ผลของการใช้น้ำมันหอมละเหยตระไคร้และน้ำมันหอมละเหยกระดังงา ต่อองค์ประกอบของซากไก่เนื้อภายใต้โรงเรือน ที่เลี้ยงในสภาพอากาศร้อนชื้น

Effect of Lemon grass Essential oil (*Cymbopogon Citratus Stapf*) and Ylang Ylang Essential oil (*Cananga odorata*) application on carcass composition of broilers raised under hot and humid chicken shed

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บทคัดย่อ

การทดลองครั้งนี้มีวัตถุประสงค์เพื่อศึกษาองค์ประกอบของซากและความสามารถในการทนต่อความร้อนของไก่เนื้อลูกผสม 1,280 ตัว (C.P.707) โดยใช้แผนการทดลอง Factorial 2x4x4 ในการทดลองออกแบบสุ่มสมบูรณ์ (CRD) ของน้ำมันหอมระเหยตะไคร้ *(Cymbopogon Citratus Stapf)* และน้ำมันหอมระเหยกระดังงา Ylang Ylang *(Cananga odorata)* เกี่ยวกับองค์ประกอบของซากไก่เนื้อลูกผสมภายใต้โรงเรือนเลี้ยงไก่ในสภาพแวดล้อมที่ร้อนและชื้น โดยการผสมอาหาร - ผสมน้ำมันหอมระเหยแต่ละชนิดลงในอาหารสัตว์ที่ระดับ 0, 0.02, 0.04 และ 0.06% แล้วให้ไก่เนื้อและใช้วิธีการฉีดพ่น – ฉีดพ่นน้ำมันหอมระเหยแต่ละชนิดที่ระดับเดียวกันกับผสมในอาหาร ฉีดพ่นให้กับไก่เนื้อเป็นเวลา 1 นาทีในแต่ละวัน เปิดอัตโนมัติเวลา 14.00 น. ดำเนินการศึกษาที่ วิทยาลัยเกษตรและเทคโนโลยีชัยนาท จังหวัดชัยนาท ประเทศไทย จะเห็นได้ว่าอุณหภูมิ

คำสำคัญ: ไก่เนื้อ น้ำมันหอมละเหยตะไคร้ น้ำมันหอมละเหยกระดังงา คุณภาพซาก สภาพอากาศร้อนชื้น

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ภายนอกจาก Black globe (BG_{Ext}, 41.24±5.19 °C) สูงกว่าอุณหภูมิภายในจาก Black globe (BG_{Int}, 34.41±3.48 °C) อย่างมีนัยสำคัญทางสถิติที่ระดับ (P<0.01) แสดงให้เห็นถึงผลกระทบของรังสีดวงอาทิตย์ต่ออุณหภูมิแวดล้อม และพบว่าสหสัมพันธ์ระหว่างพารามิเตอร์ทางสรีรวิทยาของไก่เนื้อที่ได้รับน้ำมันหอมระเหย (EO_s) และอัตราที่ผสมในอาหาร (M) มีนัยสำคัญทางสถิติที่ระดับ {RT (P<0.01), SknT12 (P<0.01) และ SknT14 (P<0.05)}. จะเห็นได้ว่ากลุ่มไก่เนื้อที่ได้รับ EO_s ของตะไคร้ (E_{LG}) มีน้ำหนักซาก หัวใจ ตับอ่อน และม้ามมีน้ำหนักเพิ่มขึ้นอย่างมีนัยสำคัญทางสถิติที่ระดับ {(P<0.05), (P<0.05), (P<0.05) และ (P< 0.05) ตามลำดับ} มากกว่าที่ได้รับ EO_sของกระดังงา(E_{YL}). เมื่อเปรียบเทียบกับผลของการฉีดพ่น (S) EO_s ลงบนไก่เนื้อ พบว่าน้ำหนักหัวใจ (g.) ของไก่เนื้อที่ได้รับสเปรย์ความเข้มข้น 0.04% (S_3, 13.69 ± 1.05) สูงกว่าที่ได้รับสเปรย์ความเข้มข้น 0.06% (S_4, 10.69 ± 0.73) อย่างมีนัยสำคัญทางสถิติที่ระดับ (P<0.05) ทั้งน้ำหนักหัวใจของ (S_3) และ (S_4) ไม่แตกต่างกันทางสถิติกับน้ำหนักหัวใจที่ 0% (S_1) และ 0.02% (S_2) แม้ว่าน้ำหนักตับของ (S_2, 66.56 ± 2.53) จะสูงกว่าน้ำหนักตับของ (S_4, 55.94 ± 2.25) อย่างมีนัยสำคัญทางสถิติ (P<0.01) แต่ทั้งการฉีดพ่น EO_s ที่ระดับ (S_4) และ (S_2) มีค่าไม่แตกต่างจากระดับ (S_1) และ(S_2) อย่างมีนัยสำคัญทางสถิติ สรุปได้ว่าการใช้ตะไคร้และกระดังงาด้วยน้ำมันหอมระเหย (EOs) ไม่ได้เพิ่มความสามารถในการทนต่อความร้อนของไก่เนื้อที่เลี้ยงในสภาพอากาศที่ร้อนชื้น แต่พบว่าสามารถเพิ่มน้ำหนักที่เกี่ยวข้องกับองค์ประกอบของซากของไก่เนื้อได้อย่างมีนัยสำคัญทางสถิติ (P<0.05)

คำสำคัญ: ไก่เนื้อ น้ำมันหอมละเหยตะไคร้ น้ำมันหอมละเหยกระดังงา คุณภาพซาก สภาพอากาศร้อนชื้น

Abstract

The objective were to measure carcass composition and heat tolerating ability of 1,280 hybrid broilers (C.P.707) which were used in Factorial 2x4x4 in a completely randomized design (CRD) of Lemon grass Essential oil (*Cymbopogon Citratus Stapf*) and Ylang Ylang Essential oil (*Cananga odorata*) on the carcass composition of hybrid broilers under the chicken house in a hot and humid environment. Feed mixing - each essential oil type was mixed into feed at 0, 0.02, 0.04 and 0.06% and fed to the broilers and/or spraying - each essential oil at the same level was sprayed on the broilers for 1 minute each day, turned on automatically at 14:00 p.m. daily. The study was carried out at Chainat College of Agriculture and Technology, Chainat Province, Thailand. It can be seen that the black globe external temperatures ($BG_{Ext,}$ 41.24±5.19 °C) were significantly (P<0.01) higher than the black globe internal temperatures (BG_{Int}, 34.41±3.48 °C). The results demonstrate the effect of solar radiation on ambient temperature and there are significant interactions between physiological parameters {RT (P<0.01), $SknT_{12}$ (P<0.01) and $SknT_{14}$ (P<0.05)} of Essential oils (EOs) and Mixing rate (M).Broiler groups that received lemon grass (E_{LG}) EOs had carcass, heart , pancreas and spleen weights that were significantly higher {(P<0.05), (P<0.05), (P<0.01) and (P<0.01), respectively} than received ylang-ylang (E_{YL}) EOs. In relation to the effects of spraying (S) EOs onto the broilers, it was found that the weight (g.) of the hearts of the broilers receiving 0.04% (S_3, 13.69 ± 1.05) concentration spray was significantly (P<0.05) higher than those that received

0.06% (S_4, 10.69 ± 0.73) concentration spray. Both heart weights of (S_3) and (S_4) were not statistically different from the heart weights of 0% (S_1) and 0.02% (S_2). While the liver weight of (S_2, 66.56 ± 2.53) was significantly ($P<0.01$) higher than that of (S_4, 55.94 ± 2.25), both (S_4) and (S_2) were not significantly different from (S_1) and (S_2). It was concluded that administration of lemon grass and ylang-ylang via Essential Oils (EOs) did not enhance the heat tolerating ability of broilers raised in a hot-wet environment. However, it was found that the weight related to the carcass composition of broiler was significantly increased ($P< 0.05$).

Keywords: broilers, lemon grass essential oil, ylang-ylang essential oil, carcass composition, hot-humid environment.

Introduction

Heat stress causes animals, including broiler chickens, to lower their performance (Hansen, 1994; Chaiyabutr, 2004; Khongdee et al., 2006, 2010; Vajrabukka, 1992), resulting in reduced growth, reproduction and immunity (Bartlett and Smith, 2003).

Essential oils (EOs) have been used (Collington et al., 1990; Khan et al., 2007) not only to stimulate growth and feed efficiency, but also to improve the health and performance of birds (Scott et al., 1982; Fadlalla et al., 2010; Abouelfetouh et al., 2012; Tiwari et al., 2018). In the past, several antibiotic growth promoters have also been used in poultry feed, with the aim of preventing disease and improving growth performance.

Work conducted by researchers to explore the nature and use of EOs in poultry nutrition has had varied results. The EOs and their compounds have proved their in-vitro efficacy as antimicrobial, hypolipidemic, immunomodulating and anti-inflammatory agents; however, the toxicological effects are observed only at higher inclusion levels. The antioxidant property of these oils also reduces loss in meat processing plants. In this context, it is therefore beneficial to extensively examine the chemical properties and biological activities of these compounds.

The efficacy of EOs application on animals depends on many factors. In general, EOs have positive effects, but knowledge surrounding their use in poultry nutrition is still insufficient. While Adaszyńska-Skwirzyńska and Szczerbińska (2017) reviewed the above properties of essential oils extensively in “Use of essential oils in broiler chicken production”, there is still demand for further research. This includes research to clarify EOs’ mode of action, the exact supplementation applied, and how these might interact with feed ingredients to produce the desired effects.

Any resulting beneficial effect of EOs in relation to animals would be indicated by improvements in the carcass composition of the subjects. Therefore, in this experiment, the application on carcass composition of broilers receiving lemon grass EOs were compared to that of broilers receiving ylang-ylang EOs, while being raised in hot humid conditions.

Materials and Methods

Permission from Nakornsawan Rajabat University Anti animal cruelty was obtained where the experiment was designed but was carried out at Chainat College of Agriculture and Technology, Chainat Province, Thailand (Lat. 15^{O} 16.8222 N.; Long.. 100^{O} 10.6332 E., 22 m ASL).

Animals: 1,280 broilers of mixed sex were used in the present study. They were kept in an open shed which was divided into sections. Therefore there were 2x4x4 Treatments. Each treatment was replicated, thus there were 32x2 = 64 experimental units, with each unit comprising 20 chicks (Figure 1) {Steel and Torrie, 1980; in a completely randomized design (CRD)}

. **Animal house**: Dry and Wet Bulb Thermometers {Ters Electronic, Shenzhen, Guangdong, China (Mainland)} and Black Globe Thermometers (Somparn, 2004) were placed at regular intervals, both externally and internally to the animal house, at 150 cm. above the floor. The meteorological parameters were taken daily at 08:00, 14:00 and 17:00 throughout the experiment.

Ten broilers from each treatment group were randomly measured by taking rectal and skin temperatures when at the ages of 15, 30, 37 and 45 days old, using Clinical thermometer {Ters Electronic, Shenzhen, Guangdong, China (Mainland)} and Infrared thermometer (Infrared Thermometer Model ST-660, Sentry Optronics Corps., China), respectively.

Design of the experiment:

1,280 mixed sex one day old chicks were used in this Factorial 2x4x4 in a completely randomized design (CRD) experiment (Steel and Torrie, 1980) with the following treatment components:

- Factor A – consisted of two types of EOs, (E_{LG}) namely Lemon Grass (*Cymbopogon Citratus Stapf*) (a1), (E_{YL}) namely Ylang Ylang Grass (*Cananga odorata*) (a2).
- Factor B – each essential oil type was mixed into feed at 0(b0), 0.02(b1), 0.04(b2) and 0.06%(b3) and given to the broilers.
- Factor C – each Factor B mixture was respectively combined with water and then sprayed onto the broilers at 4 levels, namely 0(c0), 0.02(c1), 0.04(c2) and 0.06%(c3).

Therefore there were 2x4x4 Treatments. Each treatment was replicated, thus there were 32x2 = 64 experimental units, with each unit comprising 20 chicks.

A	B	C			
		c_0	c_1	c_2	c_3
a_1	b_0	a_1 b_0 c_0 (T_1)	a_1 b_0 c_1 (T_2)	a_1 b_0 c_2 (T_3)	a_1 b_0 c_3 (T_4)
	b_1	a_1 b_1 c_0 (T_5)	a_1 b_1 c_1 (T_6)	a_1 b_1 c_2 (T_7)	a_1 b_1 c_3 (T_8)
	b_2	a_1 b_2 c_0 (T_9)	a_1 b_2 c_1 (T_{10})	a_1 b_2 c_2 (T_{11})	a_1 b_2 c_3 (T_{12})
	b_3	a_1 b_3 c_0 (T_{13})	a_1 b_3 c_1 (T_{14})	a_1 b_3 c_2 (T_{15})	a_1 b_3 c_3 (T_{16})
a_2	b_0	a_2 b_0 c_0 (T_{17})	a_2 b_0 c_1 (T_{18})	a_2 b_0 c_2 (T_{19})	a_2 b_0 c_3 (T_{20})
	b_1	a_2 b_1 c_0 (T_{21})	a_2 b_1 c_1 (T_{22})	a_2 b_1 c_2 (T_{23})	a_2 b_1 c_3 (T_{24})
	b_2	a_2 b_2 c_0 (T_{25})	a_2 b_2 c_1 (T_{26})	a_2 b_2 c_2 (T_{27})	a_2 b_2 c_3 (T_{28})
	b_3	a_2 b_3 c_0 (T_{29})	a_2 b_3 c_1 (T_{30})	a_2 b_3 c_2 (T_{31})	a_2 b_3 c_3 (T_{32})

Figure 1. Design of the present experiment.

Analysis: SAS Version 9.0 (SAS Institute Inc., 1999). Values obtained were shown as means ± std and P-value.

The experiment was performed at Chainat College of Agriculture and Technology, Chainat province (Lat. 15^{O} 16.8222 N.; Long.. 100^{O} 10.6332 E., 22 m ASL). Meteorological data was recorded 1st April – 30th June 2011 inclusive. The 1-day old chicks were placed in the animal house on 20th April 2011, and the experiment ended on 5th June 2011 when the broilers reached 45 days of age.

Essential oil from lemon grass and ylang-ylang was extracted via steam distillation (Božović et al., 2017) and then added to distilled water and ethanol (50% v/v ethanol-water) at 0, 0.02, 0.04 and 0.06%. The EOs were then administered as follows:

- Feed mixing - Each essential oil was added to feed (daily preparation)
- Spraying - Each essential oil was added to water and then sprayed on the broilers for 1 minute each day
    - The sprays were turned on automatically at 14:00 p.m. daily.
    - At 30 seconds prior switching on sprays, all fans were turned off. The fans were turned on again at 15 minutes post-spraying.

Results and Discussion

Results of the environmental temperatures black globe (BG) and ambient temperature (AT), measured both internally (BG_{Int}) and externally (BG_{Ext}) to the shed where the broilers were raised, are shown in Table 1 and Figure 2.

Table 1 Mean ± std. (°C) of black globe (BG) and ambient temperatures (AT) of the shed that housed the broilers at 08:00 a.m., 14:00 and 17:00 p.m.

Black globe temp (°C)	8:00 a.m.	14:00 p.m.	17:00 p.m.
Internal Shed	30.50±3.32	34.41±3.48^{y}	25.90±14.00
External Shed	32.00±3.49	41.24±5.19^{x}	25.33±13.95
Ambient temp (°C)	**8:00 a.m.**	**14:00 p.m.**	**17:00 p.m.**
Internal Shed	29.71±3.38	33.53±1.94	31.71±2.16
External Shed	29.93±4.38	33.71±2.59	31.64±2.84

x, y – Means within column with different superscripts are significantly different (P<0.01).

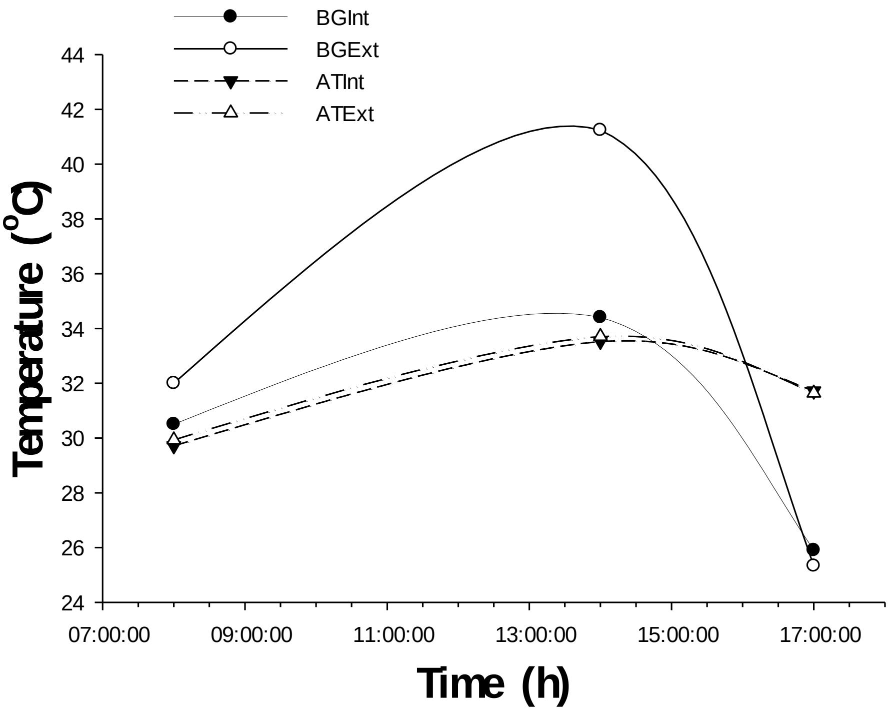

Figure 2. Curves of black globe and ambient temperatures (°C; internal and external, respectively) measured at the shed that housed the broilers at 08:00 a.m., 14:00 and 17:00 p.m.

From Figure 2. It can be seen that the black globe external temperatures (BG_{Ext}, 41.24±5.19 °C) were significantly (P<0.01) higher than the black globe internal temperatures (BG_{Int}, 34.41±3.48 °C). The results demonstrate the effect of solar radiation on ambient temperature.

Generally, broilers have a thermoneutral zone (TNZ) range of between 18-35 °C. (Sturkie, 1965; Freeman, 1968; Ewing et al., 1999; Macari et al., 2002; Avila, 2004), with the normal body temperature of a broiler ranging between 41-42°C (Donkoh, 1989). When the environmental temperature is above the TNZ, it induces broilers to heat stress (Cooper and Washburn, 1998).

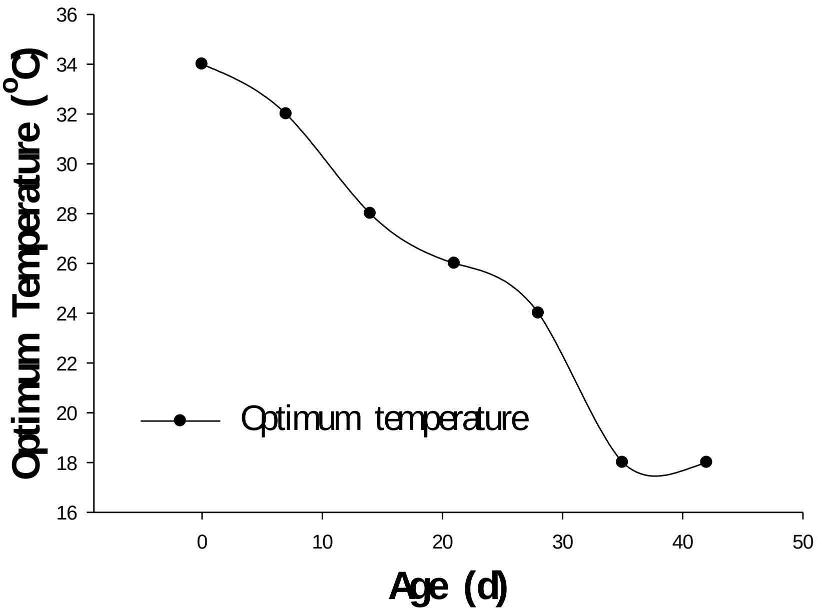

Figure 3. Optimum temperature (°C) for broiler chicken of different ages.
Adapted from Freeman (1968); Macari et al. (2002); Avila (2004).

From Figure 3. It can be seen that younger chicks have a higher optimum temperature than older chicks (Freeman (1968); Macari et al. (2002); Avila (2004), and therefore older broilers tolerate heat less than young broilers (Fairchild, 2019).The results of rectal and skin temperatures is shown in Table 2.

From Table 2. It can be seen that the RT of the broiler was not higher than 41 °C {normal body temperature of a broiler ranging between 41-42°C (Donkoh, 1989)}. and the Ambient temp (°C) (AT_{Int}) at 14:00 p.m.was 33.53±1.94 °C – the broilers were therefore not heat stressed by their surroundings. Thus, it could be concluded that any variations, including those relating to carcass and internal organ weights, that might occur were not due to heat stress and may be largely due to the application of EOs.

From Table 2. It can be seen that there were no significant differences in rectal temperature nor skin temperatures measured at 12:00 ($SknT_{12}$) or 14:00 p.m. ($SknT_{14}$) in relation to broilers that were receiving lemon grass essential oil versus ylang-ylang essential oil

Table 2. Rectal (RT), Skin temperatures Time 12:00 (SkT12) and Skin temperatures Time 14:00 (SkT14) of broilers given two different essential oils at four levels of concentration and under 4 different spraying regimes.

E	RT	SkT12	SkT14
E1 ± SEM	40.57 ± 0.07	36.16 ± 0.09	36.35 ± 0.09
E2 ± SEM	40.54 ± 0.07	36.28 ± 0.09	36.55 ± 0.10
M1 ± SEM	40.55 ± 0.11^{xy}	36.46 ± 0.10^{x}	36.62 ± 0.12
M2 ± SEM	40.40 ± 0.08^{y}	36.20 ± 0.14^{xy}	36.29 ± 0.14
M3 ± SEM	40.51 ± 0.07^{xy}	35.93 ± 0.13^{y}	36.31 ± 0.13
M4 ± SEM	40.76 ± 0.11^{x}	36.27 ± 0.11^{xy}	36.58 ± 0.14
S1 ± SEM	40.50 ± 0.11	36.20 ± 0.17	36.46 ± 0.16
S2 ± SEM	40.63 ± 0.09	36.28 ± 0.10	36.56 ± 0.13
S3 ± SEM	40.59 ± 0.10	36.24 ± 0.10	36.51 ± 0.13
S4 ± SEM	40.50 ± 0.09	36.15 ± 0.14	36.28 ± 0.12
E x M	P<0.01	P<0.01	P<0.05
E x S	N.S.	N.S.	N.S.
M x S	N.S.	N.S.	N.S.
E x M x S	N.S.	N.S.	N.S.

Superscripts x, y – **Means within column with** different superscripts were significantly difference at 1% (p<0.01).
Note: E – Essential oil E1 = Lemon grass essential oil, E2 = Ylang Ylang essential oil
M – Mixing rate M1 = 0, M2 = 0.02, M3 = 0.04, M4 = 0.06%
S – Spraying rate S1 = 0, S2 = 0.02, S3 = 0.04, S4 = 0.06%

In relation to the feed mixing (M) method for administering the EOs, the results (Table 2.) revealed that, when the EOs were mixed into feed at four different concentrations, there were highly significant differences (P<0.01) in both rectal (RT) 40.76 ± 0.11 and skin temperature measured at 12:00 (noon, SkT_{12}) 36.46 ± 0.10. The results showed that at a concentration of 0.06% (M_4) the RT was significantly higher (P<0.01) than when applied at a concentration of 0.02% (M_2). The other levels of concentration, that is 0 (M_1) and 0.04% (M_3) concentration, did not differ from the 0.02 (M_2) and 0.06% (M_4) concentration.

Furthermore, the broilers' skin temperature measured at noon ($SknT_{12}$) when administered at 0% (M_1, 36.46 ± 0.10) was significantly higher (P<0.01) than when given at 0.04% (M_3, 35.93 ± 0.13). The other levels of concentration – that is, 0.02 (M_2) and 0.04% (M_3) concentration, were not different from the 0 (M_1) and 0.06% (M_4) concentration.

Since, results (Table 2.) show that there are significant interactions between physiological parameters {RT (P<0.01), $SknT_{12}$ (P<0.01) and $SknT_{14}$ (P<0.05)} of Essential oils (EOs) and Mixing rate (M). Therefore, (M) variation has effects on the physiological parameters of the chicken. The effects is especially for RT is still within the thermo neutral zone.

Carcass, heart, liver, pancreas, gizzard, small intestine and spleen weight of the broilers that received two different essential oils at four levels of concentration via 4 different spraying regimes are shown in Table 3.

Table 3. Carcass, heart, liver, pancreas, gizzard, small intestine and spleen weight of the broilers receiving two different essential oils at four levels of concentration via 4 different spraying regimes.

E	Carcass (kg.)	Heart (g.)	Liver (g.)	Pancreas (g.)	Gizzard (g.)	Small Intestine (g.)	Spleen (g.)
E1 ± SEM	1.984 ± 0.035^{a}	13.31 ± 0.63^{a}	61.25 ± 1.71	8.91 ± 0.36^{x}	51.72 ± 3.20	155.78 ± 6.60	7.71 ± 0.63^{x}
E2 ± SEM	1.859 ± 0.045^{b}	10.97 ± 0.62^{b}	59.72 ± 2.17	6.56 ± 0.45^{y}	52.19 ± 2.23	167.41 ± 6.06	5.16 ± 0.34^{y}
M1 ± SEM	1.956 ± 0.045	11.13 ± 0.90^{b}	64.06 ± 3.51	8.19 ± 0.61	50.94 ± 5.09	151.38 ± 8.69	7.75 ± 0.63^{a}
M2 ± SEM	1.925 ± 0.038	14.06 ± 1.22^{a}	59.06 ± 2.25	8.25 ± 0.64	47.19 ± 2.62	167.81 ± 9.49	6.50 ± 1.03^{ab}
M3 ± SEM	1.956 ± 0.090	11.81 ± 0.82^{ab}	60.38 ± 2.69	7.69 ± 0.71	52.50 ± 3.74	171.25 ± 11.63	6.44 ± 0.76^{ab}
M4 ± SEM	1.850 ± 0.049	11.56 ± 0.56^{ab}	58.44 ± 2.40	6.81 ± 0.61	57.19 ± 3.56	155.94 ± 4.75	5.05 ± 0.55^{b}
S1 ± SEM	1.913 ± 0.051	11.06 ± 0.79^{ab}	57.88 ± 1.95^{xy}	7.94 ± 0.61	52.19 ± 3.23	159.50 ± 8.85	6.38 ± 0.67^{ab}
S2 ± SEM	2.000 ± 0.058	13.13 ± 0.96^{ab}	66.56 ± 2.53^{x}	8.25 ± 0.66	55.94 ± 3.91	171.56 ± 10.79	7.00 ± 0.7^{ab}
S3 ± SEM	1.944 ± 0.050	13.69 ± 1.05^{a}	61.56 ± 3.47^{xy}	7.13 ± 0.60	47.50 ± 3.59	165.31 ± 7.17	7.50 ± 1.02^{a}
S4 ± SEM	1.831 ± 0.072	10.69 ± 0.73^{b}	55.94 ± 2.25^{y}	7.63 ± 0.72	52.19 ± 4.68	150.00 ± 8.85	4.86 ± 0.58^{b}
E x M	N.S.	N.S.	P<0.05	N.S.	P<0.05	N.S.	N.S.
E x S	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.
M x S	P<0.05	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.
E x M x S	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.

Superscripts a, b – **Means within column with** different superscripts were significantly difference at 5% (p<0.05).

Superscripts x, y – **Means within column with** different superscripts were significantly difference at 1% (p<0.01).

Note: E – Essential oil E1 = Lemon grass essential oil, E2 = Ylang Ylang essential oil

M – Mixing rate M1 = 0, M2 = 0.02, M3 = 0.04, M4 = 0.06%

S – Spraying rate S1 = 0, S2 = 0.02, S3 = 0.04, S4 = 0.06%

From Table 3. It can be seen that broiler groups that received lemon grass (E_{LG}) EOs had carcass, heart , pancreas and spleen weights that were significantly higher {(P<0.05), (P<0.05), (P<0.01) and (P<0.01), respectively} than those that received ylang-ylang (E_{YL}) EOs.

When the broilers received the essential oils with different concentrations, the results (Table 3) revealed that heart weight (g.) of received 0.02% in feed (M_2, 14.06 ± 1.22) was significantly (P<0.05) higher than those that received 0% (M_1, 11.13 ± 0.90). Moreover, heart weight (g.) of both (M_1) and (M_2) were not significantly (P>0.05) different from (M_3) and (M_4).

The results (Table 3) showed that spleen weight (g.) of (M_1, 7.75 ± 0.63) was significantly (P<0.05) higher than (M_4, 5.05 ± 0.55). The spleen weight of both (M_1) and (M_4) were not different from the spleen weights of both (M_2) and (M_3).

In relation to the effects of spraying (S) EOs onto the broilers, it was found that the weight (g.) of the hearts of the broilers receiving 0.04% (S_3, 13.69 ± 1.05) concentration spray was significantly (P<0.05) higher than those that received 0.06% (S_4, 10.69 ± 0.73) concentration spray. Both heart weights of (S_3) and (S_4) were not statistically different from the heart weights of 0% (S_1) and 0.02% (S_2). While the liver weight of (S_2, 66.56 ± 2.53) was significantly (P<0.01) higher than that of (S_4, 55.94 ± 2.25), both (S_4) and (S_2) were not significantly different from (S_1) and (S_2).

Furthermore there was significant interaction between Essential oils (S) and Feed mixing (M) concentration for both liver (P<0.05) and gizzard (P<0.05) weights. The significant interactions (P<0.05) between (M) and (S) was also found in relation to carcass weight.

The results revealed the broilers that received lemon grass EOs yielded heavier carcass, heart, pancreas and spleen weights than those that were administered ylang-ylang EOs.

Conclusion

The essential oils cannot enhance heat tolerating ability of the broilers used in the present study. However, it was found that the weight related to the carcass composition of broiler was significantly increased (P< 0.05). Further experiment may be designed to investigate into other factors that influenced the different liveweights of the broiler that received EOs from lemon grass or ylang-ylang.

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