Original Research

Economics of Preparation of Mutton Patties Incorporated with Bioactive Rich Plant Materials

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Abstract

Functional mutton patties (FMP) were prepared from a standardized formulation and were incorporated with optimized level of Bioactive Rich Plant Materials (BRPM) viz. cabbage powder, red kidney beans powder, orange pulp and their blend. Optimization of levels of BRPM was done by sensory evaluation of treatment products and those having sensory status closer to control were selected. The cost of FMP after replacement of lean meat with selected level of BRPM and their blend were compared among themselves to determine the most economic preparation. It was found that FMP incorporated with BRPM were cheaper than control products and among the treatment FMP least cost was for orange pulp incorporated functional mutton patties. The studies indicated that incorporation of BRPM at their optimum level viz. cabbage powder, red kidney beans powder, orange pulp and their blend resulted in cost reduction of FMP by ₹ 24, 33, 37 and 33 per Kg respectively as compared to control.

Key words: Bioactive Rich Plant Materials, Blend, Cost, Economics, Functional Mutton Patties

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Introduction

Sheep with its multi-faceted utility for wool, meat, milk, skins and manure form an important component of rural economy particularly in the arid, semi-arid and mountainous areas of the country. With a production figure of 485.52 thousand tons of mutton in 2015-16, India contributes around 3.50% of World mutton

production (DADF, 2016). The share of sheep meat in India's total meat production is 7.0% (BAHS 2015). Like all other meats, mutton is a rich source of nutrients and micronutrients that are needed for good health throughout life. Modern consumers are no longer satisfied with the traditional meat products and often associate meat and meat products with negative health image. This regrettable image of meat is mainly due to its high levels of saturated fatty acids, cholesterol, sodium, absence of dietary fibre, high fat and calorie contents (Whitney and Rolfes, 2001) and their association with chronic diseases, such as cardiovascular diseases, some types of cancer, and obesity (Chan, 2004). Consumers nowadays look forward not only to safe and nutritious food products, but they also demand that it should be healthy and natural (Jimenez-Colmenero, 2001), therefore demand for meat products with incorporated functional ingredients has sharp rise in recent years (Zhang, 2010).

Antioxidants are first line of defence against free radical damage, and critical for maintaining optimum health and wellbeing (Sies, 1996). As part of a healthy lifestyle and a well-balanced, wholesome diet, antioxidant supplementation is now being recognized as an important means for healthy living. Also these prevent the oxidation of muscle foods which is a leading cause for quality deterioration during processing and storage. There is a growing interest in the use of natural antioxidants, particularly those that are derived from plant sources due to the harmful effects of synthetic antioxidants. Due to high content of phenolic compounds and dietary fibre, fruits and other plant materials are an excellent source of natural antioxidants and provide a good alternative to currently used conventional synthetic antioxidants (Nunez de Gonzalez, 2008) and incorporate DF into the meat products (Zhang, 2010). Potential use of powders and extracts of different fruits as bio-preservatives and as functional ingredients have been studied in recent years. Many natural antioxidants have been reported to be more active than synthetic antioxidants and the food application of these compounds need to be explored.

In present study bioactive rich plant materials as the source of antioxidants and dietary fibre were incorporated at optimum level for the production of functional mutton patties (FMP). These BRPM may improve the oxidative-stability and functionality of the finished products along with reduction of cost. Economics (cost) is a very important criterion along with nutritive value and sensory acceptability, which determine the marketability of meat products. Therefore in present study the production cost of FMP incorporated with BRPM at their optimum level *viz.* cabbage powder, red kidney beans powder, orange pulp and their blend was determined and compared with control.

Materials and Methods

Mutton was procured from Experimental Abattoir of Division of Livestock Products Technology, Indian Veterinary Research Institute, Izatnagar. It was packed in clean polyethylene bags and brought to the laboratory. The meat cuts were deboned manually, packed in clean polyethylene bags and frozen at -18 ±

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1^0 C until use. Analar and food grade chemicals were procured from Qualigens, Mercks and BDH. Refined salt (Tata Chemicals Ltd., Mumbai), refined wheat flour (maida), cabbage, red kidney beans and orange, low density polyethylene film (200 gauges) bags, onion and garlic were procured from local market of Bareilly (U. P.). To prepare condiment, onion and garlic were peeled off, cut into small pieces and homogenized in a mixer to obtain a fine paste. Spices prepared in laboratory as per pre-standardized formulation. Powder from cabbage and red kidney beans and pulp from oranges were prepared in the laboratory following the standard procedure.

Preparation of Functional Mutton Patties

For optimization of level of either of the BRPM and their blend, replacement of lean meat in control formulation was made at three different levels. Based on physico-chemical attributes and sensory characteristics the optimum level of replacement was adjudged as 6.0% cabbage powder (1:1 hydration, w/w), 5.0% red kidney beans powder (1:1 hydration, w/w), 7.5% orange pulp (pasty consistency) and most acceptable blend that was blend A [3.5% cabbage powder (1:1 hydration, w/w), 3.5% red kidney beans powder (1:1 hydration, w/w), 2% orange pulp (pasty consistency)] was determined and compared with control. Functional mutton patties incorporated with BRPM and their blend were prepared by replacing the lean meat in pre-standardized formulation and processing conditions.

Formulation

Lean mutton (70%), refined vegetable oil (10%), ice flakes (10%), condiments (3.8%), refined wheat flour (3.5%), salt (1.6%), STPP (0.3%), sodium nitrite (100 ppm), sugar (0.3%) and dry spices (1.5%).

Processing

Mincing of deboned mutton was done through 8mm sieve plate of a meat mincer followed by chopping in a Hobart bowl chopper with salt, ice flakes and refined wheat flour. To this mixture, pre-weighed ingredients (vegetable oil, spices, condiments, sodium nitrite and sodium tripolyphosphate) were added. Finally uniform dough was prepared and meat patties each of about 70 gm, were formed manually utilizing petriplate of 70 mm diameter. Mutton patties were cooked in hot air oven at 180° C for 30 minutes with in between turning of patties once. Core temperature of cooked patties was recorded by using probe thermometer that should reach to 72° C. Cooled sample of each treatment was assigned for physico-chemical analysis.

FMP incorporated with optimum level of BRPM and their blend were subjected to sensory evaluation by a minimum of seven experienced panelists using 8 point descriptive scale (8) where 8= extremely desirable and 1= extremely undesirable. The sensory panellists consisted of scientists and postgraduate students of the Livestock Products Technology Division of IVRI. The preparation cost of FMP were calculated

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considering the ingredients and processing conditions utilized in the preparation of product to finally determine the most economic FMP formulation.

Result and Discussion

The comparative cost for formulation of 50 Kg control and FMP incorporated with optimum level of BRPM and their blend is presented in Table 1.

Table 1: Comparative cost for formulation of 50 Kg control and functional mutton patties

Ingredients	Rate	Control		Cabbage powder (6%)		Red kidney beans powder (5%)		Orange pulp (7.5%)		Blend A (9%)	
	₹ / Kg	Qt. (Kg)	₹	Qt (Kg)	₹	Qt. (Kg)	₹	Qt. (Kg)	₹	Qt. (Kg)	₹
Lean mutton	400	35	14000	32	12800	32.5	13000	31.25	12500	30.5	12200
Cabbage powder	200	-	-	1.5	300	-	-	-	-	0.875	175
Red kidney beans powder	200	-	-	-	-	1.25	250	-	-	0.875	175
Orange pulp	5	-	-	-	-	-	-	3.75	18.75	1	5
Vegetable oil	100	5	500	5	500	5	500	5	500	5	500
Spice mix	250	0.75	150	0.75	150	0.75	150	0.75	150	0.75	150
Condiments	40	1.9	76	1.9	76	1.9	76	1.9	76	1.9	76
Refined wheat flour	20	1.75	35	1.75	35	1.75	35	1.75	35	1.75	35
Salt, phosphate and nitrite	68	0.955	64.94	0.955	64.94	0.955	64.94	0.955	64.94	0.955	64.94
Sugar	30	0.15	4.5	0.15	4.5	0.15	4.5	0.15	4.5	0.15	4.5
Transportation cost	-	-	100	-	100	-	100	-	100	-	100
Total (₹)	-	-	**14930.44**	-	**14030.44**	-	**14180.44**	-	**13449.19**	-	**13485.44**

It includes the cost of raw materials required for preparation of functional mutton patties which are deboned mutton, table salt, spice mixture, condiments, refined wheat flour, STPP, sodium nitrite, cabbage powder, red kidney beans powder and orange pulp. In addition transportation cost for the purchase of raw materials was included. The retail prices for these ingredients are relatively stable in our marketing system. However, the cost of these ingredients can be lowered if purchased in bulk quantities from distributors/whole sale agents that may further reduce the cost of production. The formulation cost of 50 Kg product was ₹ 14931, 14031, 14181, 13450 and 13486 for control and treatments including cabbage powder, red kidney beans powder, orange pulp and their blend respectively. It was found that formulation cost for treatment FMP were less than control product and among the treatments least formulation cost was for orange pulp incorporated FMP. Less formulation cost for treatment products as compared to control product was due to the fact that all the BRPM utilised at their optimum level were much cheaper than deboned mutton.

Overhead cost involved in product preparation is presented in Table 2, it includes labour charges (skilled and unskilled), electricity charges, rent of building, packaging material cost, water charges, maintenance

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cost and equipment depreciation (@ 10% per annum). It was similar for control and treatment products and was found to be ₹ 1930 for the production of 50 Kg product.

Table 2: Overhead production cost of 50 Kg functional mutton patties

Labour charges	Skilled staff = 300 × 1 = ₹300 /day
	Unskilled staff = 200 × 2 = ₹400 /day
	Total = ₹700 /day
Electric charges	26 KWh × ₹ 6/ KWh = ₹ 156 /day
Equipment depreciation*	@ 10% per annum i.e. = ₹ 22, 320/annum i.e. = ₹ 62/day
Cost of Packaging material	(8″ x 6″ LDPE pouches) = 200 x 1 = ₹ 200.00
Water charges (200 litre)	200 x 0.06 = ₹ 12.00
Maintenance cost	₹300 per day
Rent of building	₹500 per day
Total overhead cost	≅ ₹ 1930

Similar considerations were followed by Verma *et al.* (2015) and Singh *et al.* (2015) for the calculation of overhead cost for the preparation of functional fiber-enriched pork loaves and spent hen meat cutlets respectively. Similarly Krofa *et al.* (2018) calculated the cost of production functional chevon patties fortified with microencapsulated docosahexaenoic acid powder and reported that coat was marginally higher (7.27%) in treatment patties than the control. In Table 3 production cost of FMP in actual considering the yield is presented.

Table 3: Production cost of functional mutton patties

Parameter	Control	Cabbage powder (6%)	Red kidney beans powder (5%)	Orange pulp (7.5%)	Blend A (9%)
Cost of formulation (₹)	14931	14031	14181	13450	13486
Overhead Production Cost (₹)	1930	1930	1930	1930	1930
Total (₹) expenditure	16,861	15,961	16,111	15,380	15,416
Product yield (Kg)	44	44.5	46	44.5	44
Actual cost per Kg product (₹)	383	359	350	346	350

The product yield was around 90%, 91%, 92%, 90% and 91% for control and treatments including cabbage powder, red kidney beans powder, orange pulp and blend respectively. However, a safety margin of 1 to 2 % should be considered to compensate the losses that might occur during various steps of processing, packaging and marketing, considering a final yield at 88%, 89%, 92%, 89% and 88 % for control and treatment products. Total expenditure for the preparation of 50 kg FMP was ₹16861, 15961, 16111, 15380 and 15416 and the product yield (Kg) was 44, 44.5, 46, 44.5, 44 for control and treatments including cabbage powder, red kidney beans powder, orange pulp and blend respectively. Therefore the cost of 1 kg product comes to be ₹ 383, 359, 350, 346 and 350 for control and treatment products. Similarly Malav *et al.* (2013) and Kadakadiyavar *et al.* (2017) calculated the cost of production of restructured chicken meat

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blocks extended with different vegetative extenders and chicken nuggets treated with antioxidants respectively.

Conclusion

The studies indicated that incorporation of BRPM at optimum level viz. cabbage powder, red kidney beans powder, orange pulp and blend resulted reduction in cost of FMP by ₹ 24, 33, 37 and 33 per Kg respectively as compared to control that was approximately 6, 9, 10 and 9% less per Kg than control.

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