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Evaluation of emu meat product for its sensory acceptability and cost economics

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Abstract

The study was conducted to assess the product characteristics developed from emu meat with respect to its acceptability and cost economics. The characteristics of developed emu meat rolls were compared with those of chicken and mutton rolls. For the product development live male birds were slaughtered in slaughter house of the department. Carcasses were separated into different portions for deboning and meat procurement. Emu meat rolls were developed and stored at refrigerated for the study. The sensory evaluation revealed that the tenderness of emu rolls was comparable to chicken and higher than mutton rolls. The overall acceptability of emu meat rolls was similar to that of chicken and significantly higher than mutton rolls. Cost of the product was calculated by taking in account all the expenditures involving capital and recurring cost for a small unit where it was observed that final production cost was Rs175, Rs 299 and Rs 550 for emu, chicken and mutton rolls respectively.

Keywords: Emu, meat roll, sensory, cost economics

Introduction

Emu (*Dromaius novaehollandiae*), a native bird of Australia is a flightless bird of ratites family that includes ostrich, cassowary, rhea and kiwi. The word ratite is used to describe the entire group of large birds, which have rudimentary wings, flat breast bone and their sternum have keel-like bone. Emus have been around for thousands of years, although their commercial value was not recognized until 1987, when emu farming was licensed in Western Australia (Frapple and Hagan, 1992) [4]. Since then, it has expanded to flock in USA, Europe, China, India and many other countries. Emus were traditionally farmed for production of feathers, high quality leather and fat. More recently, emu production has been adopted in many parts of the world for its meat (Berge *et al.*, 1997) [2]. Emu meat is recognized as healthy alternative to other red meats due to its leanness, low cholesterol and favourable fatty acids (Sales and Horbanczuk, 1998) [12]. Emu meat is the best alternative to red meat as it contains low fat and cholesterol (Jogdand *et al.*, 2023) [7]. Intramuscular lipids of emu drumstick meat contain higher level of linoleic, arachidonic, alpha linolenic and decosahexaenoic acids than those of chicken drum sticks and beef steak.

Non-vegetarian diet loving people in India have a craving for the variety of meat and meat products. Sometimes, available products from mutton, chevon and broiler meat are not able to satisfy their palate. In this regard, emu meat can be a better option for an alternative source of meat. The ratio of unsaturated fatty acids (USFA) to saturated fatty acids (SFA) in emu meat has been reported to be higher than chicken meat and beef (Wang *et al.*, 2000) [15]. It is a better source of haem iron than beef and its consumption is recommended by American Heart Association because of its low fat and cholesterol content (Pegg *et al.*, 2006) [10]. In spite of its healthy composition, emu farmers are finding it difficult to market the new source of meat (Daniel *et al.*, 2000) [3]. Therefore, popularization and marketing of emu meat products are essential for the sustainability of emu based industry. Buffalo meat and mutton are the red meats of choice for various communities in India. So, emu meat can be a suitable alternative to these red meats. Moreover, it can provide some special delicacy to consumers demanding a variety of meat. The emu meat has a good potential to be used as an alternative source of meat (Raut *et al.*, 2017) [11]. Hence the present study was conducted to analyze the quality of emu meat with respect to its product acceptability

and cost economics to produce a better picture of its sensory characteristic and economic viability.

Materials and Methods

Meat

Emu male birds of around 14 months of age and weighing approximately 35 kg were procured from emu farm in Hisar. They were slaughtered and dressed as per standard procedure in the slaughterhouse of Department of Livestock Products Technology, Lala Lajpat Rai University of Veterinary and Animal Sciences. Carcasses were washed thoroughly and meat was deboned manually after trimming of visible fat. A uniform mix of the deboned meat was also made to represent the whole carcass. All meat samples were frozen and stored in a freezer (-18°C) for further studies. Healthy sheep of around one year of age and broilers were obtained from the Livestock Farm, College of Veterinary Sciences, LUVAS, Hisar. Similar slaughter and dressing procedure was adopted for mutton and broiler meat procurement.

Preparation of meat rolls

Meat rolls from emu meat, mutton and broiler meat were prepared. Frozen meat was cut into smaller cubes and minced in a meat mincer through 4 mm pore size plate. Minced meat was mixed with already standardized additives, condiments and spice mix and thorough emulsion was prepared in bowl chopper as per the formulation mentioned in table 1. After filling in autoclavable beakers, cooking of emulsion was carried out at 121°C for 20 minutes to make meat rolls. Product was stored at $4\pm 1^{\circ}\text{C}$ for further storage studies.

Sensory evaluation

A semi trained panel consisting of scientists and post graduate students evaluated the sensory attributes viz: colour, flavour, texture, juiciness, tenderness and over all acceptability of meat rolls using 8-point descriptive scale (Keeton, 1983) [8].

Statistical analysis

The analysis was carried out in triplicates and repeated two times for each parameter. Data obtained ($n=6$) were subjected to analysis of variance followed by Duncan's multiple range test at 5% significance level (Snedecor and Cochran, 1989) [13] and results were expressed as mean \pm standard deviation.

Cost economics

The cost economics of the developed product was analyzed for respective samples. While calculating the cost of products a detailed expenses were taken into account for the preparation of 50 kg meat rolls of per day. The capital investment and annual depreciation was taken into account for the analysis of cost economics of the developed product.

Results and Discussion

Sensory characteristics

The colour score for emu meat rolls (Table 2) was significantly ($p\leq 0.05$) higher than those of chicken and

mutton rolls. Higher colour scoring by sensory panellist was on expected lines due to high myoglobin content and highest redness value assessed by instrument colour profile (Table 2). The flavour scores were however, comparable amongst all. The textural score of emu meat rolls was intermediate of chicken and mutton rolls. The juiciness of emu meat rolls was significantly ($p\leq 0.05$) lower in comparison to chicken meat rolls, however, it did not differ significantly from that of mutton rolls. Govind *et al.* (2013) [5] on the other hand had documented that juiciness did not differ significantly among emu, broiler and spent hen sausages. The tenderness score of emu rolls was comparable to chicken and higher than mutton rolls, was might be due to low amount of connective tissue in emu and chicken meat. Adams *et al.* (1997) [1] had also reported that emu steaks were rated more juicy, tender and flavourful than beef rib eye steaks. Emu meat was rated more juicy and tender compared to sirloin steaks from beef (Taylor *et al.*, 1997) [14]. Govind *et al.* (2014) [6] documented higher tenderness of emu sausages than hen sausages. The overall acceptability of emu meat rolls was similar to that of chicken and significantly ($p\leq 0.05$) higher than mutton rolls. Govind *et al.* (2014) [6] also did not find significant difference among overall acceptability of emu, broiler and spent hen sausages. Naveena *et al.* (2013) [9] observed that there was no significant difference in sensory attributes of cooked emu and goat meat. Berge *et al.* (1997) [2] also revealed that most panellists were unable to differentiate cooked emu and beef during sensory evaluation.

Cost economics

Table 3 shows major capital investments with cost and annual depreciation for processing of 50 kg of meat/day for preparation of meat rolls. Basic minimum equipments required for processing of 50 kg of meat cost Rs 80890@ 10% depreciation. Total depreciation amount comes to Rs 7899. It does not include LPG connection as there is no depreciation on this item. Detailed break up of product cost has been presented in table 4. This break up has been prepared with the assumption that 50 kg of deboned meat processed daily for 300 working days in an year yield 15000 kg of minced meat/year. This break up is detailed under three main heads. Part(A) contains manufacturing cost, part(B) general expenses and part (C) product cost i.e. (A+B). Under manufacturing cost there are two heads i.e. direct product cost (a) and fixed charges (b). Direct product cost has been split into six subheads i.e. raw material, operating labour and supervision, power utility, maintenance charges, cleaning material and LPG cylinder. As emu carcass yield 60% of deboned meat, 25000 kg emu meat is required for obtaining 15000 kg of deboned meat. In case of chicken and mutton, 55% of meat is obtained from carcass after deboning, 27273 kg of meat is required for obtaining 15000 kg deboned meat.

Other raw material like salts and additive are used in similar quantity in all the three types of meat rolls. After taking into consideration the cost of raw materials and other expenses as mention in table 4, the product cost per annum for emu, chicken and mutton rolls comes out to be Rs 3460169, Rs 5869309 and Rs 10778449 respectively. Cost/kg has been

calculated on the basis of total raw material and cooking yield for each type of roll. Since as per table 1, many ingredients are added in 100 g of meat. total amount of raw material comes to 137 g. Hence 15000 kg of raw deboned meat per annum yield 20550 kg of raw emulsion. Amount of final product/kg has been calculated with cooking yields of 96.01, 95.54 and 95.38% for emu, chicken and mutton rolls respectively. Cost of the product calculated this way is Rs175, Rs 299 and Rs 550 for emu, chicken and mutton rolls respectively (Table 5). Selling prize and margin of profit depends upon prevailing market forces.

Table 1: Composition of meat emulsion

Ingredients	Emu (g)	Chicken (g)	Mutton (g)
Meat	100	100	100
Sodium chloride	2.5	2.5	2.5
STPP (Sodium tripolyphosphate)	0.4	0.4	0.4
Spice mix	3	3	3
Condiments (Onion:Garlic,2:1)	4	4	4
Egg albumin	10	10	10
Vegetable oil	5	5	5
Sodium nitrite	0.02	0.02	0.02
Chilled water	12	12	12

Table 2: Sensory scores of emu, chicken and mutton rolls (Mean \pm SD, n=18)

Components	Emu	Chicken	Mutton
Colour	7.67 ^b \pm 0.45	7.25 ^a \pm 0.35	7.03 ^a \pm 0.12
Flavour	7.17 ^a \pm 0.34	7.11 ^a \pm 0.65	6.97 ^a \pm 0.44
Texture	7.39 ^{ab} \pm 0.47	7.67 ^b \pm 0.49	7.17 ^a \pm 0.49
Juiciness	6.92 ^a \pm 0.60	7.61 ^b \pm 0.47	7.11 ^a \pm 0.44
Tenderness	7.64 ^b \pm 0.48	7.72 ^b \pm 0.43	7.11 ^a \pm 0.32
Overall acceptability	7.61 ^b \pm 0.56	7.67 ^b \pm 0.45	7.14 ^a \pm 0.33

Means with different lower case superscript in a row differ significantly at $p \leq 0.05$

Table 3: Major capital investment with cost and annual depreciation for processing of 50 kg of meat per day for preparation of meat rolls.

Sr. No.	Items	Particulars	Qty.	Estimated cost (Rs)	Rate of (%) depreciation	Annual depreciation (Rs)
1.	Weighing balance	10 kg	1	1500	10	150
2.	Sealing machine	--	1	4000	10	400
3.	Stainless steel patila	40 lit	2	2200	10	220
4.	Stainless steel spoons	Big	6	300	10	30
5.	Stainless steel trays	Big	4	600	10	60
6.	Stainless steel buckets	20 lit.	2	1500	10	150
7.	Chopping knives	--	2	300	10	30
8.	Chopping board	--	1	100	10	10
9.	Tub plastic	--	2	400	10	40
10.	Refrigerator	300 lit	1	35000	10	3500
11.	Glass beakers	500 ml	20	1400	10	140
12.	Pressure cookers	20 lit.	1	5000	10	500
13.	Measuring vessels	1 lit	2	50	10	5
14.	LPG connection (DBC)	--	1	1900	--	-
15.	Burner brass	--	2	1600	10	160
16.	Lighter electronic	--	1	40	10	4
17.	Electric mixer	--	1	5000	10	500
18.	Electric mincer	--	1	20000	10	2000
	Total			80890		7899

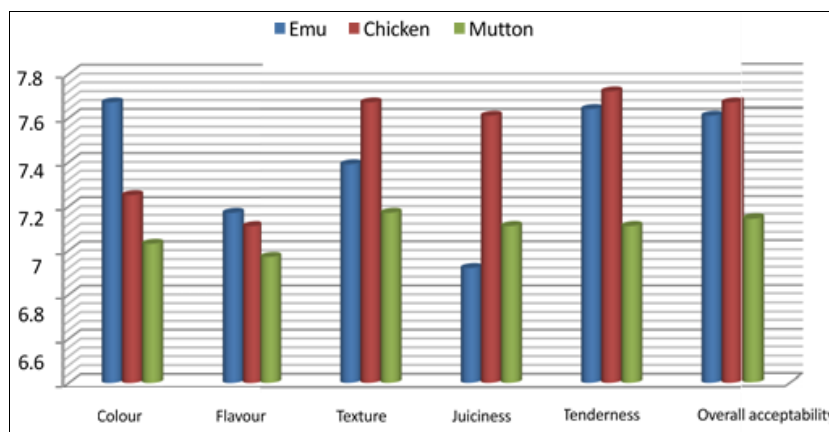
Table 4: Detailed break up of product cost for the manufacture of emu, chicken and mutton meat rolls

Sr. No.	Component	Rate (Rs)	Requirement (per annum)	Expenditure per annum (Rs)
A) Manufacturing cost				
a) Direct product cost				
I. Raw material				
1.	Emu meat (without deboning)	100 /kg	25,000 kg	25,00,000
2.	Chicken meat (without deboning)	180/kg	27,273 kg	49,09,140
3.	Mutton meat (without deboning)	360/kg	27,273 kg	98,18,280
4.	Deboned meat (60% of whole meat) for Emu.	-	15,000 kg	-
	Deboned meat (55% of whole meat) for chicken and mutton.	-	15,000 kg	-
5.	Common salt	16/kg	375 kg	6000
6.	Sodium tripolyphosphate	280/kg	60.0 kg	16,800
7.	Sodium nitrite	240/kg	3.0 kg	720
8.	Spice mix	600/kg	450 kg	2,70,000
9.	Refined vegetable oils	100/kg	750 kg	75,000
10.	Egg albumin	125/kg	1500 kg	1,87,500
11.	Condiments	50/kg	600kg	30,000

12.	Printed poly packs (Capacity-500gms)	0.60/pack	30,000 packs	18,000
	Subtotal(I)			
	Emu			31,04,020
	Chicken			55,13,160
	Mutton			1,04,22,300
II. Operating labour and supervision				
1.	Skilled labour	10000/month	Two	2,40,000
	Sub-total (II)			2,40,000
III. Power and utility				
1.	Power	7/KWH	840 KWH	5,880
2.	Water	2/100lit	150000	3000
	Sub-total (III)			8,880
IV	Maintenance/Laboratory charges	1000/month		12,000
V	Cleaning material (detergent)	60/kg.	300	18,000
VI	LPG Cylinder	1200/19 kg	15	18,000
	Sub-total(a)=I+II+III+IV+V+VI			
	For Emu=			34,00,900
	For Chicken=			58,10,040
	For Mutton=			1,07,19,180
b) Fixed charges				
1.	Rent for building	3000/month		36,000
2.	Depreciation on capital investment (10%)			7,899
3.	Insurance and taxes@4%of capital investment			3236
	Sub-total(b)=			47,135
	Sub-total A=a+b			
	For Emu=			34,48,035
	For Chicken=			58,57,175
	For Mutton=			1,07,66,315
B	General expenses			
	Interest on investment @ 15% per annum			12,134
	(C) Product cost (A+B)			
	Product cost/annum for Emu			34, 60,169
	Product cost/annum for Chicken			58, 69,309
	Product cost/annum for Mutton			1,07,78,449

Table 5: Final product cost for the manufacture of emu, chicken and mutton meat rolls

	Total raw material (kg)	Cooking Yield (%)	Final product (kg)	Cost/kg in Rs.
Product cost of Emu rolls	20550	96.01	19730	175
Product cost of chicken rolls	20550	95.54	19633	299
Product cost of mutton rolls	20550	95.38	19600	550

**Fig:** Sensory scores of emu, chicken and mutton rolls**Conclusion**

Production costs of emu, chicken and mutton rolls were Rs 175, Rs 299 and Rs550/kg respectively. It is concluded that emu meat is suitable for development of meat rolls and is

comparable with chicken meat with regard to product characteristics and acceptability. Shelf stability of emu rolls at refrigerated temperature is 15 days. The study revealed that due to bright red colour and low fat content, emu meat can

be a healthy alternative red meat like mutton.

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