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Fatty Acid Content and Carcass Quality of Broiler Chicken Fed Diet Formulated With Saturated and Unsaturated Oils

Uchewa, E. N.
Ebonyi State University, P. M. B. 53 Abakaliki, Nigeria.
Email: euchewa@yahoo.co.uk

Abstract – **Twelve (12) weeks feeding trial was conducted to determine the effect of fatty acid content/total lipid and carcass characteristics/organoleptic qualities of broiler fed diets supplemented with dietary fat sources at levels of 5% saturated and 5% unsaturated. Three experimental diets identified as T_1, T_2 and T_3 were formulated, the control diet T_1 was with 0% fat, T_2 contained palm oil at 5% inclusion and T_3 contained 5% groundnut oil respectively. Feed and water was provided ad-Libitum. Hundred and twenty (120) day old Anak Strain broiler chicks were randomly distributed into three (3) experimental diets in a completely randomized design (CRD). Each treatment group was replicated into four with thirty birds per replicate. The result indicated that the different dietary treatments has effect on Total cholesterol, triglycerides, high-density-lipoprotein and low density lipoprotein ($P>0.05$) except T_3 that had high-density- lipoprotein which reduces total cholesterol. However, addition of dietary fats increased the total cholesterol, Triglycerides and low-density-lipoprotein in T_2 of the experiment ($p>0.05$). Chicks fed diet with supplemented fat sources had the most body live weight and no significant differences were observed in meat tenderness, juiciness and flavour ($p>0.05$). There were significant differences between carcass characteristics (except for abdominal fat pad) due to dietary treatment ($p>0.05$) and levels of inclusions. Based on the result of this study/research; it is recommended that 5% inclusion or more of unsaturated fat source (groundnut oil) be used as supplement in meal of broiler diets.**

Keywords – **Saturated, Unsaturated, Oil, Fatty Acid and Total Lipid.**

I. Introduction

Organoleptic characteristics or properties are the trait that influence the consumer to regularly purchase and eat meat. Nutritional value concerns the chemical composition of the meat and its suitability for human consumption. Although, many factors can influence meat quality, this research work is only concerned with the nutritional and eating qualities of meat, particularly broilers. It attempts to examine the possibilities for nutritional manipulation of these characteristics in the animal and to establish their likely value to both the consumer and the producer.

Fats are rich source of energy and are frequently included in broilers diet to increase the energy density. Several experiments have shown that an increase in energy concentration produces a decrease in feed intake but does not negatively affect daily gain, resulting in improvement in feed efficiency (Scaife and Moyo, 1994). Significant correlations between the nature of dietary lipids and that of fatty and muscle tissues have being demonstrated. The main effect of unsaturated dietary fat or oils is to induce the deposition, in body lipids, of polyunsaturated fatty acids that are not synthesized by chickens, namely lincoleic and linolenic acids in fatty and muscle tissues, and long-chain polyunsaturated fatty acids muscles (Lessire, 1995). Changes in the fatty acid profile of fats deposit in chickens result in a modification of the carcass, aspect, carcass score indicate they are firmer and drier when feeds are supplemented with tallow (Edwards *et al*; 1973; Caudro *et al*; 1993).

Conversely, foods enriched with unsaturated fatty acids or n-3 fatty acids are gaining popularity because, these fatty acids have reported to protect against cardiovascular and inflammatory diseases, certain types of cancer (Kinsella *et al*; 1990), decreases plasma triglycerides, blood pressure, platelet aggregation, thrombosis and atherosclerosis particularly in diabetics and they also provide essential nutrients required for brain and visual development in children and enhance immunity in adult and more ovet, chicken fed on unsaturated oils shows carcasses with softer fats (Caudon *et al*; 1993).

Cardiovascular diseases in mankind are mostly ascribed to either a family history and/or of dietary origin. Modern diets high in saturated fatty acids (SFA) and low in monounsaturated (MUFA) and polyunsaturated (PUFA) fatty acids are mostly blamed for the increase incidence of these diseases. Since dietary fatty acids are absorbed by monogastric animals and deposited in their tissues without significant modification (Coetzee and Hottman, 2002) considerable potential exists for the manipulation of the fatty acid profile protein sources has the potential to increase the supply of Omega-3 (n-3) PUFA'S as well as to improve the PUFA/SFA ratio (Warnants *et al*, 1998). The inclusion of saturated and unsaturated oil source in composition of broiler feed has immensely added to the value of quality of feed and increased the carcass quality of birds. This therefore has the potential to reduce coronary/ cardiovascular diseases in humans.

II. Materials and Methods

Experimental Site

The experiment was carried out in the poultry unit of the Department of Animal Science Ebonyi State University, Abakaliki.

Experimental Birds and Design

Three hundred and sixty day-old Anak breed broiler chicks were randomly placed into three (3) dietary treatments and twelve replicates in a completely

randomized design for a period of twelve (12) weeks (3 months). The experimental birds were obtained from a reputable farm (CY farms) in Abakaliki, Ebonyi State. The birds were brooded in deep litter pens using wooden partition with wire gauze to separate the birds and wood shavings was used as litter material. During the brooding period, each pen was provided with 200 watts electrical bulb to provide optimum temperature. The birds were vaccinated as and when due According to Odoh (2006).

The environment where the experiment was carried out was kept clean always and the litter materials were changed periodically (every 2 weeks) or when damped or caked to prevent infection. The water troughs were washed daily. At the commencement of the experiment, the birds were weighed and had an initial body weight of 0.2kg ± 0.01kg and were replicated twelve (12) times with ten (30) birds per replicate with a total number of one hundred and twenty (120) birds per treatment. Feed and water were supplied *ad-libitum*.

Feeding

The chicks were given ad-libitum access to experimental diets from conica feeding troughs. Water was made available for consumption on rubber and aluminium water troughs. The raw groundnut oil which was used was extracted from the raw groundnut seed that was purchased from Abakaliki feedstuff market and palm oil as well, while other feed material were bought from farm Association in Enugu State. The groundnut seed was made free of dirt, pounded and the oil was extracted while the remains was used for *Kuli kuli*. The oil was stored in the bottle to avoid contamination and from becoming rancid.

Dietary Treatments

The two hundred and sixty birds (260) were randomly assigned to three (3) dietary treatments, having ten (30) birds per replicate, one hundred and twenty birds per treatment and treatment one (T_1) served as the control. The treatments were identified as T_1, T_2 and T_3 respectively.

The raw groundnut oil and palm oil was included in the diets of T_2 and T_3 at levels 5% respectively, both at starter and finisher phase of the experiment. The proximate composition of experimental diet and ingredient percentage of composition of starter feed used to formulate the diet are presented in table 1.

Laboratory Analysis

At the end of the experimental period, the broiler chickens were weighed and a medium body weight animal was then separated from each repelication. After six hours of fasting, they were slaughtered. Soon after the slaughter, the broiler chickens were frozen at – 18°C temperature until the proximate analyses were conducted on them using Hartman and Lago methodology (1986). The carcasses were deposited in the refrigerator with temperature around 10^6 for two hours. Then, all the visible fat and skin sample. The meat was grinded in a food processor until a pasty matter was obtained. The moisture (dry matter) and ashes (mineral matter) analysis were conducted in the laboratory. The remaining samples were placed in labelled trays and dried in an oven with circulating air at 55°c for 24hours to remove the moisture. The dry sample were then sent for poultry physical proximate analysis laboratory were the crude proteins, either extract and FAS profile analyses were performed using Hartman and Lago methodology (1986).

Fatty Acids Analysis

The FAs analysis was accomplished in dry matter and in duplicate using the Hartman and Lago (1986) methodology. The FA_S identification method was the comparison between the triglycerides methyl ester samples and triglycerides from authentic standard (methyl esters sigma). The total lipid analysis was carried out according to AOAC (1995b) methodology with the following parameters total cholesterol, triglycerides, high density lipoprotein (HDL) and low-density lipoprotein (LDL).

Carcass Quality

Determination of carcass characteristics and organoleptic quality: The procedures for the measurement of carcass and organ weights and assessment of organoleptic qualities were as described in Okeudo *et al* (2005). 12 birds (4 from each treatment) were selected after the termination of feeding trial. Birds of similar live weights were selected, except when none is available. Birds were starved overnight and there after slaughtered and dressed following conventional procedure. The weight of the carcasses and the organs were recorded. One drumstick from each carcass was used for the determination for sensory evaluation test. Drumsticks were cut in cubes packaged individually and heated in a pot on a hot plate for 30 minutes. Thereafter, they were cooled under room temperature and served to a panel of 10 assessors previously trained in basic organoleptic assessment procedure. Each panellist was required to masticate 3 samples and score each for tenderness, juiciness, flavour and degree of likeness using the 9 points category rating scale (AMSA, 1978). It was planned that the 3 samples offered to each panellist must come from three different dietary groups.

III. Statistical Analysis

The statistical data were analyzed using ANOVA as outlined by Scot *et al* (1989). Differences between means were separated using Duncan multiple range test, (Duncan 1995) at 5% significance level.

The linear model used was

$$X_{ij} = \mu + T_i + E_{ij}$$

Where, X_{ij} = Individual observation
n = Overall population mean
T_i = Treatment
e = Experimental error
i = Number of treatments
j = Number of replicate

IV. Results

Proximate Analysis of the Breast and Thigh

The result of the proximate analysis of the breast and thigh of the experimental birds shows that there was no significant difference (P>0.05) in the humidity, crude protein and Ether Extract in the breast and thigh of the

birds in all the treatments. (Table 2) T_3 had the highest value in the breast (74.81) followed by T_2 (74.23) while T_1 had the least (73.49) for humidity.

Saturated Fatty Acid Analysis of the Breast and Thigh of the Broiler Chicken Fed experimental diet

The result showed that there was no significant difference (P>0.05) in all the treatment in their composition of palmitic acid and stearic acid but there was a significant difference (P<0.05) in the myrsitic acid composition especially on the breast of the experimental birds in T_1 and T_2, had the highest level of myristic acid (0.20) followed by T_3 (0.12) while T_2 had the least (0.10) (Table 3). There was no significant difference in the PUFA content of the breast and thigh of the experimental birds in all the treatments T_1 had the highest level of PUFA (4.57) followed by T_3 while T_2 had the least (3.43), all these increases, were seen in the thigh (Table 4) figure, but there was a numerical decrease in the PUFA content of the breast and thigh of the birds in T_2 but it was statistically difference.

Carcass Yield and Quality

The mean values of bird weight showed significant difference in all the treatments. T_3 had the highest (2.94kg/birds), followed by T_2 (2.78kg/bird) while T_1 was the lowest, significantly difference also existed in all the parameters measured in all treatments: Defeathered weight, Dressed carcass weight, Breast weight, Drumstick/thigh weigh, wing weight, Gizzard weight and abdominal fat weight (Table 5).

Sensory/Organoleptic evaluation of meat

There was no significant difference (P > 0.05) found in the sensory/organoleptic qualities of the meat of the experimental animals fed with the three experimental diets. Though T1 scored greater value for appearance (7.79) and T3 scored the highest value for overall acceptability (7.57) among the treatments, these values were not statistically different.

Lipid Profile Indices of Broiler Chicken Feed on the Experimental Diet

The result of fatty acid content n relation to lipid profile analysis showed that the mean values of T_1 and T_2 total cholesterol and low-density-lipoprotein differs numerically to T_3, but there was no significant difference (P>0.05) the triglycerides, High Density Lipoprotein and Low Density Lipoprotein in all the treatments. T_2 had the highest low-density lipoprotein in all the treatments. T_2 had the highest low-density lipoprotein (2.05), followed by T_1 (1.78) while T_3 had the least (1.51). Whereas in high density lipoprotein, T_3 had the highest (0.82), followed by T_1 (0.67) and then T_2 (0.6), but in the triglycerides, T_2 had the highest (0.60), followed by T_1 (0.58) then T_3 (0.41) (Table 7).

V. Discussion

Effect of treatments on carcass quality

Significant difference (P>0.05) did not occur in all the treatments for humidity, Ether Extract and crude protein but significant difference (P<0.05) occurred in the thigh of the birds in T_2 for ash, this could be because the birds in T_2 which were fed with saturated oils were not able to digest them and or assimilate or synthesize them adequately. This result is in line with that obtained by Van Heerden *et al* (2002) who studied the chemical composition of broiler chickens sold in south Africa's trade and they reported lower values for thigh, humidity, equal values for the breast, higher values regarding the fat and protein in the breast and thigh, and equal values regarding the ashes content in both cuts when compared to this study and with values in the united state Department of Agriculture (USDA) food composition Table (1999).

The total contents of lipids in this research regarding the white meat presented lower values than those shown in the table that contains $1.65g.100^{g-1}$. The protein quantity presented by the USDA Table (1999) is $23.20g.100g^{-1}$ and this value is higher than the ones obtained in this study. In the raw thigh, it was related in USDA table 4.31.100g-1 of lipids, showing very similar results to the current research, and, 20.08g.100-1 of proteins, in both evaluated cuts, the results are in agreement with this study. When the results were compared to the Brazilian food composition Table – TACO (2004), it shows higher values of lipids and protein for the broilers breast and thigh. Regarding humidity and ashes, the table shows similar values to the breast and thigh portion as those reported in this study.

Saturated Fatty Acid Analysis of the breast and thigh

The saturated myristic fatty acid was higher in the breast and thigh of chicken in T_2 and T_1 as against the reduced level in T_3 which was fed with feed formulated with unsaturated oils (Table 3). This reduction is beneficial since this acid is considered hyperlidemic (Keys *et al*; 1965). In addition, the hypercholesterolemic effect of saturated fatty acids according to Farfan (1996), is associated with the palmitic acid (C12:0), myristic acid (C14:0), and palmitic acid (C16:0) which causes more harm than good. Palm oil inclusion in this study presented adverse responses to the birds in T_2, the poultry adipose tissue did not synthesize substantial amounts of fat, so, it can be said that it was dependent on the fatty acids from digestion or those synthesized by the liver because there is also a basic difference between the metabolism in mammals and in poultry regarding the occurrence of lipogenesis. In mammals, lipogenesis occurs, practically, in adipose tissue; however, in poultry it is processed in liver cells. In poultry, only after this physiological mechanism that the distribution of lipids to the adipose tissue is done. The effect of saturated oils used in feed compared with unsaturated in the broiler chicken lipid metabolism has been described by many researchers (Qureshi *et al*; 1980a). A significant decrease in the cholesterol biosynthesis occurs when saturated oil is used on diets, and this effect is followed by a great increase in the fatty acid biosynthesis (Burger *et al*; 1982). Therefore, the chemical composition variation of certain foods can define their use. Thus, the NSP has a great control over the poultry diet interfering in the intestinal absorption of lipids, reducing the abdominal fat (Francesch *et al*; 1994), and it can also reduce the diet efficiency and decrease the digestibility of many nutrients (Brufau *et al*; 1994).

In the evaluation of thigh cut, no significant difference (P>0.05) between the treatments analyzed in relation to the FA_S saturated was observed. Regarding the FA_S saturated no statistical difference between the treatments for breast meat or thigh was found.

Polyunsaturated (PUFA) fatty acid analysis on the breast and thigh

The numerical decrease observed in the polyunsaturated fatty acid content of the breast and thigh of the birds in T_2 though not statistically significant is an indication that there was an increased rate of lipid catabolism. This increased the organoleptic properties of the meat and may reduce the increase in susceptibility to lipid oxidation in meat (Cortinas *et al*; 2001, Grau *et al*; 2001a, b). This result is in line with that obtained by (Sanz 2000) who found that chicken fed with polyunsaturated fats compared with those fed with saturated fat has the ability to increase the rate of fatty acids synthesis. In this study the tissue fat content of birds in treatment (T_3) fed polyunsaturated oils was higher when the lipid content was analyzed. The inclusion of unsaturated oils in their feed may have reduced blood cholesterol while increasing High density lipoprotein. In order to keep the blood cholesterol low, the diet should be poor in total lipids, cholesterol, and saturated fatty acids (Bragagnolo and Rodriguez Amaya 2002). Meaning that the inclusion of unsaturated oils should be encouraged especially when formulating livestock ration. According to Pan and Storlien (1993) and Lopez-Bote *et al*, (1997), generally, the change in FA_S intramuscular fat deposition is used mainly as cell membranes and the cell has to keep the physical characteristics to ensure the flow and permeability that have different combinations. Those studies corroborate the present study since there was no change in the chicken $PUFA_S$ profile. Difference functions of FA_S tissues profile may be assigned to different functions of the FAS in this tissue or to the different phospholipids contents.

Carcass Yield and Quality

The significant differences recorded in the carcass quality of the experimental bird in all the parameters measured could be as a result of ad-dibitum feeding and inclusion of unsaturated oils (groundnut oil) which is easily broken down or synthesize by the body system of the chickens and which lowers the low density lipoprotein (the bad cholesterol). The results of the study indicated a significant (P<0.05) effect of dietary fat deposition on the body, thus enhancing the body weight. This is in line with the funding of lesson and Atteh (1995), Pest; *et al* (2002) who observed that at the same level of inclusion of saturated and unsaturated oil, there are differences in performance of birds due to fat source. Significant difference (P<0.05) was found to exist in all the treatments on the breast whereas no significance difference (P>0.05) was seen among the treatments in the drumstick, wing and gizzard but there was a numerical increase in T_3. On the abdominal fat pad there was a significant difference (P<0.05) between T_3 and T_2 while T_1, the control remained the least. T_2 having the highest followed by T_3 in the treatment.

Deposition of abdominal fat was significantly greater in fat fed birds compared to those on the control diet. Dietary fat levels (saturated) increases significantly abdominal fat pad deposition (P<0.05) (Peebles *et al*. 2000; Ghazalah, 2008). This is in accordance with the results of Snaz *et al*. (1999) and Snaz *et al* (2000) who reported lower abdominal fat deposition in birds fed unsaturated fat than those fed saturated fat. According to Newsholme and Leech (1984); *et a.l* at high fat intakes, β-oxidation is enhanced through the increased activity of the enzymes involved which could hide the different effect of polyunsaturated and saturated fatty acids on abdominal fat deposition. Addition of unsaturated and saturated or a binary mixture (0.5:0.5w/w) of two fats had proportional effect on accumulation of abdominal fat. Similar feedings have been previously reported for abdominal fat deposition in birds fed diets containing fats (Peebles *et al.* 2000; Ghazalah, 2008).

Sensory/organoleptic Qualities

Sensory evaluation/organoleptic properties of Drumstick meat from all the treatment groups indicated no significant difference in the mean scores for colour and flavour (Table 6). Although statistically similar, but mean sensory scores for tenderness and juiciness were slightly better in treatment groups than the control group. The overall acceptability scores for drumstick meat from all the treatments ranged from 7.27 in control to 7.58 in T_2 and T_3 but the difference were statistically non-significant. However, statistically similar mean overall acceptability scores for all the treatment groups showed that dietary fat supplementation did not affect the organoleptic quality of meat.

Lipid Profile

There was no significant difference (P>0.05) in the lipid profile parameters; total Cholesterol, Triglycerides, High density lipoprotein and low density lipoprotein (TC, TG, HDL and LDL). The total cholesterol of birds on T2 (saturated oils) had the highest total cholesterol among the treatment groups. This may be, because it contained fat which increases low density lipoprotein Mensink, R.P; Katan M.B. (1992) and T_1, as well. T_3 (unsaturated oils) had the lowest total cholesterol, this may be as a result of unsaturated fat dietary feed that is easily synthesized by the animal and so reduces total cholesterol with/by increasing High-density-lipoprotein.

There was significant value (P<0.05) between T_2 and other treatments on triglycerides follow by T_1 and T_3. The result also showed that there was marginal difference between High-Density-lipoprotein of T_2 and T_3. T_3 had the highest High Density lipoprotein that is believed to reduce total cholesterol while T_2 had the highest low-Density-Lipoprotein that increases total cholesterol. These value obtained in T_3 (unsaturated diet) fall within the same range of lipid profile standard on cholesterol testing as established by American Heart Association (2009). The result of inclusion of dietary fat source which is manufactured by the liver to repair blood vessels and help transport fat-soluble vitamins to cell of the body. Moreover, studies have shown that unsaturated fats had cholesterol known as good cholesterol, this is in

accordance with the National Cholesterol Educating Programme (2009), which states that HDL which removes excess cholesterol from the arterial plague, slowing its build up, decreases inflammation, reduces blood clothing (and/or thick blood) and help regulate blood pressure. However, the above reason was indicated in the lipid profile indices of the experiment. Since birds fed on T3 diet recorded a maximum value in High density Lipoprotein against heart disease, Atherosclerosis and Cardiovascular diseases. T_2 (saturated oil) diet which contained palm oil had the highest value of total cholesterol, triglycerides and low-density-lipoprotein which is believed to accumulate in arteries and then later on result to heart diseases, stroke etc. As saturated fatty acid collects within the body wreaks havoc and causes detrimental health; while T_1 had slightly the same value with T_2.

VI. Conclusion

The findings of the study indicate that the fat source and the degree of saturation of dietary fats does affect their metabolic use for body weight gain, carcass yield, abdominal fat pad deposition and total cholesterol. However, an increase in the saturated fatty acids at expense of the polyunsaturated fatty acids may increase the risk of coronary arterial diseases. Therefore, further research is needed to explore the best ratio of unsaturated to saturated fatty acids of solid fats such as in T_2.

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Table 1: Percentage composition of the starter diet

Ingredients	**T_1**	**T_2**	**T_3**
Yellow maize	50	50	50
Soya bean	20	20	20
Wheat offal	10	10	10
Palm kernel cake (DKC)	6	5.5	5.5
Groundnut cake	10	10	10
Saturated oils	0	0.5	0.0
Unsaturated oils	0	0.0	0.5
Fish meals	1	1	1
Lime stone	0.1	0.1	0.1
Methionine	0.1	0.1	0.1
Lysine	0.1	0.1	0.1
Bone meal	2	2	2
Starter prem	0.25	0.25	0.25
Common salt	0.3	0.3	0.3
Total (kg)	100	100	100
Calculated crude protein	19.99	30.879	20.022
Digestible energy (Kcal/kg)	3199.87	3249.79	3274.25

Table 2: The proximate analysis of the breast and thigh of broiler chicken fed diet formulated with saturated and unsaturated oils.

	Humidity (%)		Ashes (%)		CP* (%)		EE (%)		CP** (%)		EE** (%)	
Treatment 1	73.49^{a}	75.62^{a}	1.34^{a}	1.07^{b}	84.97^{a}	82.94^{a}	4.65^{a}	20.72^{a}	21.48^{a}	15.99^{a}	1.24^{a}	5.08^{a}
Treatment 2	74.23^{a}	74.99^{a}	1.21^{a}	1.11^{b}	82.92^{a}	81.74^{a}	3.22^{a}	15.76^{a}	20.68^{a}	17.22^{a}	0.83	3.94^{a}
Treatment 3	74.81^{a}	76.23^{a}	1.09^{a}	0.80^{a}	82.80^{a}	80.06^{a}	4.34^{a}	16.25^{a}	19.97^{a}	15.94^{a}	1.08^{a}	3.86^{a}

The values in the columns followed by different superscripts differ significantly (P<0.05);
** The analyses are expressed on a dry matter basis;*
*** The analyses are expressed on a natural matter basis.*

Table 3: Saturated Fatty Acid Analysis of the breast and thigh of the experimental birds ($g.100^{-1}$).

Fatty Acid	Treatment 1		Treatment 2		Treatment 3		SEM	
	Breast	Thigh	Breast	Thigh	Breast	Thigh	Breast	Thigh
C14:0 Myristic acid	0.020^{b}	0.090^{a}	0.010^{a}	0.073^{a}	0.013^{ab}	0.077^{a}	0.000	0.009
C16:0 Palmctic acid	0.880^{a}	4.203^{a}	0.877^{a}	3.183^{a}	0.933^{a}	3.147^{a}	0.099	0.39
C18:0 Stearic Acid	0.297^{a}	1.217^{a}	0.253^{a}	0.973^{a}	0.973^{a}	0.977^{a}	0.030	0.113
Total	1.197^{a}	5.51^{a}	1.140^{a}	4.229^{a}	1.21^{a}	4.201^{a}	0.040	0.156

**The values in the columns followed by different superscripts are significantly different (P< 0.05). Analyses are expressed on a dry matter basis.*

Table 4: Polyunsaturated FA (PUFA) analysis on the breast and thigh of the experimental animals

	Treatment 1		Treatment 2		Treatment 3		SEM	
	Breast	Thigh	Breast	Thigh	Breast	Thigh	Breast	Thigh
C18:12, 10–6 Lionoleic acid	0.98^{a}	4.27^{a}	0.89^{a}	3.25^{a}	0.91^{a}	3.38_{a}	0.12	0.57
C18:3, 10–3 Adinolenic acid	0.07^{a}	0.30^{a}	0.06^{a}	0.23^{a}	0.06_{a}	0.23^{a}	0.01	0.04
$PUFA_S$ total	1.05	4.57^{a}	0.96	3.48^{a}	0.97	3.61^{a}	0.03	0.26

**The values in the lines followed by different superscripts are significantly different (P<0.05) among themselves.*

Table 5: Effect of treatments on Carcass Quality of broiler chicken

Parameters	Treatments			
	T_1	T_2	T_3	SEM
Bird weight (kg/bird)	2.55^{c}	2.78^{b}	2.94^{a}	0.05
Defeathered weight (kg/bird)	2.39^{c}	2.55^{b}	2.73^{a}	0.04
Dressed carcass weight (kg/bird)	2.098^{c}	2.146^{bc}	2.302^{a}	0.05
Breast weight (kg/bird)	0.30^{b}	0.427^{a}	0.456^{a}	0.03
Drumstick/thigh weight (kg/bird)	0.264^{a}	0.276^{a}	0.276^{a}	0.04
Wing weight (kg/bird)	0.088^{b}	0.094^{a}	0.098^{a}	0.00
Gizzard weight (kg/bird)	0.43^{c}	0.051^{b}	0.064^{a}	0.00
Abdominal weight (kg/bird)	0.036^{c}	0.074^{a}	0.049^{b}	0.00

*^{b} *Mean on the same row followed with different superscript are significantly different (P<0.05).*

Table 6: Sensory Characteristics

Parameters	Levels of inclusion of oils		
	0%	5% saturated	5% unsaturated
Appearance	7.79 ± 0.49	7.14 ± 0.48	7.64± 0.48
Tenderness	7.29 ± 0.49	7.57 ± 0.61	7.79 ± 0.57
Juiciness	7.21± 0.39	7.36 ± 0.56	7.57 ± 0.67
Flavour	7.29 ± 0.57	7.64 ± 0.75	7.36 ± 0.48
Overall Acceptability	7.26 ± 0.53	7.36 ± 0.42	7.57 ± 0.53

Table 7: Lipid profile indices of broiler chicken fed experimental diet

Parameters	Experimental Diet			
	T_1	T_2	T_3	SEM
Total Cholesterol (mmol/L)	2.9^{a}	2.995^{a}	2.5^{a}	0.0081
Triglycerides (mmol/L)	0.575^{b}	0.60^{a}	0.41^{c}	0.01605
High Density Lipoprotein (mmol/L)	0.67^{b}	0.61^{b}	0.815^{a}	0.00345
Low Density Lipoprotein (mmol/L)	1.775^{b}	2.05^{a}	1.505^{c}	0.0021