

**NSAP****47th Annual Conference
(JOS 2022)****CONFERENCE
PROCEEDINGS**THEME
**SECURING ANIMAL
AGRICULTURE AMIDST
GLOBAL CHALLENGES****EFFECT OF PAWPAW LEAF EXTRACT ON pH, TEMPERATURE, OXIDATIVE RANCIDITY,
WATER HOLDING CAPACITY OF SPENT LAYERS OF MEAT****Etop, S.C.¹, Oshibanjo D.O.², Amaduruonye, W.³, Nwaoru, C. E.⁴, Oyinlola, O. O.⁶ Pam, B.², Chuhwak,
M. M.², Seizing, D.N² and Benjamin D.⁶**Department of Animal Science, University of Ibadan, Ibadan¹Department of Animal Production, University of Jos, Jos²Department of Animal Breeding and Physiology, Michael Okpara University of Agriculture, Umudike³Department of Agribusiness and Management, Michael Okpara University of Agriculture, Umudike⁴Department of Animal Health and Production, Oyo state College of Agriculture and Technology, Igboora,
Oyo state, Nigeria⁵Nigerian Institute of Leather and Science Technology, Jos Plateau State, Nigeria⁶

Corresponding author's email: samietop@gmail.com;

+234-083-391-4844.

ABSTRACT

This study was conducted to evaluate the Effect of pawpaw leaf extract on pH, temperature, and oxidative rancidity of spent layers of meat. An experiment was carried out on 20 spent layers' hen. The birds were slaughtered following standard procedure, dressed hygienically, and manually deboned. The fresh pawpaw leaf was picked, washed, and blended with distilled water at 0%, 5%/L, 10%/Land 15%/L. The breast, thigh, and drumstick were mainly used. The marinated carcass was kept in the refrigerator at the temperature of 4°C overnight to ensure easy mincing. The results show there was no significant difference ($p > 0.05$) in pH among the treatments. Control without the extract has the highest temperature value of 24.75 °C, with the lowest in 10% and 15% inclusion level of the extract at 23.35 °C. Oxidative rancidity was higher in control with a 0% inclusion level while the lowest value was observed in meat from 15% pawpaw leave extract. Water holding capacity was significantly higher in meat marinated in 15.0% pawpaw leaf extract with the least value in meat marinated in control. The result obtained in the present study showed that pawpaw leaf extract can be used as a natural antioxidant up to 15% inclusion without adverse effects in oxidative rancidity and water holding capacity.

Keywords: Pawpaw leaf extract, pH, temperature, oxidative rancidity, and spent layers of meat

INTRODUCTION

Spent hens after the end of their economic laying cycle, also contribute a significant amount of the meat for domestic consumption. The meat from these birds remains tough and fibrous even after cooking for a long time (Mendiratta, Sharma, Majhi & Kumare, 2011). The use of the spent layer has been limited in scope and it has been a problem to the food industry because of its unacceptable toughness. The toughness associated with the spent layer's meat is primarily due to the increased crosslinking in the connective tissue of older animals. Meat tenderness is considered as the most important palatability attribute of meat and it is the most critical eating quality which determines whether consumers are repeat buyers (Koohmaraie *et al.*, 1987). To improve the tenderness of older and tougher cuts, previous studies have tested different post-mortem treatments. Those include electrical stimulation (Hwang *et al.*, 2003), proteolytic enzymes (Naveena *et al.*, 2004), carcass suspension (Herring *et al.*, 1965), the tender cut method (Ludwig *et al.*, 1997), and blade tenderization (Benito-Delgado *et al.*, 1994) and the injection of various artificial and natural metabolites and/or tenderizers (Morgan *et al.*, 1991) has been conducted. These enzymes can be obtained from plant, bacterial and fungal sources. *Carica papaya* leaves is a good source of this enzyme. Pawpaw (*Carica papaya*) belongs to the family *Caricaceae* with over twenty species but only one member of the genus *Carica* is cultivated as a fruit tree, while the other three genera (*Cyclicomorpha*, *Jarilla* and *Jacaratia*) are grown primarily as ornamentals (Nwinyi & Abikoye, 2010). This study seeks to evaluate the effect of pawpaw leaf extract on pH, temperature, oxidative rancidity and water holding capacity.



NSAP

47th Annual Conference
(JOS 2022)

CONFERENCE PROCEEDINGS

THEME
SECURING ANIMAL
AGRICULTURE AMIDST
GLOBAL CHALLENGES

MATERIALS AND METHODS

Experimental site

This study was carried out in the Animal Products and Processing laboratory of the Department of Animal Production, Faculty of Agriculture, University of Jos, Jos Plateau State.

Procedure

An experiment was carried out on 20 spent layers' hen. The birds were slaughtered following standard procedure, dressed hygienically, and manually deboned. The fresh pawpaw leaf was picked, washed, and blended with distilled water at 0%, 5%/L, 10%/L and 15%/L. The breast, thigh, and drumstick were mainly used. The marinated carcass was kept in the refrigerator at the temperature of 4°C overnight to ensure easy mincing.

Parameters measured

pH: The pH value of raw samples of meat was determined by the method described by AOAC (2000).

Temperature: The temperature was determined using a probe meter as described by AOAC (2000).

Oxidative rancidity: Thiobarbituric acid value (TBA) was estimated by the modified methods of Buege and Aust (1978).

Water holding capacity

Water Holding Capacity (WHC) was determined according to the procedure described by Wardlaw, Maccaskill, & Acton (1973).

Statistical Analysis

The various data were statistically analyzed using one-way ANOVA and multiple t-tests of graph pad prism version 8, with results presented as mean $\pm$ standard deviation. A 95% confidence interval was used to determine the statistical difference between the control and the treated and between groups.

RESULTS

Table 1 shows the effect of pawpaw leaf extract on the pH, temperature, and oxidative rancidity of marinated spent layer meat. The results from the table show there was no significant difference in pH across the treatments which ranges 6.55 – 6.65. Control without the extract had the highest temperature value of 24.75 °C, with the lowest values in meat from 10% and 15% inclusion level of the extract 23.35 °C. Oxidative rancidity value was significantly higher in control with 0% inclusion level with least value in meat from 15% pawpaw leave extract.

Figure 1 shows the Water holding capacity of meat marinated with pawpaw leaf extract

Water holding capacity was significantly higher in meat marinated in 15.0% pawpaw leaf extract with the least value in meat marinated in control.

Table 1: Chemical evaluation of spent layers' meat tender with pawpaw leaf extract

Parameters	Control	5% Pawpaw leaf extract	10% Pawpaw leaf extract	15% Pawpaw leaf extract	SEM
pH	6.55	6.55	6.55	6.65	0.08
Temperature °C	24.05 ^a	23.55 ^b	23.35 ^c	23.35 ^c	0.09
Oxidative rancidity (mg/kg)	4.93 ^a	4.37 ^a	3.11 ^b	3.00 ^b	0.2

^{abc} Means on the same row with different superscripts are significantly different (p<0.05)

SEM= Standard Error mean



NSAP

47th Annual
Conference
(JOS 2022)

CONFERENCE
PROCEEDINGS

THEME
SECURING ANIMAL
AGRICULTURE AMIDST
GLOBAL CHALLENGES

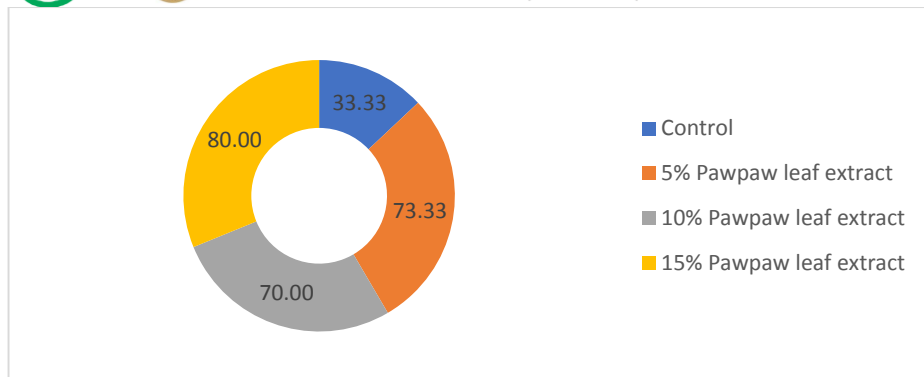


Figure 1: Water holding capacity of meat marinated with pawpaw leaf extract

Discussion

pH is the measurement of the acidity and alkalinity of a material. pH is one of the most important factors affecting other physicochemical and quality parameters such as water holding capacity, tenderness, and juiciness (Ketnawa and Rawdkuen, 2011). The pH values for all treatments ranged from 6.55 to 6.2 (Table 7). No significant difference was observed in pH among treated samples. Naveena *et al.* (2004) reported that treatment of meat patties treated with ginger extract did not alter the pH significantly. Naveena *et al.* (2004), found no significant difference in pH after treatments between control and treatments from buffalo *Biceps femoris* muscle. Due to the protein denaturation at very high and low pH, water holding capacity reduces again (Offer, 1991).

This result indicated that as the inclusion level increased, the temperature decreases. Control without the extract was significantly higher ($p < 0.05$) with a temperature value of 24.75 °C, then T2, T3, and T4 with the lowest in 10% and 15% inclusion level of the extract of 23.35 °C. The result obtained in the present study could be due to the pH. Oxidative rancidity ranges from 4.37 to 2.93 (Table 1) with T3 significantly higher ($p < 0.05$) than T1, T2, and T4. There was no significant difference ($p < 0.05$) between treatment T2 (5%), T4 (15%) and T1 (control). But there was a significant difference among the sample treated with pawpaw leaves extract. The result obtained in the present study could be due to the antioxidant ability possessed by the pawpaw leave extract and the level of pH.

One of the main properties determining the quality of meat is water holding capacity. Water holding capacity is the ability of meat to retain its internal water when an external force is applied on it. Other factors like juiciness, aroma and color are directly related with water-holding capacity (Gokuglu *et al.*, 2017). The water holding capacity values ranged from 33.55 to 80.00 and was increased significantly by marination. This result is in line with the research of Karakaya & Ockerman (2002) reported that the addition of papain, bromelain and ficin increased the water holding capacity of beef as compared to untreated controls. Chan *et al.* (2011) recorded that low and normal pH turkey breast meat showed the same amount of protein denaturation, but low pH meat had lower water holding capacity than normal pH meat. Also Huff-Lonergan & Lonergan (2005) reported that myofibrillar proteins lost the ability to bind water as they are closed to their isoelectric point. Therefore, there could be different reasons for the lower water retention ability of low pH meat instead of protein denaturation (Van Laack & Lane, 2000).

CONCLUSION

The result obtained in the present study showed that pawpaw leaf extract can be used as a natural antioxidant up to 15% inclusion without adverse effect in oxidative rancidity.



NSAP

47th Annual Conference
(JOS 2022)

CONFERENCE PROCEEDINGS

THEME
SECURING ANIMAL
AGRICULTURE AMIDST
GLOBAL CHALLENGES

REFERENCES

- AOAC,(2005). Official Method of Analysis, 15th ed. Virginia, Association of Official nalytical Chemistry International.
- Benito-Delgado J, Marriott, N.G., Claus, J.R., Wang, H and Graham, P.P. (1994). Chuck longissimus and infraspinatus muscle characteristics as affected by rigor state, blade tenderization and calcium chloride injection. *J Food Sci.* ;59:295–299. doi: 10.1111/j.1365-2621.1994.tb06951.x.
- Gokoglu N., P. Yerlikaya, Ucak I. and Yatmaz, H.A. (2016). Effect of bromelain and papain enzymes addition on physicochemical and textural properties of squid (*Loligo vulgaris*), *Journal of Food Measurement and Characterization*, Vol. 11(1), pp. 1-7. Doi: [https:// doi.org/10.1007/s11694-016-9403-3](https://doi.org/10.1007/s11694-016-9403-3).
- Herring H.K., Cassens R and Briskey E.J. (1965). Further studies on bovine muscle tenderness as influenced by carcass position, sarcomere length, and fiber diameter. *J Food Sci.* ;30:1049–1054. doi: 10.1111/j.1365-2621.1965.tb01885.x. [CrossRef] [Google Scholar]
- Hwang, I.H., Devine, C.E., Hopkins, D.L. (2003). The biochemical and physical effects of electrical stimulation on beef and sheep meat tenderness. *Meat Sci.* ;65:677–691. doi: 10.1016/S0309-1740(02)00271-1. [PubMed] [CrossRef] [Google Scholar]
- Karakaya, M. and Ockerman, H. W. (2002). NaCl-K₂HPO₄, Bazi Bitkisel Enzimler ve Yaglarin Sigr Etinin Emulsiyon ve Su Tutma Kapasitesine Etkisi. *Gida* (2002). 27:21-26.
- Ketnawa S., Rawdkuen S. (2011): Application of bromelain extract for muscle foods tenderization. *Food and Nutrition Sciences*, 2, 393.
- Koohmaraie M., Seideman SC, Schollmeyer JE, Dutson TR, Grouse JD. (1987). Effect of postmortem storage on Ca² Dependent proteases, their inhibitor and myofibril fragmentation. *Meat Science* 19:187–196
- Ludwig, C.J., Clans, J.R., Marriott, N.G., Johnson, J. and Wang H. (1997). Skeletal alternation to improve beef longissimus muscle tenderness. *J Anim Sci.* ;75:2404–2410. doi: 10.2527/1997.7592404x.
- Mendiratta SK, G Chauhan, PK Nanda, ASR Anjaneyulu, N Kondaiah & S Devatkal,(2002). Preparation of enrobed chunks from spent hen meat tenderized with papain. *Indian J Poult Sci*, 37: 295-298.
- Morgan, D. L., Claflin, D. R., & Julian, F. J. (1991). Tension as a function of sarcomere length and velocity of shortening in single skeletal muscle fibers of the frob. *Journal of Physiology*, 441, 719–732
- Naveena B.M., S.K. Mendiratta and A.S.R. Anjaneyulu, (2004). Tenderization of buffalo meat using plant proteases from *Cucumis trigonus* Roxb (Kachri) and *Zingiber officinale* roscoe (Ginger rhizome), *Meat Science*, Vol. 68(3), pp. 363-369. Doi: 10.1016/j. meatsci.2004.04.004.
- Nwinyi, O.C. and Abikoye B.A. (2010). Antifungal effects of pawpaw seed extracts and papain on post-harvest *Carica papaya* L. fruit rot. *African Journal of Agricultural Research.*; 5(12):1531-1535.
- Offer, G. (1991). Modeling of the formation of pale, soft and exudative meat: Effects of chilling regime and rate and extent of glycolysis. *Meat Science*. 30:157-184.
- Van Laack, R. L. J. M. and. Lane, J. L (2000). Denaturation of myofibrillar proteins from chicken as affected by pH, temperature, and adenosine triphosphate concentration. *poultry. Science*. 79:105–109.
- Wardlaw, F. B., McCaskill L. H., and Acton J. C. (1973). Effects of postmortem muscle changes on poultry meat loaf properties. *J. Food Sci.* 38:421-423