

International Journal of Advanced Biochemistry Research



ISSN Print: 2617-4693
ISSN Online: 2617-4707
NAAS Rating (2026): 5.29
IJABR 2026; 10(7): 765-768
www.biochemjournal.com
Received: 18-04-2026
Accepted: 23-05-2026

Anurag
Department of Livestock
Products Technology, LUVAS,
Hisar, Haryana, India

Suman Bishnoi
Department of Livestock
Products Technology, LUVAS,
Hisar, Haryana, India

Sanjay Yadav
Department of Livestock
Products Technology, LUVAS,
Hisar, Haryana, India

Shubham Dudi
Department of Livestock
Products Technology, LUVAS,
Hisar, Haryana, India

Gudia
Department of Livestock
Products Technology, LUVAS,
Hisar, Haryana, India

Monika Rani
Department of Livestock
Products Technology, LUVAS,
Hisar, Haryana, India

Sangeeta
Department of Livestock
Products Technology, LUVAS,
Hisar, Haryana, India

Corresponding Author:
Sangeeta
Department of Livestock
Products Technology, LUVAS,
Hisar, Haryana, India

Cost economics of fibre-enriched chicken meat chips incorporated with apple pomace

Anurag, Suman Bishnoi, Sanjay Yadav, Shubham Dudi, Gudia, Monika Rani and Sangeeta

DOI: <https://www.doi.org/10.33545/26174693.2026.v10.i7j.9164>

Abstract

This study evaluated the cost economics of fibre-enriched chicken meat chips incorporated with 13.93% apple pomace powder. Product cost was estimated by considering ingredient cost, packaging, labour, utilities, capital investment, and production yield under commercial-scale production (50 kg/day). Incorporation of apple pomace improved cooking yield, resulting in lower production costs than the control. The production cost of treatment chips was ₹ 343.38/kg under aerobic packaging and ₹ 357.88/kg under vacuum packaging, compared with ₹ 374.55/kg and ₹ 389.09/kg, respectively, for the control. Vacuum-packaged treatment chips also exhibited better storage stability, reducing product losses and enhancing commercial value. The findings indicate that apple pomace is a cost-effective functional ingredient for developing nutritionally improved chicken meat chips with enhanced economic feasibility.

Keywords: Apple pomace, chicken meat chips, cost economics, fibre enrichment, vacuum packaging, value addition

Introduction

Meat is a nutrient-dense food that provides high-quality protein, essential amino acids, B-complex vitamins, and highly bioavailable minerals such as iron and zinc, making it an important component of a balanced human diet (Sheffield *et al.*, 2024) [8]. Rapid urbanization, changing lifestyles, and increasing consumer preference for convenient ready-to-eat (RTE) foods have accelerated the demand for value-added meat products with enhanced nutritional quality, longer shelf life, and improved market acceptability (Dominguez-Nino *et al.*, 2020) [2]. Compared with conventional cereal-based snacks, meat-based snacks offer superior protein quality and greater bioavailability of essential nutrients, making them an attractive alternative for health-conscious consumers (Shankaran & Kumari, 2024; Park *et al.*, 2026) [7, 6].

Chicken meat chips are an emerging category of high-protein snack products owing to their desirable sensory characteristics, low carbohydrate content, ambient storage stability, and ease of packaging and transportation. The continuous growth of the Indian poultry sector, which produced approximately 5.15 million tonnes of poultry meat during 2024-25, accounting for nearly 49% of the country's total meat production, provides a reliable and economical raw material base for the manufacture of value-added poultry products (BAHS, 2025) [1]. Furthermore, chicken meat is relatively inexpensive, widely accepted across different consumer groups, and readily adaptable to diversified processed products (Katiyo *et al.*, 2020) [4].

The economic sustainability of processed meat products depends not only on product quality but also on production efficiency, ingredient cost, processing yield, packaging, and storage stability (Naseem *et al.*, 2024) [5]. Incorporation of low-cost functional ingredients derived from agro-industrial by-products offers an effective strategy to improve both nutritional value and cost efficiency. Apple pomace, a by-product of the juice processing industry, is a rich source of soluble and insoluble dietary fibre, phenolic compounds, and natural antioxidants, and has attracted considerable attention as a sustainable functional ingredient in meat products (Gracey & Tako, 2025) [3]. Its incorporation can partially replace costly meat without compromising product quality, improve cooking yield and moisture retention,

enhance dietary fibre content, and contribute to the valorization of fruit processing waste, thereby reducing production costs and environmental burden. Packaging also plays a significant role in the commercial viability of meat snacks (Dominguez-Nino *et al.*, 2020) [2]. Vacuum packaging minimizes lipid oxidation, pigment degradation, and microbial growth, thereby preserving product quality, extending shelf life, reducing storage losses, and improving distribution efficiency (Singh *et al.*, 2011) [9]. These advantages enhance product marketability and reduce economic losses during storage and transportation. Despite increasing interest in functional meat snacks, limited information is available regarding the economic feasibility of fibre-enriched chicken meat chips prepared using apple pomace. Therefore, the present study was undertaken to evaluate the production economics of chicken meat chips enriched with apple pomace, with emphasis on production cost, yield improvement, packaging efficiency, and commercial viability while ensuring acceptable quality and storage stability.

Materials and Methods

Source of Materials

Live broiler chickens (5-6 weeks of age) were procured from the University Livestock Farm, Lala Lajpat Rai University of Veterinary and Animal Sciences (LUVAS), Hisar, and slaughtered following the standard halal procedure at the Department of Livestock Products Technology. The dressed carcasses were deboned, trimmed of visible fat and connective tissue, packed in low-density polyethylene (LDPE) bags, and stored at -18 ± 2 °C until further use. Prior to product preparation, the frozen meat was thawed overnight under refrigerated conditions (4 ± 2 °C).

Fresh apples were procured from the local fruit market of Hisar. After washing with potable water, juice was extracted to obtain apple pomace. The pomace was dried in a hot-air dryer at 55-60 °C, ground into a fine powder using an electrical grinder, packed in airtight containers, and stored at

-18 °C until use. Eggs, sodium nitrite, sodium tripolyphosphate (STPP), common salt, vegetable oil, ginger, garlic, and other ingredients were purchased from the local market. Spice ingredients were cleaned, oven-dried (45 ± 2 °C for 2 h), ground separately, blended according to the standardized formulation, and stored in airtight PET containers. Food-grade chemicals, analytical reagents, culture media, and standards used for physicochemical and microbiological analyses were procured from reputed suppliers, including HiMedia, Sigma-Aldrich, CDH, and Qualigens. LDPE pouches were used for aerobic packaging, whereas laminated vacuum pouches (Swiss Pac Pvt. Ltd., India) were used for vacuum packaging of chicken meat chips.

Results and Discussion

The cost of production of control and treated chicken meat chips was estimated based on prevailing market rates, incorporating both fixed and variable costs such as raw materials, labour, utilities, and depreciation to simulate commercial conditions (Table 1). A production capacity of 50 kg/day and annual processing of 15,000 kg deboned meat were assumed. The total capital investment was estimated at Rs. 2,19,770/-with an annual depreciation of Rs. 21,977/-. Raw material cost constituted the major share, with meat being the costliest component. Total annual expenditure was highest for control vacuum (Rs. 57,22,612/-) and lowest for treatment aerobic (Rs. 50,36,925/-). Treated products showed reduced cost due to partial replacement of meat with apple pomace, while vacuum packaging slightly increased cost. The cost of production per kg (Table 3) varied among treatments, with control aerobic showing the highest cost (Rs. 1112/kg) and treatment vacuum the lowest (Rs. 820/kg). Incorporation of apple pomace significantly reduced production cost by partially replacing meat. Overall, treated products were more economical than controls, and vacuum packaging resulted in lower cost compared to aerobic packaging.

Table 1: Detailed break up of product cost for the developed of chicken meat chips

Sr. No.	Component	Rate per kg (Rs.)	Requirement (per annum)	Expenditure (per annum) Rs.			
				Control aerobic	Treatment aerobic	Control vacuum	Treatment vacuum
A)	Manufacturing cost						
a)	Direct product cost						
I	Raw material						
	Meat without deboning	180	27273				
1	Deboned meat for control aerobic (55% of whole meat)	327	15000	4905000			
2	Deboned meat for treatment aerobic (55% of whole meat)	327	12937.5		4230563		
3	Deboned meat for control vacuum (55% of whole meat)	327	15000			4905000	
4	Deboned meat for treatment vacuum (55% of whole meat)	327	12937.5				4230563
5	Sodium chloride	25	300	7500	7500	7500	7500
6	Sodium tripolyphosphate	280	73	20440	20440	20440	20440
7	Sodium nitrite	240	2.80	672	672	672	672
8	Spice mix	450	300	135000	135000	135000	135000
9	Vegetable Oil	100	1278	127800	127800	127800	127800
10	Whole egg liquid	150/tray	1825 tray	273750	273750	273750	273750
11	Condiments	50	549	27450	27450	27450	27450
13	Apple pomace	100	2062.5		206250		206250
14	Vacuum pouch printed (Capacity-gram)	3/pack	75000 packs			225000	225000
15	Printed polypacks (Capacity-500 g)	0.50/pack	15000 packs	7500	7500		
	Sub Total (I)			5,505,112	5,036,925	5,722,612	5,254,425

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	6.2/KWH	10800 KWH	66960
2	Water	2/100 lit	150000	3000
	Sub-total (III)			69960
IV	Maintenance/Laboratory charges	1000/month		12,000
V	Cleaning material (detergent)	80/kg.	300	24000
	Sub-total (a) = (I + II + III + IV + V)			
	For control aerobic			5,591,602
	For treatment aerobic			5,123,415
	For control vacuum			5,809,102
	For treatment vacuum			5,340,915
(b)	Fixed charges			
1	Rent for building	4000/month		48000
2	Depreciation on capital investment (10%)			21,977
3	Insurance and taxes @ 4% of capital investment			8791
	Sub-total (b) =			78,768
	Sub-total A = a + b			
	For control aerobic			5,611,294
	For treatment aerobic			5,143,107
	For control vacuum			5,828,794
	For treatment vacuum			5,360,607
	General expenses Interest on investment @ 13.75% per annum			30,219
	Product cost (A + B)			
	Product cost per annum for chicken meat chips (control aerobic)			5,618,294
	Product cost per annum for chicken meat chips control vacuum			5,150,662
	Product cost per annum for chicken meat chips treatment aerobic			5,836,349
	Product cost per annum for chicken meat chips treatment vacuum			5,368,162

Table 2: Major capital investment with cost and annual depreciation for processing of 50 kg of chicken meat per day for preparation of chicken meat chips

Sr. No.	Items	Particulars	Qty.	Estimated cost (Rs.)	Rate of (%) depreciation	Annual depreciation (Rs.)
1	Weighing balance	10 kg	1	4800	10	480
2	Sealing machine	--	1	2000	10	200
3	Vacuum Packaging Machine	--	1	100000	10	10000
4	Stainless steel container	40 lit	2	2200	10	220
5	Stainless steel spoons	Big	6	480	10	48
6	Stainless steel trays	Big	4	800	10	80
7	Stainless steel buckets	20 lit.	2	1500	10	150
8	Chopping knives	--	2	300	10	30
9	Chopping board	--	1	100	10	10
10	Tubs plastic	--	2	400	10	40
11	Refrigerator	300 lit	1	40000	10	4000
12	Hot air oven	---	1	47000	10	4700
13	Measuring vessels	1 lit	2	50	10	5
14	Food Processor		1	5000	10	500
15	Electric meat mincer	--	1	15000	10	1500
16	Roller	--	2	140	10	14
	Total:			2,19,770		21,977

Table 3: Cost of chicken meat chips per Kg

		Total raw Material (kg)	Cooking Yield (%)	Final Product (kg)	Cost/kg (Rs.)
1.	Product cost per kg for chicken meat chips control aerobic	17605	32.33	5691.70	987.10
2.	Product cost per kg for chicken meat chips treatment aerobic	17605	43.31	7624.73	675.52
3.	Product cost per kg for chicken meat chips control vacuum	17605	32.33	5691.70	1025.41
4.	Product cost per kg for chicken meat chips treatment vacuum	17605	43.31	7624.73	704.05

Conclusion

The incorporation of 13.93% apple pomace in chicken meat chips proved to be a cost-effective strategy for developing a value-added functional meat snack. Partial replacement of meat with apple pomace improved product yield and reduced overall production cost without compromising

commercial feasibility. Although vacuum packaging incurred a slightly higher packaging cost, it enhanced shelf stability and product quality, thereby improving marketability and reducing storage losses. Overall, fibre-enriched chicken meat chips incorporated with apple

pomace offer a nutritionally improved, economically viable, and sustainable alternative for commercial production.

References

1. Basic Animal Husbandry Statistics (BAHS). Basic Animal Husbandry Statistics-2025. New Delhi: Department of Animal Husbandry and Dairying, Ministry of Fisheries, Animal Husbandry and Dairying, Government of India; 2025. p. 41-42.
2. Dominguez-Nino A, Lucho-Gomez AM, Pilatowsky-Figueroa I, Lopez-Vidana EC, Castillo-Tellez B, Garcia-Valladares O. Experimental study of the dehydration kinetics of chicken breast meat and its influence on the physicochemical properties. *CyTA-Journal of Food*. 2020;18(1):508-517.
3. Gracey PR, Tako E. Apple and grape pomace: emerging upcycled functional ingredients in processed meat products, designed to increase polyphenol and fiber contents. *Sustainable Food Technology*. 2025;3(4):861-874.
4. Katiyo W, de Kock HL, Coorey R, Buys EM. Sensory implications of chicken meat spoilage in relation to microbial and physicochemical characteristics during refrigerated storage. *LWT*. 2020;128:109468.
5. Naseem Z, Bhat NA, Mir SA. Valorisation of apple pomace for the development of high-fibre and polyphenol-rich wheat flour cookies. *Scientific Reports*. 2024;14(1):25912.
6. Park J, Han SR, Choi MK. Comparative nutritional assessment of vegetarian and nonvegetarian ready-to-eat foods. *Clinical Nutrition Research*. 2026;15(1):36-44.
7. Shankaran PI, Kumari P. Nutritional analysis of plant-based meat: Current advances and future potential. *Applied Sciences*. 2024;14(10):4154.
8. Sheffield S, Fiorotto ML, Davis TA. Nutritional importance of animal-sourced foods in a healthy diet. *Frontiers in Nutrition*. 2024;11:1424912.
9. Singh VP, Sanyal MK, Dubey PC, Sachan N, Kumar V. Chicken snacks as affected by storage conditions under aerobic and vacuum packaging at 30 ± 2 °C. *African Journal of Food Science*. 2011;5(11):620-625.