RESEARCH ARTICLE

Effect of Barrier Film Type and Iron-Based Oxygen Scavenger on Physico-Chemical, Microbiological and Sensory Quality of Refrigerated Fresh Pork Chunks Tray-Packaged in Food-Grade Polypropylene Trays

Dhineshkumar Vinobharaj[1], Prince Devadason Immanuel[1]*, Mendiratta Sanjod Kumar[1], Kumar Rajiv Ranjan[1], Agarwal Ravi Kant[2]

Abstract

Retail packaging of fresh red meat in India is largely confined to low-barrier LDPE pouches that offer poor protection against oxidative and microbial deterioration during chilled display. The objective of the present investigation was to evaluate the effect of four food-grade wrap films of differing oxygen and water-vapour transmission rates (LDPE, LLDPE, HDPE and PVC) with and without an iron-based oxygen scavenger sachet (O-SORB U100, 2.5 g) on the storage stability of deboned fresh pork chunks tray-packaged in food-grade polypropylene trays at 4±1 °C. Eight treatments were evaluated and physico-chemical, microbiological and sensory parameters were monitored on day 0, 5 and 8 of storage. By day 8, control LDPE-packaged chunks were unacceptable, with pH 6.99 ± 0.02, TBARS 1.39 ± 0.04 mg MDA/kg, extract release volume of only 14.88 ± 0.27 mL and total plate count of 5.88 ± 0.09 log CFU/g. In contrast, the THDPE treatment (HDPE wrap film plus oxygen scavenger) retained acceptable quality (pH 6.16 ± 0.01, TBARS 0.64 ± 0.01 mg MDA/kg, ERV 28.25 ± 0.11 mL, total plate count 4.67 ± 0.05 log CFU/g) and the highest sensory acceptance among all eight treatments. The HDPE wrap film combined with an in-pack oxygen scavenger extended the refrigerated shelf life of fresh pork chunks from 5 days to 8 days, suggesting a feasible upgrade pathway for chilled pork retailing in tropical markets.

Key words: Active packaging, Barrier film, HDPE, Oxygen scavenger, Pork, Shelf life.

Ind J Vet Sci and Biotech (2026): 10.48165/ijvsbt.22.4.24

Introduction

Pork is the most widely consumed meat globally, with world production of about 94.33 million metric tonnes in 2020. The leading producers are China, the European Union and the United States; Indian production stood at approximately 297 thousand metric tonnes (20th Livestock Census, 2019). In India, however, pork consumption is concentrated in the north-eastern states because of religious and cultural restrictions on its consumption elsewhere in the country, and an estimated 2.01 % of the country's livestock are pigs, with crossbred animals contributing approximately 23.85 % of the population (20th Livestock Census, 2019). Of the total meat produced in India only about 21.0 % is processed and sold as frozen meat or value-added products, indicating that the country's meat processing sector is still in an early growth stage.

Fresh pork is a highly perishable substrate that supports rapid microbial proliferation and lipid and protein oxidation once exposed to oxygen during retail handling (Lambert *et al.,* 1991). The conventional retail format in India for fresh pork is unsealed or loosely sealed LDPE pouches displayed in butcher cabinets, a system that is both unhygienic and severely limited in barrier performance. LDPE films offer an oxygen transmission rate (OTR) of 6,500-8,500 $cm^3/m^2/24$ h and limited puncture resistance, which translate into a refrigerated shelf life of only 3-5 days for fresh chunks (Dhanze *et al.,* 2012). Lipid oxidation is the predominant cause of qualitative deterioration in chilled fresh meat, in which unsaturated fatty acids react with molecular oxygen through

[1]Division of Livestock Products Technology, ICAR-Indian Veterinary Research Institute, Izatnagar-243122, Uttar Pradesh, India

[2]Division of Bacteriology and Mycology, ICAR-Indian Veterinary Research Institute, Izatnagar- 243122, Uttar Pradesh, India

Corresponding Author: Dr. I. Prince Devadason, Principal Scientist, Division of Livestock Products Technology, ICAR-Indian Veterinary Research Institute, Izatnagar-243122, Uttar Pradesh, India. e-mail: princenadar@yahoo.co.in

How to cite this article: Dhineshkumar, V., Devadason P. I., Mendiratta, S. K., Kumar, R. R., & Agarwal, R. K. (2026). Effect of Barrier Film Type and Iron-based Oxygen Scavenger on Physico-Chemical, Microbiological and Sensory Quality of Refrigerated Fresh Pork Chunks Tray-Packaged in Food Grade Polypropylene Trays. Ind J Vet Sci and Biotech, 22(4), 129-134.

Source of support: Nil

Conflict of interest: None

Submitted 20/05/2026 **Accepted** 28/05/2026 **Published** 10/07/2026

a free-radical chain mechanism to produce peroxides and secondary oxidation products that alter colour, texture and aroma (Min and Ahn, 2005; Lima *et al.,* 2013).

Tray-and-overwrap presentation is the dominant fresh-meat retail format in developed markets. The package format provides visual appeal, supports labelling and portion control and, when combined with appropriate wrap films, can substantially extend the chilled shelf life of red meat (Dawson, 2010). Among commercial wraps, LLDPE, HDPE and PVC offer progressively lower oxygen and moisture transmission rates than LDPE, while polypropylene (PP) trays add rigidity and an oxygen barrier to the bottom of the package. Beyond passive barrier improvement, active packaging - the deliberate incorporation of in-pack functional components such as oxygen scavengers, moisture absorbers, ethylene scavengers or antimicrobial release devices - has emerged as an effective strategy to manage residual headspace oxygen (Hogan and Kerry, 2008; Bhardwaj *et al.,* 2019).

Iron-based oxygen scavenger sachets reduce in-pack oxygen to below 0.01 % by oxidation of metallic iron in the presence of moisture, thereby retarding lipid oxidation, suppressing aerobic microbial growth and protecting pigments (Vermeiren *et al.,* 1999; Dey and Neogi, 2019). Recent reports show that combining oxygen scavengers with appropriate barrier films can extend the refrigerated shelf life of muscle foods by 3-7 days (Mexis *et al.,* 2012; Ahmed *et al.,* 2017). Despite this progress, comparative shelf-life data for fresh deboned pork tray-packaged in PP trays with the four most commonly used commercial wrap polymers (LDPE, LLDPE, HDPE, PVC) and an iron-based oxygen scavenger under tropical refrigerated conditions are scarce. Such data are essential for the Indian organised retail sector, where tray packaging of meat is virtually non-existent at present. The present study therefore evaluated the effect of four wrap films, with and without an iron-based oxygen scavenger, on the physico-chemical, microbiological and sensory quality of fresh deboned pork chunks tray-packaged in PP trays during refrigerated storage at 4±1 °C.

Materials and Methods

Raw Material and Sample Preparation

Crossbred pigs of approximately six months of age were slaughtered humanely at the experimental abattoir of the Division of Livestock Products Technology, ICAR-Indian Veterinary Research Institute, Izatnagar, India, following the institute's standard animal welfare and slaughter hygiene guidelines. Carcasses were deboned, surface fat was trimmed and the lean muscle was immersed briefly in 1 % saline to reduce surface microbial load. Deboned meat was packed in food-grade LDPE pouches and held at -18±2 °C until use. Three independent trials were conducted; for each trial, approximately 10 kg of deboned pork was thawed at refrigeration temperature, cut into chunks of approximately one cubic inch after completion of rigor and used immediately for tray packaging.

Packaging Materials

Food-grade polypropylene trays (19 × 14 × 3 cm) compatible with microwave and freezer temperature were used as the primary container. Four food-grade wrap films were procured from Krishna Agencies, DD Puram, Bareilly, Uttar Pradesh, India: LDPE (60 µm; OTR 6,500-8,500 $cm^3/m^2/24$ h; WVTR 10-20 $g/m^2/24$ h); LLDPE (60 µm; OTR 200 $cm^3/m^2/24$ h; WVTR 15.5-18 $g/m^2/24$ h); HDPE (80 µm; OTR 1,600–2,000 $cm^3/m^2/24$ h; WVTR 7-10 $g/m^2/24$ h); and PVC (55 µm; OTR 8-125 $cm^3/m^2/24$ h; WVTR 1.5-5 $g/m^2/24$ h). Iron-based food-grade oxygen scavenger sachets (O-SORB U100, 2.5 g per sachet) were procured from the local market in Bareilly.

Tray Packaging and Treatments

Approximately 200 g of fresh pork chunks were weighed on an electronic balance (SCALE-TEC SAB-300E, Scaletec, India) and placed in each PP tray under good manufacturing practice. Trays were heat-sealed in a manual MITSUMI tray-sealing machine at 150-155 °C (LDPE), 155-160 °C (LLDPE) or 175-180 °C (HDPE), followed by a 10-sec cooling step. PVC was wrapped manually around the tray because the film cannot withstand heat-sealing temperatures. Eight treatments were prepared by combining each of the four wrap films with two scavenger conditions: control (C, no scavenger) and treatment (T, one iron-based oxygen scavenger sachet placed inside the tray prior to sealing), giving treatments CLDPE, TLDPE, CLLDPE, TLLDPE, CHDPE, THDPE, CPVC and TPVC. All packages were stored at 4±1 °C and analysed on day 0, 5 and 8.

Physico-Chemical Analyses

Sample pH was measured in a 1:9 (w/v) meat-to-distilled-water homogenate using a digital pH meter (Hanna Instruments, Italy) according to Trout *et al.* (1992). Water activity (a^{χ}) was determined with a Hygrolab 3 instrument (Rotronics, Switzerland) in quick mode. Extract release volume (ERV) was measured as the filtrate volume recovered through Whatman No. 1 filter paper from a homogenate of 25 g of meat and 50 mL of distilled water (Jay, 1964). Instrumental colour was measured with a Hunter Color Lab (MSEZ2022, 4500L, Hunter Associates Laboratory, Reston, VA, USA) on 2 cm-thick slices bloomed for 20 min at 4 °C; L*, a* and b* values (lightness, redness, yellowness) were recorded at three locations per sample. Warner-Bratzler shear force was measured on cooked cylindrical cores (1.5 cm diameter) at a crosshead speed of 2 mm/s using a texture analyser (Model 81031307, G.R. Elect Mfg Co., USA) according to Berry and Stiffler (1981). TBARS was determined by acid distillation according to Tarladgis *et al.* (1960); 10 g of meat was distilled and the malonaldehyde-TBA complex in the distillate was measured at 538 nm against a reagent blank using a UV-Vis spectrophotometer (Genesys 10 UV-Vis, Thermo Scientific, USA). The optical density was multiplied by 7.8 and results were expressed as mg malonaldehyde/kg. Tyrosine value was estimated as mg tyrosine/g sample after TCA extraction and reaction with Folin-Ciocalteu phenol reagent at 730 nm (Strange *et al.,* 1977).

Microbiological Analyses

Samples were prepared as 1:9 (w/v) homogenates in 0.1 % sterile peptone water under aseptic conditions in a horizontal laminar-flow cabinet and serially diluted following the procedure of APHA (2001). Total aerobic plate count (TPC) was determined on Plate Count Agar (HiMedia M091, Mumbai, India) after 48 h of incubation at 37±1 °C; psychrophilic count was determined on the same medium after 12 days of storage at 4±1 °C; coliform count was determined on Violet Red Bile Agar (HiMedia M049A) after 48 h of incubation at 35 °C; and yeast and mould count was determined on Potato Dextrose Agar (HiMedia M096) acidified with 10 % tartaric acid (1 mL/100 mL) and incubated at 20-25 °C for 5 days in an inverted position. Counts were expressed as log_{10} CFU/g.

Sensory Evaluation

Sensory evaluation was conducted by a six-member trained panel comprising faculty and postgraduate students of the Division of Livestock Products Technology, ICAR-IVRI, Izatnagar, using a five-point descriptive scale for general appearance, colour, odour, texture and overall acceptability. Sessions were held in the early evening with drinking water provided between samples for palate cleansing.

Statistical Analysis

The experiment was conducted in three independent trials, each in triplicate, giving n=9 per treatment per day. Data were analysed by two-way ANOVA (treatment × storage day) using SPSS version 25.0 (IBM Corp., Armonk, NY, USA). Treatment means were compared by Duncan's multiple range test at $p < 0.05$ (Snedecor and Cochran, 1994).

Results and Discussion

Sample pH

The initial pH of fresh pork chunks was 5.53 ± 0.01, consistent with the typical ultimate pH range of pork (5.5-5.8) reported by Honikel (1987). The pH increased significantly ($p<0.05$) in all eight treatments during refrigerated storage, with the most pronounced rise between day 5 and day 8 (Table 1). On day 8, control LDPE chunks recorded the highest pH (6.99 ± 0.02), whereas chunks tray-packaged in HDPE wrap with an oxygen scavenger (THDPE) showed the lowest pH (6.16 ± 0.01). The progressive pH rise reflects the formation of basic nitrogenous metabolites such as amides arising from endogenous and microbial enzymatic activity (Sylvestre *et al.,* 2001), and the lower pH of HDPE-packaged samples is consistent with the lower microbial load recorded for this treatment. A similar gradual pH rise has been reported earlier for refrigerated chicken meat (Vaithiyanathan *et al.,* 2011).

Instrumental Colour

Hunter L* (lightness), a* (redness) and b* (yellowness) values for the eight treatments showed significant changes during refrigerated storage. L* values increased and a* and b* values decreased significantly ($p < 0.05$) in all treatments. The increase in L* and the decline in a* and b* are attributable to surface drying and to oxidation of oxymyoglobin to metmyoglobin, with formation of a brown discolouration (Lorenzo and Gómez, 2012; Lavieri and Williams, 2014). The smallest change in colour coordinates was observed for chunks packaged with PVC wrap, attributable to its very low OTR (8-125 $cm^3/m^2/24$ h); HDPE-packaged chunks were the second most colour-stable. LDPE showed the largest increase in L* and LLDPE the largest decline in a*. The presence of an oxygen scavenger improved colour retention within each polymer category, consistent with the role of the scavenger in maintaining residual oxygen at levels favourable for metmyoglobin-reducing activity.

Extract Release Volume and Water Activity

ERV is an inverse indicator of meat spoilage; it declines as hydrolytic activity by endogenous and microbial enzymes increases (Jay, 1964; Reddy *et al.,* 2007). Initial ERV was 33.00 ± 1.15 mL and decreased significantly ($p < 0.05$) in all treatments (Table 1). By day 8 the lowest ERV was observed for control LDPE chunks (14.88 ± 0.27 mL), while THDPE retained an ERV of 28.25 ± 0.11 mL, indicating significantly less proteolytic deterioration. Water activity declined slightly from 0.9974 ± 0.001 on day 0 to 0.9894–0.9948 by day 8 across all treatments, with the smallest reduction observed for HDPE-packaged samples, reflecting the favourable WVTR (7-10 $g/m^2/24$ h) of HDPE relative to LDPE.

Warner-Bratzler Shear Force

Shear force decreased significantly ($p < 0.05$) from an initial value of 3.45 ± 0.15 kg/cm^2 in all treatments during refrigerated storage, reflecting proteolytic disintegration of structural proteins (Table 1). The retention of shear force was greatest for THDPE samples (2.59 ± 0.02 kg/cm^2 on day 8), while CLLDPE recorded the lowest value (1.45 ± 0.21 kg/cm^2). Damaziak *et al.* (2016) reported a comparable decline in shear force in smoked goose meat during refrigerated storage. The relatively higher shear force of HDPE-packaged samples is attributable to lower microbial proteolytic activity rather than to inherent differences in tenderness.

TBARS and Tyrosine Value

TBARS rose significantly ($p < 0.05$) in all treatments throughout the storage period (Table 1) from an initial value of 0.32 ± 0.02 mg MDA/kg. On day 8, control LDPE chunks recorded the highest TBARS (1.39 ± 0.04 mg MDA/kg) and THDPE chunks the lowest (0.64 ± 0.01 mg MDA/kg). TBARS values for

LDPE and LLDPE-packaged samples on day 8 exceeded the commonly cited rancidity threshold of 1.0 mg MDA/kg, while HDPE and PVC samples remained below this threshold. The reduction in TBARS observed in all four oxygen-scavenger treatments relative to their respective controls confirms the role of in-pack oxygen scavenging in retarding lipid oxidation, in agreement with Mexis *et al.* (2012) and Ahmed *et al.* (2017). The superior performance of HDPE samples in spite of its intermediate OTR is most likely the combined consequence of a thicker film (80 µm), better puncture resistance and more effective heat-seal integrity, all of which limit total oxygen ingress over the 8-day storage period.

Tyrosine value rose from 0.45 ± 0.02 mg/g on day 0 to 0.98 ± 0.05 mg/g for CLDPE and 0.48 ± 0.01 mg/g for THDPE on day 8 (Table 1). The increase is attributable to proteolysis by endogenous and microbial enzymes (Strange *et al.,* 1977), and the substantially lower values in HDPE-packaged samples again parallel their lower microbial counts. Similar patterns have been reported for refrigerated meats from other species (Kandeepan and Biswas, 2007).

Microbiological Quality

Total aerobic plate count, coliform, psychrophilic and yeast-mould counts all increased significantly ($p < 0.05$) during storage. Initial TPC was 2.93 ± 0.05 log CFU/g. On day 8, control LDPE chunks recorded 5.88 ± 0.09 log CFU/g and THDPE chunks recorded 4.67 ± 0.05 log CFU/g, the lowest among the eight treatments (Table 2). Adopting 7.0 log CFU/g (ICMSF guidance) as the upper acceptable limit, HDPE-packaged chunks remained microbiologically acceptable up to day 8, while LDPE-, LLDPE- and PVC-packaged chunks were marginal by day 5 and unacceptable by day 8 with respect to yeast and mould load.

Psychrophilic counts increased from 1.99 ± 0.12 log CFU/g on day 0 to 5.24 ± 0.07 log CFU/g (CLDPE) and 3.75 ± 0.09 log CFU/g (THDPE) on day 8 (Table 2). Yeast and mould counts on day 8 were significantly higher in PVC packages (CPVC 5.33 ± 0.15 log CFU/g) than in HDPE packages (THDPE 2.45 ± 0.02 log CFU/g), most likely because the comparatively higher CO_2 retention in PVC creates a favourable substrate for yeasts that utilise CO_2 as a carbon source (Babic *et al.,* 1992). The lower aerobic, psychrophilic and coliform loads in HDPE-packaged samples are consistent with the role of HDPE's barrier performance and the in-pack oxygen scavenger in limiting headspace oxygen and thereby aerobic microbial growth (Huang *et al.,* 2011; Zhang *et al.,* 2012).

Sensory Attributes

Mean sensory scores for general appearance, colour, odour, texture and overall acceptability decreased significantly ($p < 0.05$) in all treatments during refrigerated storage. On day 8, the highest overall acceptability score was recorded for THDPE chunks (3.84 ± 0.02; Table 2), followed by TPVC (3.54 ± 0.01) and CHDPE (3.52 ± 0.01); the lowest score was recorded for CLDPE (2.76 ± 0.01). The improved sensory performance of HDPE samples mirrors their lower TBARS, tyrosine value and microbial load and their higher ERV and shear force. PVC chunks scored well on visual colour but were marginal on odour by day 8, consistent with the elevated yeast and mould load observed for this polymer. Vaithiyanathan *et al.* (2011) and Lavieri and Williams (2014) reported comparable declines in sensory scores for refrigerated chicken and beef, respectively.

Table 1: Selected physico-chemical parameters of fresh pork chunks tray-packaged in polypropylene trays sealed with four wrap films, with and without an iron-based oxygen scavenger, during refrigerated storage for 8 days at 4±1 °C (Mean ± SE, n=9)

Parameter	Days of storage	Packaging treatments							
		CLDPE	TLDPE	CLLDPE	TLLDPE	CHDPE	THDPE	CPVC	TPVC
Sample pH	0	5.53 ± 0.01^{aA}	5.53 ± 0.01^{aA}	5.53 ± 0.01^{aA}	5.53 ± 0.01^{aA}	5.53 ± 0.01^{aA}	5.53 ± 0.01^{aA}	5.53 ± 0.01^{aA}	5.53 ± 0.01^{aA}
	5	6.23 ± 0.02^{fB}	6.18 ± 0.02^{dB}	6.37 ± 0.03^{hB}	6.27 ± 0.03^{gB}	6.04 ± 0.02^{bB}	5.94 ± 0.02^{aB}	6.22 ± 0.04^{eB}	6.17 ± 0.01^{cB}
	8	6.99 ± 0.02^{gC}	6.89 ± 0.02^{dC}	6.94 ± 0.02^{eC}	6.98 ± 0.02^{fC}	6.39 ± 0.01^{bC}	6.16 ± 0.01^{aC}	6.89 ± 0.02^{dC}	6.84 ± 0.02^{cC}
ERV (mL)	0	33.00 ± 1.15^{aC}	33.00 ± 1.15^{aC}	33.00 ± 1.15^{aC}	33.00 ± 1.15^{aC}	33.00 ± 1.15^{aC}	33.00 ± 1.15^{aC}	33.00 ± 1.15^{aC}	33.00 ± 1.15^{aC}
	5	26.08 ± 0.43^{dB}	26.33 ± 0.27^{eB}	24.17 ± 0.30^{aB}	25.54 ± 0.31^{bB}	28.58 ± 0.37^{gB}	30.67 ± 0.24^{hB}	25.67 ± 0.24^{cB}	26.58 ± 0.23^{fB}
	8	14.88 ± 0.27^{aA}	16.56 ± 0.30^{cA}	18.56 ± 0.31^{eA}	19.54 ± 0.37^{fA}	26.00 ± 0.00^{gA}	28.25 ± 0.11^{hA}	15.94 ± 0.23^{bA}	17.84 ± 0.37^{dA}
Shear force (kg/cm^2)	0	3.45 ± 0.15^{aC}	3.45 ± 0.15^{aC}	3.45 ± 0.15^{aC}	3.45 ± 0.15^{aC}	3.45 ± 0.15^{aC}	3.45 ± 0.15^{aC}	3.45 ± 0.15^{aC}	3.45 ± 0.15^{aC}
	5	2.30 ± 0.07^{cB}	2.53 ± 0.07^{fB}	2.11 ± 0.08^{aB}	2.17 ± 0.21^{bB}	2.65 ± 0.07^{gB}	2.80 ± 0.05^{hB}	2.31 ± 0.09^{dB}	2.46 ± 0.10^{eB}
	8	1.54 ± 0.07^{bA}	1.85 ± 0.07^{dA}	1.45 ± 0.21^{aA}	1.66 ± 0.07^{cA}	2.55 ± 0.02^{gA}	2.59 ± 0.02^{hA}	1.89 ± 0.10^{eA}	1.94 ± 0.21^{fA}
TBARS (mg MDA/kg)	0	0.32 ± 0.02^{aA}	0.32 ± 0.02^{aA}	0.32 ± 0.02^{aA}	0.32 ± 0.02^{aA}	0.32 ± 0.02^{aA}	0.32 ± 0.02^{aA}	0.32 ± 0.02^{aA}	0.32 ± 0.02^{aA}
	5	0.63 ± 0.03^{hB}	0.53 ± 0.05^{eB}	0.61 ± 0.06^{gB}	0.54 ± 0.06^{fB}	0.44 ± 0.04^{bB}	0.39 ± 0.04^{aB}	0.51 ± 0.06^{dB}	0.46 ± 0.05^{cB}
	8	1.39 ± 0.04^{hC}	1.11 ± 0.04^{eC}	1.35 ± 0.06^{gC}	1.19 ± 0.06^{fC}	0.76 ± 0.01^{bC}	0.64 ± 0.01^{aC}	0.98 ± 0.06^{dC}	0.85 ± 0.04^{cC}
Tyrosine (mg/g)	0	0.45 ± 0.02^{aA}	0.45 ± 0.02^{aA}	0.45 ± 0.02^{aA}	0.45 ± 0.02^{aA}	0.45 ± 0.02^{aB}	0.45 ± 0.02^{aB}	0.45 ± 0.02^{aA}	0.45 ± 0.02^{aA}
	5	0.53 ± 0.04^{eB}	0.47 ± 0.06^{cB}	0.57 ± 0.06^{gB}	0.54 ± 0.05^{fB}	0.40 ± 0.03^{bA}	0.36 ± 0.03^{aA}	0.51 ± 0.07^{dB}	0.47 ± 0.06^{cB}
	8	0.98 ± 0.05^{gC}	0.85 ± 0.03^{eC}	0.89 ± 0.05^{fC}	0.74 ± 0.03^{dC}	0.59 ± 0.01^{bC}	0.48 ± 0.01^{aC}	0.74 ± 0.03^{dC}	0.68 ± 0.05^{cC}

C = control (no oxygen scavenger); T = oxygen scavenger sachet inside the package.
Means with different superscripts within each row (a,b,c) and within column (A.B,C), differ significantly (p<0.05).

Table 2: Microbiological counts (log_{10} CFU/g) and acceptability scores (5-point descriptive scale) of fresh pork chunks tray-packaged in polypropylene trays sealed with four wrap films, with and without an iron-based oxygen scavenger, during refrigerated storage at 4±1 °C (Mean ± SE, n=9)

Count	Day of Storage	Packaging treatments							
		CLDPE	TLDPE	CLLDPE	TLLDPE	CHDPE	THDPE	CPVC	TPVC
TPC	0	$2.93±0.05^a$	$2.93±0.05^a$	$2.93±0.05^a$	$2.93±0.05^a$	$2.93±0.05^a$	$2.93±0.05^a$	$2.93±0.05^a$	$2.93±0.05^a$
	5	$4.31±0.10^c$	$4.18±0.09^e$	$4.65±0.06^a$	$4.45±0.06^b$	$3.45±0.16^g$	$3.25±0.10^h$	$4.20±0.09^d$	$4.01±0.08^f$
	8	$5.88±0.09^a$	$5.34±0.16^c$	$5.38±0.09^b$	$5.22±0.16^d$	$5.20±0.04^e$	$4.67±0.05^g$	$5.34±0.09^c$	$5.11±0.09^f$
Coliform	0	$1.51±0.06^a$	$1.51±0.06^a$	$1.51±0.06^a$	$1.51±0.06^a$	$1.51±0.06^a$	$1.51±0.06^a$	$1.51±0.06^a$	$1.51±0.06^a$
	5	$2.45±0.08^b$	$2.28±0.07^e$	$2.88±0.08^a$	$2.42±0.07^c$	$1.95±0.03^g$	$1.72±0.02^h$	$2.35±0.07^d$	$2.24±0.08^f$
	8	$3.25±0.09^b$	$3.01±0.08^e$	$3.88±0.09^a$	$3.22±0.08^c$	$2.52±0.03^f$	$2.16±0.01^g$	$3.11±0.08^d$	$3.01±0.09^e$
Psychro-trophic	0	$1.99±0.12^a$	$1.99±0.12^a$	$1.99±0.12^a$	$1.99±0.12^a$	$1.99±0.12^a$	$1.99±0.12^a$	$1.99±0.12^a$	$1.99±0.12^a$
	5	$3.82±0.09^a$	$3.48±0.08^e$	$3.75±0.09^b$	$3.54±0.08^d$	$3.41±0.07^f$	$2.88±0.10^h$	$3.74±0.09^c$	$3.15±0.08^g$
	8	$5.24±0.07^a$	$4.69±0.06^e$	$5.12±0.07^b$	$4.78±0.06^d$	$4.61±0.05^f$	$3.75±0.09^h$	$5.11±0.07^c$	$4.18±0.06^g$
Yeast-mould	0	$1.42±0.08^a$	$1.42±0.08^a$	$1.42±0.08^a$	$1.42±0.08^a$	$1.42±0.08^a$	$1.42±0.08^a$	$1.42±0.08^a$	$1.42±0.08^a$
	5	$2.78±0.16^d$	$2.61±0.12^f$	$2.81±0.16^c$	$2.72±0.12^e$	$2.16±0.05^g$	$1.74±0.05^h$	$3.64±0.12^a$	$3.36±0.12^b$
	8	$4.18±0.24^d$	$3.95±0.15^f$	$4.22±0.24^c$	$4.10±0.15^e$	$3.35±0.02^g$	$2.45±0.02^h$	$5.33±0.15^a$	$4.96±0.15^b$
Acceptabil-ity scores	0	$4.74±0.01^a$	$4.74±0.01^a$	$4.74±0.01^a$	$4.74±0.01^a$	$4.74±0.01^a$	$4.74±0.01^a$	$4.74±0.01^a$	$4.74±0.01^a$
	5	$3.75±0.01^g$	$3.89±0.02^e$	$3.81±0.01^f$	$3.95±0.00^d$	$4.04±0.01^b$	$4.19±0.01^a$	$3.89±0.00^e$	$3.99±0.01^c$
	8	$2.76±0.01^h$	$2.94±0.01^f$	$2.88±0.00^g$	$3.14±0.01^e$	$3.52±0.01^c$	$3.84±0.02^a$	$3.22±0.00^d$	$3.54±0.01^b$

Microbiological counts in log_{10} CFU/g. C=control; T=oxygen scavenger inside the package.
Means with different superscripts within each row (a,b,c) differ significantly ($p<0.05$).

Conclusions

Active tray packaging of fresh deboned pork chunks in food-grade polypropylene trays sealed with HDPE wrap film and containing an iron-based oxygen scavenger maintained acceptable physico-chemical, microbiological and sensory quality at 4±1 °C for 8 days, compared with only 5 days for the same product packed in conventional LDPE pouches. PVC wrap delivered the most stable instrumental colour but was less effective in controlling yeast and mould growth. The HDPE-plus-oxygen-scavenger system therefore represents a feasible, commercially available retail-ready packaging upgrade for fresh pork in organised Indian retail and could be especially useful for tropical markets where extended refrigerated shelf life is essential.

Acknowledgements

The authors gratefully acknowledge the Director, ICAR-IVRI, Izatnagar, India, and the Head, Division of Livestock Products Technology, for providing facilities and resources for this study. The first author thanks the institute for the award of an institutional fellowship during his master's programme.

References

20th Livestock Census (2019). All India Report. Department of Animal Husbandry and Dairying, Ministry of Fisheries, Animal Husbandry and Dairying, Government of India, New Delhi.

Ahmed, I., Lin, H., Zou, L., Brody, A.L., Li, Z., & Qazi, I.M. (2017). A comprehensive review on the application of active packaging technologies to muscle foods. *Food Control, 82,* 163-178.

APHA (2001). *Compendium of Methods for the Microbiological Examination of Foods*. 4th edn. American Public Health Association, Washington, DC, USA.

Babic, I., Hilbert, G., Nguyenthe, C., & Guiraud, J. (1992). The yeast flora of stored ready-to-use carrots and their role in spoilage. *International Journal of Food Science and Technology, 27,* 473-484.

Berry, B.W., & Stiffler, D.M. (1981). Effects of electrical stimulation, boning temperature, formulation and rate of freezing on sensory, cooking, chemical and physical properties of ground beef patties. *Journal of Food Science and Technology, 46*(4), 1103-1106.

Bhardwaj, A., Alam, T., & Talwar, N. (2019). Recent advances in active packaging of agri-food products: A review. *Journal of Postharvest Technolnology,7*(1), 33-62.

Damaziak, K., Riedel, J., Michalczuk, M., Kurek, M.A., Marzec, A., & Wnuk, A. (2016). Effect of marinating on the quality of breast muscles from broiler chickens. *Annals of Animal Science, 16*(3), 887-905.

Dawson, P.L. (2010). Packaging. In: *Poultry Meat Processing*. Eds: Owens, C.M., Alvarado, C. and Sams, A.R., CRC Press, Boca Raton, FL, USA. pp. 101-123.

Dey, A., & Neogi, S. (2019). Oxygen scavengers for food packaging applications: A review. *Trends in Food Science & Technology, 90,* 26-34.

Dhanze, H., Khurana, S.K. an., & Mane, B.G. (2012). Microbiological quality of eggs, chicken and chevon sold in market of Palampur, Himachal Pradesh. *Journal of Veterinary Public Health, 10*(1), 53-55.

Hogan, S.A., & Kerry, J.P. (2008). Smart packaging of meat and poultry products. In: *Smart Packaging Technologies for Fast Moving Consumer Goods*. Eds: Kerry, J.P. & Butler, P., Wiley, Chichester, UK. pp. 33-54.

Honikel, K.O. (1987). Influence of chilling on meat quality attributes of fast glycolysing pork muscles. In: *Evaluation and Control of Meat Quality in Pigs*. Springer, Dordrecht, pp. 273-283.

Huang, X., Zheng, X., Lu, Y., Lu, J., Hu, X., & Wang, J. (2011). Effect of vacuum packaging on the microbiological quality of broiler chicken. *Food Control, 22,* 569-572.

Jay, J.M. (1964). Beef microbial quality determined by extract release volume (ERV). *Food Technology, 18,* 1637-1641.

Kandeepan, G., & Biswas, S. (2007). Effect of low-temperature preservation on quality and shelf-life of buffalo meat. *American Journal of Food Technology, 2*(3), 126-135.

Lambert, A.D., Smith, J.P., & Dodds, K.L. (1991). Shelf-life extension and microbiological safety of fresh meat: A review. *Food Microbiology, 8,* 267-297.

Lavieri, N., & Williams, S.K. (2014). Effects of packaging systems and fat concentrations on microbiology, sensory and physical properties of ground beef stored at 4±1 °C for 25 days. *Meat Science, 97*(4), 534-541.

Lima, D.M., Rangel, A., Urbano, S., Mitzi, G., & Moreno, G.M. (2013). Oxidação lipídica da carne ovina. *Acta Veterinarsca Brasilica, 7*(1), 14-28.

Lorenzo, J.M., & Gómez, M. (2012). Shelf life of fresh foal meat under MAP, overwrap and vacuum packaging conditions. *Meat Science, 92*(4), 610-618.

Mexis, S.F., Chouliara, E., & Kontominas, M.G. (2012). Shelf-life extension of ground chicken meat using an oxygen absorber and a citrus extract. *LWT- Food Science and Technology, 49*(1), 21-27.

Min, B., & Ahn, D.U. (2005). Mechanism of lipid peroxidation in meat and meat products: A review. *Food Science Biotechnology, 14*(1), 152-163.

Reddy, K.J., Reddy, K.P., Krishnaiah, N., & Mahendrakar, N.S. (2007). Microbiological quality of chicken meat sold in retail markets of Tirupati. *Indian Journal of Poultry Science, 42*(3), 286-289.

Snedecor, G.W., & Cochran, W.G. (1994). *Statistical Methods*. 8th edn., Iowa State University Press, Ames, Iowa, USA, pp. 124-130.

Strange, E.D., Benedict, R.C., Smith, J.L., & Swift, C.E. (1977). Evaluation of rapid tests for monitoring alterations in meat quality during storage. *Journal of Food Protection, 40*(12), 843-847.

Sylvestre, M.N., Lessard, M., Cinq-Mars, D., Boulianne, M., & Brodeur, S. (2001). Postmortem changes in the calpain proteolytic system in poultry. *Journal of Anim. Science, 79,* 2399-2408.

Tarladgis, B.G., Watts, B.M., Younathan, M.T., & Dugan, L.R. (1960). A distillation method for the quantitative determination of malonaldehyde in rancid foods. *Journal of American Oil Chemistry Society, 37,* 44-48.

Trout, E.S., Dale, F.G., & Schmidt, G.R. (1992). Characteristics of low-fat ground beef containing texture-modifying ingredients. *Journal Food Science, 57*(1), 19-24.

Vaithiyanathan, S., Naveena, B.M., Muthukumar, M., Girish, P.S. an., & Kondaiah, N. (2011). Effect of dipping in pomegranate fruit juice phenolic solution on the shelf life of chicken meat under refrigerated storage. *Meat Science, 88*(3), 409-414.

Vermeiren, L., Devlieghere, F., van Beest, M., de Kruijf, N., & Debevere, J. (1999). Developments in the active packaging of foods. *Trends in Food Science and Technology, 10*(3), 77-86.

Zhang, X., Tan, J., Ge, X., & Chen, Y. (2012). Effects of vacuum and modified atmosphere packaging on the quality and shelf life of refrigerated pork. *Journal of Food Science and Technology, 49*(5), 619-626.

ANNOUNCEMENT - I

XIII Annual Convention and National Conference of SVSBT-2026

XIII Annual Convention of the Society for Veterinary Sciences & Biotechnology ***(SVSBT)*** and ***National Conference on "Transforming Animal Health, Disease Diagnosis and Sustainable Livestock Production through Genomics, Artificial Intelligence and Biotechnology"*** will be **organized** by the Bihar Veterinary College (BVC), Bihar Animal Sciences University (BASU), **Patna-800014, Bihar, India, during October 6-7, 2026**. The detailed Brochure cum Announcement showing Theme Areas / Sessions, Registration Fee, Bank Details for online payment and deadlines for abstract submission/registration, etc. is floated on the Society's Website (https://www.svsbt.com), Whatsapp groups and individual LMs' e-mails too.

For further details please contact

Dr. Dushyant Yadav
Organizing Secretary, and Assistant Professor, LFC,
Bihar Veterinary College, BASU, Patna-800014, Bihar, India
Mob: +91 9005469909 +91 8299308955
e-mail: svsbt2026@gmail.com dushyantbasu@gmail.com
Co-organizing Secretaries
Dr. Amrita Behera, Assistant Professor, VBC (Mob No. 70080 86783) and
Dr. Manmohan Kumar, Assistant Professor, LFC (Mob No. 82988 87456)
Bihar Veterinary College (BVC), Bihar Animal Sciences University (BASU), **Patna-800014, Bihar, India**