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Carcass and meat quality of rabbits supplemented camel's foot (*Piliostigma thonningii*) essential oil based diet

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ABSTRACT

This study examined the impact of essential oil from *Piliostigma thonningii* on rabbit carcass features, organ weight and relative weight, and organoleptic aspects. The rabbits were split randomly into three treatment groups, each containing fifteen rabbits, and their body weight was adjusted so that, in a completely random design, the average beginning body weight (BW) of each group was similar at 262.89 ± 22.36 g. Dietary basal control was the first treatment. Two milliliters and four milliliters of PEO per kilogram, respectively, were added to the base control diet in treatments two and three. The proportion of carcass dressing and head weight in T2 and T3 were greater ($P < 0.05$) than in T1. Carcass properties and organoleptic properties were not affected ($P > 0.05$) by treatments. Carcass dressing percentage and head weight were higher ($P < 0.05$) in T2 and T3 than in T1. Fasted live weight, slaughtered and dressed weights increased ($P < 0.05$) with increasing level of PEO supplementation. Carcass forelimb weight, hind limb weight and thorax weight were higher ($P < 0.05$) in T3 than in T2 and T1. Organ and relative organ weights, blood weight, carcass properties and organoleptic properties, were not affected ($P > 0.05$) by treatments. It is concluded that *P. thonningii* essential oil supplementation improved carcass characteristics of the experimental rabbits. However, 4 ml PEO/kg diet is the optimum supplementation level, as it was more effective in enhancing the dressing percentage without affecting the organoleptic properties of the meat.

Keywords: bucks, phytogenics feed supplement, lipid peroxidation, organoleptic properties, organ characteristics.

INTRODUCTION

Rabbit farming in Africa, mainly Nigeria is challenged with multitudinous problems, which have resulted to a gross insufficiency of meat to meet up the increasing population challenge in our country (Anaso 2023a). High temperature (heat) is a critically transcient climatic factor affecting rabbit production in the tropics. Essential oils are significant aromatic properties of plant materials that are gathered, extracted, and isolated, according to Anaso (2023a and 2023b). The word "essential" originated from the *"quinta essentia*" hypothesis, which was first put forth by Paracelsus von Hohenheim in the 16th century. According to him, "this quintessence was the efficient and effective element in a medical preparation." The camel's foot, or *Piliostigma thonningii* Schum. Milne – Rech (*Caesalpiniaceae)*, is a tiny tree with crooked growth and dark brown to black fissured bark that is frequently found in savannahs. Nigerian traditional healers have long utilized *Piliostigma thonningii* to cure dermatosis and malaria. Recent research has revealed that the plant also possesses normal flavoring, antioxidant, insecticidal, and antibacterial qualities.

The current epidermic of antimicrobial resistance challenge and subsequent ban on antibiotic growth promoters by several countries have compelled the search for alternatives of improving animal productivity and minimizing adverse effects on human consumers. Due to this ban, the use of phytogenics as substitute feed additives in animal nutrition has been the subject of much research.

Phytogenic substances such as essential oils are generally regarded as safe and are frequently used in the food and feed industries. The study conducted by Bassiony et al. (2015) assessed the impact of varying concentrations of cinnamaldehyde and thymol as bioactive compounds found in essential oils on growth performance and carcass traits. The findings indicated that dietary treatments did not significantly alter the relative weight of the carcass, digestive tract, abdominal fat, or caecum weight and length. The current impact of EOs, as a phytogenic feed substance, on the carcass and meat quality in livestock is considered vital for the biological activities (Ahmed and Abdallah 2020).

There is no information on the carcass and meat quality of rabbits supplemented *Piliostigma thonningii* essential oil. The study's goals were, therefore, to 1) Evaluate the carcass characteristics of rabbits fed PEO supplemented diet and 2) Determine the organ and relative organ weight of rabbits fed PEO supplemented diet 3) Access the carcass properties and 4) determine the organoleptic/meat properties of PEO supplemented diet.

MATERIALS AND METHODS

Collection of Piliostigma thonningii seeds and extraction of the essential oil

The seeds of *Piliostigma thonningii* were obtained from the southern Guinea savannah agro-ecological zone, namely the Federal Capital Region of Nigeria. a taxonomist from the Forestry Research Institute of Nigeria (FRIN) verified (recognized) at the Department of Biological Science.

The *P. thonningii* seeds were first shade-dried, then ground finely, and then stored at room temperature until the essential oil was extracted. The process of extracting the essential oil involved precisely 100 g of ground, dried sample suspended in 700 ml of distilled water using steam distillation process at 100°C for precisely 3 hours by placing in steel apparatus and allowing the sample to soften and produce the essential oil in vaporized form by heating up after connecting the condenser appropriately. The produced vaporized essential oil droplets mixed with the steam, converged in a cooling system. The essential oil was extracted using the Clevenger apparatus using the method described by Anaso (2023b).

Experimental site

The current experimental research was carried out at the Monogastric Research Unit of the University of Abuja. The project site lies between latitudes 08051' and 09037'N and longitudes 007020' and 007051' E. Annual rainfall ranges from 1,145 – 1,631 mm. The temperature in dry season is between 36 – 42°C and 25.8 – 30.2°C during the raining season. Relative humidity is about 60% during the raining season and 30% during dry season (Itiowe et al 2019).

Ethical Approval

Ethical approval was granted by the Animal Ethics and Conduct Board of the Department of Animal Science University of Abuja, Nigeria following the presentation of the research proposal on the 17th Day of November 2022, with approval registration number 19/501/ANSJ/002. The approval granted before the thesis proceeded and was strictly adhered to and scrutinized to conform with international standards for conducting research on rabbits.

Experimental animals, management and treatment

Forty-five clinically certified healthy post-weaned male Dutch rabbits of about six weeks of age with average initial BW of 262.89 ± 22.36 g was used for the experiment. The rabbits were purchased from a reliable research institute (National Animal Production Research Institute, Ahmadu Bello University, Zaria Nigeria). Two weeks prior to the arrival of the rabbits, the hutches and their immediate surroundings were disinfected with antiseptic (Morigad) and Hypo® (sodium hypochlorite, caustic soda and de-mineralized

water). Following the manufacturer's instructions, the animals were placed in quarantine for a duration of two weeks and received a single preventive medication at the onset of the trial.

Rabbits were housed in separate open sided metabolic hutches which separated faeces from urine. All the rabbits were weighed individually using weighing scale to determine their initial BW. The rabbits were divided into precisely three groups (T1, T2 and T3), with fifteen rabbits per treatment groups. After balancing for body weight, the rabbits in each group were assigned to one of three treatment groups in a completely random design, with their beginning body weights being similar on average.

A basal control diet in Table 1 below was formulated according to NRC (1984) requirements for growing rabbits. Both water and feed were provided *ad libitum* for a period of 12 weeks, while feeding was done twice a day, in the morning at precisely 08:00 hrs and in the evening at precisely 16:00 hrs. Rabbits in the first treatment were fed a basal control diet. In the other treatments, the control diet was supplemented with 2 and 4 mL of PEO/kg of the diet.

Table 1. Ingredient composition (%) of the experimental diet

Ingredient	Quantity
Maize	30.00
Cowpea husk	20.00
Soybean meal	7.00
Corn bran	20.00
Groundnut cake	19.40
Bone meal	2.00
Salt	0.30
Limestone	1.00
Premix	0.30
Total	**100.00**

Carcass characteristics and meat quality evaluation

Carcass evaluation

Following the conclusion of the trial period (12 weeks), In each group, ten rabbits were randomly selected and fasted for about 12 hours, weighed individually, subsequently slaughtered and exsanguinated according to Whittaker (1988) and World Rabbit Science Association (WRSA) recommendations (Blasco and Ouhayoun 1993). Following the initial process,

the slaughtered rabbits were defurred using hot water and then eviscerated. The internal organs which included the intestine, liver, heart, kidney and lung were separated and weighed. Intestine lengths were also measured.

Dressing percentage

The dressing percentage (DP) was determined arithmetically according to Aduku and Olukosi (2000) as:

$$DP\ \% = (\text{Dressed weight/live weight}) \times 100$$

Cooking losses and yield

Each carcass's thigh meat was sliced into equal-sized pieces for each treatment. The next step involved measuring the amount of cooking loss by individually placing identical-sized meat samples inside plastic bags that were placed in boiling water for approximately 20 minutes before being cooled to room temperature. After being removed from the bags, the cooked beef samples were weighed again and dried using filter paper. According to the American Meat Science Association (1995), the percentage loss in the meat's weight divided by its starting weight prior to cooking was used to illustrate cooking loss. The formula for calculating cooking loss is shown below.

$$\text{Cooking loss (\%)} = W1 - W2/W1 \times 100$$

W1 = weight of meat before cooking
W2 = weight of meat after cooking

The cooking yield percentage was obtained by subtracting the cooking loss from 100

$$\text{Cooking yield} = 100 - \%\ \text{cooking loss}$$

Water holding capacity (WHC)

The WHC was established using samples of loin meat. The filter paper press method was employed for this task. Two 9 cm pieces of Whatmann filter paper were used to press about 1 g of meat samples. This was pressed for one minute at an absolute pressure of about 35.2 kg/cm between 10.2 x 10.2 cm plexiglasses. Samples of meat were taken out and let to air dry. According to Moawad et al. (2013), the area of the pressed meat samples was used to estimate the amount of water released from the samples indirectly. The WHC was calculated thus:

$$WHC = 1 - MA/WA \times 100$$

MA= Area of meat sample (cm^2)
WA = Area of water released from meat sample (cm^2).

Sensory evaluation

Meat samples for sensory evaluations were obtained from thigh muscle and boiled to an internal temperature of 72℃. A complete number of 10 trained individuals were used to evaluate the quality of the cooked meat samples. Bite size uniformity across treatments was blind coded. replicated three times and arraigned in an odourless plastic plate. Each sample was assessed on a 9-point Hedonic scale for colour, flavour, aroma, juiciness and tenderness. Cracker biscuits and sachet water was used to cleanse the palate between samples (American Meat Science Association 1995)

Statistical analyses

Data on carcass characteristics and properties were subjected to an analysis of variance with SPSS (24.0) in a fully randomized design. The same software's Duncan multiple range test was performed to assess the significance of the mean difference at the $P \leq 0.05$ level. The statistical model is shown below

$$Yij = \mu + ti + eij$$

Yij = the general response to the specific parameter under investigation,
μ, the general mean peculiar to each observation,
tij = the fixed effect of the dietary treatments (i = 3) on the observed parameters
eij = the random error term for each estimate

RESULTS AND DISCUSSION

Chemical composition of experimental diet

Table 2 shows the chemical composition of experimental diet. The dry matter (DM) was 88.06%, crude protein (CP), 16.54%; ether extract (EE), 2.26%; crude fibre (CF), 13.30%; ash, 9.44%; neutral detergent fibre (NDF), 32.06%; acid detergent fibre (ADF), 18.72%; and organic matter (OM), 90.56%. The generally high DM of the diets is of great importance because it implies less moisture and more nutrients. According to Mowlem (1992), DM is a particular content of the feed that contains the nutrients. The DM was 88.06% fresh matter indicating that the experimental diet had a little above 10% moisture content. This low moisture content is adequate for preventing growth of molds, thereby enhancing the optimal shelf-life of diet.

The CP was within the range of 16 - 17.5% value reported by NRC (1977, 1984) report for growing rabbits. The CP of 16.54% in the current study is also similar to the crude protein requirement of 16% for growing rabbits in small and medium-scale enterprises (Lebas, 2013).

Table 2. Chemical composition of experimental diet

Components	% composition
Dry matter (% fresh material)	88.06
Crude protein	16.54
Ether extract	2.26
Crude fibre	13.30
Ash	9.44
Neutral detergent fibre	32.06
Acid detergent fibre	18.72
Organic matter	90.56
Nitrogen free extract	58.46

Carcass characteristics of rabbits fed Piliostigma thonningii essential oil supplemented diet

Table 3 shows the carcass characteristics of rabbits fed PEO supplemented diet. The fasted live weight varied from 1700.00 to 2156.67 g, slaughtered weight from 1632.27 to 2098.52 g and dressed weight from 1000.00 to 1370.00 g. They all adhered to the same pattern or trend with highest values in T3 and lowest in T1 ($P < 0.05$). Dressing percentage (58.72 – 63.66%) and head weight (61.33 – 87.33 g) were higher and similar ($P < 0.05$) in rabbits supplemented with PEO (T2 and T3). Forelimb weight (60.67 – 94.67 g), hind limb weight (136.00 – 186.00 g) and thorax weight (88.00 – 154.00 g) all adhered to the same pattern with higher values ($P < 0.05$) in T3 than T1 and T2 which had similar values ($P > 0.05$). Blood weight (58.15 – 67.78 g) did not differ ($P > 0.05$) among treatments.

The carcass characteristic differed significantly among treatment groups, proving that PEO supplementation to the experimental animals had no adverse effect on the quality of the carcass. The significantly higher carcass characteristic parameters differed from reports by Elghalid et al (2020) who fed phytogenic feed additives in high and low doses to growing rabbits. Result of the current study was also not in line with the work of El- Gogary et al (2018) who reported that carcass parameters, were not affected significantly in growing rabbits fed Rosemary EO. The significantly obvious effects of PEO on carcass weight are also not in agreement with previous studies in which feeding of phytogenic additives positively affected carcass characteristics and relative organ weights (Hong et al., 2012; Cho et al., 2014; Bassiony et al., 2015; Abdel-Wareth et al., 2018). Additionally, Hernandez et al. (2004) reported no variations in the carcass features of broiler hens fed feed with essential oil extract from thyme, rosemary, cinnamon, oregano, pepper, or

basil. These findings are inconsistent with the found results. When different essential oils were added to broiler diets based on maize and regional cereals, Jamroz et al. (2005) and Cabuk et al. (2006) saw similar outcomes to Hernandez et al. (2004).

Table 3. Carcass characteristics of rabbits fed *Piliostigma thonningii* essential oil supplemented diet

Parameter	T1	T2	T3	SEM
Fasted live weight (g)	1700.00^{c}	1876.67^{b}	2156.67^{a}	59.93
Slaughtered weight (g)	1632.27^{c}	1808.89^{b}	2098.52^{a}	54.70
Blood weight (g)	67.73	67.78	58.15	6.21
Dressed weight (g)	1000.00^{c}	1170.00^{b}	1370.00^{a}	57.44
Dressing percentage (%)	58.72^{b}	62.68^{a}	63.66^{a}	5.74
Head weight (g)	61.33^{b}	78.44^{a}	87.33^{a}	5.22
Forelimb weight (g)	60.67^{b}	75.33^{b}	94.67^{a}	6.73
Hind limb weight (g)	136.00^{b}	150.00^{b}	186.00^{a}	13.24
Thorax weight (g)	88.00^{b}	96.00^{b}	154.00^{a}	21.72

^{abc} *Means with the different superscripts along the row are significantly (P < 0.05) different*
T1, 0 ml/ kg diet PEO; T2, 2 ml kg diet PEO; T3, 4 ml kg diet PEO

However, results from the experiment showed that the majority carcass characteristic parameters were significantly highest in T3 supplemented 4 ml PEO in their diet. Dressing percentage is generally influenced by several factors including the live weight, fat level, age, gender, breed and management system. In the current experimental study, the bioactive components in PEO which enhanced feed palatability, intake, digestibility and growth in T2 and T3 were responsible for the significantly higher dressing percentage. Dressing percentage in economic terms, expresses the weight in which payment is made by the consumer on live weight basis for animal on sale. Similar to results in the current study, Alçiçek et al. (2003), and Zhang et al. (2005) found that birds fed EOs combination extracted from herbs showed significantly higher carcass yields than those fed basal diet. Badr et al. (2013) observed that carcass weight and dressing percentages were higher when growing rabbits were offered natural mixture juice of garlic, onion and lemon in drinking water.

Organ weight and relative organ weight of rabbits fed Piliostigma thonningii essential oil supplemented diet

Table 4 shows the organ weight and relative organ weight of rabbits fed PEO supplemented diet. The values for the liver weight (22.00 – 27.00 g), liver weight/fasted live weight (2.55 – 3.41%), kidney weight (6.66 – 8.00 g), kidney weight/fasted live weight (0.79-0.92%), intestine weight (200.66 – 277.33 g), intestinal weight/fasted live weight (27.71 – 28.80%), heart weight (2.00 – 2.33 g), heart weight/fasted live weight (0.24 – 0.28%), lung weight (7.00 - 9.33 g), lung weight/fasted live weight (0.81 – 1.09%) and intestinal length (310.00 -330.00 cm) did not differ ($P > 0.05$) among treatments.

The carcass internal organ weight and lengths were similar in all treatment groups, indicating that the *P. thoninningi* EO supplementation to the experimental animals had no adverse effect on internal organs. The experimental animals' livers did not exhibit any inflammation or atrophy, as seen by their unchanged liver weight. Atrophy or a decrease in liver weight typically signifies a fatal hepatocellular damage.

Increased or decreased kidney weight could be the outcome of inadequate management. which may indicate microbial infection leading to loss of kidney functions and kidney failure. This provides additional evidence that PEO and its bioactive compounds had no effect on the kidney as it functions in filtration and ultrafiltration while maintaining fluids in the bloodstream.

Weight at the heart was not significantly substantial. along treatments indicating that PEO did not cause cardiomegaly (cardiomyopathy). Cases of abnormal heart weight may be due to mismanagement, nervous and hormonal imbalances causing cellular apoptosis.

Enlargement in the lungs is indicated as hyperinflation caused by poor ventilation, physical agitations and general mismanagement not necessarily influenced phytochemical constituents of the EO. This therefore justifies the non-significance in lung weight of experimental rabbits among treatment groups. Elghalid et al. (2020), Abdel-Wareth et al. (2018), El- Gogary et al. (2018), Cho et al. (2014) and Hong et al. (2012) observed that supplementation of rabbits with several Eos and phytogenics did not affect the percentage of internal organs such as liver, heart, lungs and kidneys of the carcass

The fact that certain bioactive hydrocarbons, such as decane, 1-hexaconasol, and 1-eiconasol, present in the EO had no negative or toxic effect on the internal organs of the experimental animals—which were not shown to be atrophied or enlarged, leading to a decrease in weight or increase—can thus be attributed to the non-significant difference in the organ weight and length.

Table 4. Organ weight and relative organ weight of rabbits fed *Piliostigma thonningii* essential oil supplemented diet

Parameter	T1	T2	T3	SEM
Liver weight (g)	25.00	22.00	27.00	3.97
Liver weight/fasted live weight (%)	3.41	2.55	2.81	0.38
Kidney weight (g)	6.66	8.00	7.33	1.39
Kidney weight/fasted live weight (%)	0.91	0.92	0.79	0.10
Intestinal weight (g)	200.66	229.33	277.33	32.69
Intestinal weight/fasted live weight (%)	27.71	28.36	28.80	2.95
Heart weight (g)	2.00	2.00	2.33	0.27
Heart weight/fasted live weight (%)	0.28	0.24	0.24	0.04
Lung weight (g)	7.00	9.00	9.33	1.08
Lung weight/ fasted live weight (%)	0.81	0.91	1.09	0.18
Intestinal length (cm)	310.00	328.33	330.00	47.10

[abc] Means with the different superscripts along the row are significantly (P < 0.05) different
T1, 0 ml/ kg diet PEO; T2, 2 ml kg diet PEO; T3, 4 ml kg diet PEO

Carcass properties of rabbits fed Piliostigma thonningii essential oil supplemented diet

Table 5 shows the carcass properties of rabbits fed PEO supplemented diet. The water holding capacity (41.06 – 51.00%), pH at 0 hour (6.50 – 6.83), 1 hour (6.33 – 6.56) and 24 hours (5.45 – 5.53), cooking loss (9 – 10 %) and cooking yield (90 – 91 %) for treatment groups supplemented with PEO were statistically similar as compared to the control ($P > 0.05$). The non-significant effect of PEO on the carcass properties among treatment groups indicates that the treatments neither altered nor had adverse effect on the properties of the carcass of the experimental rabbits. The indifferent result for WHC suggests that dietary supplementation of *P. thonningii* EO did not compromise the water holding capacity of the resulting meat as there was no increased portion of water in free form. It is pertinent to say that water loss decreases the meat nutritional worth because some nutrients may escape in the exudate, giving rise to less tender meat.

Table 5. Carcass properties of rabbits fed *Piliostigma thonningii* essential oil supplemented diet

Parameter	T1	T2	T3	SEM
Water holding capacity (%)	41.06	47.23	51.00	7.67
pH at 0 hour	6.50	6.83	6.80	0.3
pH at 1 hour	6.50	6.56	6.33	0.17
pH at 24 hours	5.45	5.46	5.53	0.29
Cooking loss (%)	10.00	9.00	9.00	0.00
Cooking yield (%)	90.00	91.00	91.00	0.00

[abc] Means with the different superscripts along the row are significantly (P < 0.05) different
T1, 0 ml/ kg diet PEO; T2, 2 ml kg diet PEO; T3, 4 ml kg diet PEO

According to Ameha (2006), pH is a crucial factor determining meat quality. The ideal pH is determined 24 hours post-slaughter, using a pH meter. Outstanding meat normally has a pH of 5.4-5.7. The muscle of a living animal has a pH of 7.1. The extent to which pH is reduced after slaughtering depends on the quantity of glycogen in the muscle before death. Rabbit meat stored has a pH of 5.6 to 5.85, showing that rabbit meat has an inferior shelf life compared to other types of meat (Mazmanyan 2020). The pH of the rabbits at 0, 1 and 24 hours was not influenced by the treatment indicating that the bioactive components of PEO had no adverse effect on meat preservation and storage.

The non-significant cooking loss indicates that the physical difference in quantity or weight of meat cut left after boiling, which could be due to moisture loss (shrink) as a result of change in the meat structural integrity, was not affected by PEO supplementation in the diet. Cooking yield is a product of cooking loss. The non-significant result indicates PEO supplementation in the diet had no obvious effect on the available meat and its turnover. It is therefore pertinent to say that PEO and its bioactive components had no effect on the drip loss or purge of the experimental rabbit's meat.

Organoleptic properties of rabbits fed Piliostigma thonningii essential oil supplemented diet

Table 6 shows the organoleptic properties of rabbits fed PEO supplemented diet. Tenderness (6.89 – 7.44), juiciness (6.78 – 7.33), flavour (6.78 – 7.56), colour (7.22 – 7.44) and aroma (6.67 – 6.88) were not ($P > 0.05$) affected by the treatments. The tenderness, juiciness, flavour, colour and aroma of the cooked meat were not altered or adversely affected by the treatments. According to NRC (1976) reports, meat tenderness is a function of

the presence of connective tissue, muscle fibres and the olfactory sensation of structures in the mouth such as the tongue, teeth and the cheeks. The unaffected meat tenderness further agrees with the above factors proving that PEO supplementation had no effect in T2 and T3.

Table 6. Organoleptic properties of rabbits fed *Piliostigma thonningii* essential oil supplemented diet

Parameters	T1	T2	T3	SEM
Tenderness	7.00	6.89	7.44	0.26
Juiciness	6.78	7.00	7.33	0.25
Flavour	6.78	7.56	7.11	0.26
Colour	7.34	7.44	7.22	0.18
Aroma	6.88	6.88	6.67	0.27

[abc] Means with the different superscripts along the row are significantly (P < 0.05) different
T1, 0 ml/ kg diet PEO; T2, 2 ml kg diet PEO; T3, 4 ml kg diet PEO

Lack of treatment effect on meat juiciness can be related to the drip loss (weep or purge) and pH of the meat. Juiciness is based on olfactory sensation during mastication (chewing) and not necessarily a product of management (Lawrie 1966). Cross et al. (1986) reported juiciness of meat to be correlated to its intramuscular lipids and the moisture content. The impression of moisture released during mastication and saliva produced by flavour impression give the feel of juiciness of the meat (Omojola et al., 2003). Xazela et al. (2011) explained that management practices such as diet were likely to have an influence on the flavour and juiciness of meat from domestic animals. Omojola and Adesehinwa (2007) reiterated that the melted lipids constitute a broth in combination with water. This consequently proves that the lower the cooking loss, the juicer the meat. However, both cooking loss and juiciness were not affected significantly in the current study.

Meat flavour impression is mainly a functional interplay of amino acids, peptides, reducing sugars, vitamins and nucleotides. The indifference among treatments can be adduced to the fact that PEO supplementation did not have any significant effect on the general meat structures, which supports the findings of Rivaroli et al. (2016) who fed domestic animals with essential oil blend of oregano, garlic, lemon, rosemary, thyme, eucalyptus and sweet orange and reported no effect on the muscle structure and chemical composition of meat. Miller (2004) reported flavour aromatics of meat to be due to sulphurous and carbonyl containing compounds. Omojola and Adesehinwa (2007) reported flavour impression as a function of cooking loss and the WHC. In this study, however, it can be summarised that PEO dietary supplementation and subsequent boiling of the meat had no significant effect

on the constitution of meat composition, such that it was difficult for the panellist (using sensory organs) to decipher differences in flavour (taste).

The unaffected aroma of meat from experimental rabbits indicates that PEO supplementation of the basal had significantly no major effect the sulphur and nitrogen compounds associated with aroma of cooked (boiled) meat. Ideally, there is little or no aroma in raw (uncooked) meat (Mottram, 1994). Generally, flavour and aroma are two compound features of meat influenced by species, age, fatness and type of tissue, locality, gender, diet and method of preparation (Munchenje et al., 2009). In this study the flavour and aroma were not influenced by treatments proving that the supplementation of P.thonningii EO which possess certain harmful bioactive hydrocarbons such as erucic acid and decane, had no significant effect on the final products to the consumers.

The unaffected meat colour among treatment groups could inexplicably be related to the fact that of the basal diet and management were same among treatment groups. Also, the fact that the meat in the current experiment was cooked only for 20 minutes giving the normal pearly pink colour for improperly cooked meat as described by Showell (2012). The protein myoglobin is referenced as a major determinant of meat colour. After slaughter and dressing processes, oxymyoglobin (product of reaction between myoglobin and atmospheric oxygen) responsible for the meat's pinkish colour formed. However, haemoglobin may also be the reason for meat colour, but is however implicated to an extreme less extent in rabbit meat (Showell, 2012).

CONCLUSION

Under the conditions of the current findings, *P. thonningii* essential oil supplementation enhanced the carcass characteristics, without necessarily disrupting the organoleptic qualities of the meat in rabbits supplemented *P. thonningii.*

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