooked beef patties during 9 days storage period. Pizzocaro *et al*. [40] reported that the addition of ground fresh leaves of rosemary (0.3% by wt.) or rosemary + sage (0.3% by wt. each) have a considerable antioxidative action in beef hamburgers stored for up to 10 months at -20°C. It was also reported that the freshness retention as well as the sensory quality of the beef hamburgers was improved during storage.

Conclusion

Different methods of cooking have considerable effect on the proximate composition and fatty acid composition of chevon meat balls. The microbiological quality should remain acceptable in all the cooked products. The moisture and protein content remains better in microwave cooked products. Considering the fatty acid profile of different samples, microwave cooking is found to be the best cooking methods for healthy eating.

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