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Effects of Oral Administration of Cocos Nucifera (Coconut) Water and Oil on Growth Performance and Selected Serum Biochemistry of Broiler Chicks

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Abstract:
Broilers as meat producing animal for human consumption must themselves be produced with minimum amount of fat due to the attendant risk of coronary heart disease associated with consumption of fatty meat. This study was therefore, designed to investigate the effect of oral administration of Cocos nucifera (coconut) water and oil on growth performance and selected serum biochemistry of broiler chicks. The selected serum biochemistry was those of lipid profile and hepatic marker enzymes. The coconut water and oil were extracted locally. The body mass (weight) and organ mass were carried out by use of standard weighing balance. The lipid analysis and enzymes assays were done using standard methods. The result obtained showed a non-significant (P>0.05) changes (rise or fall) in the body mass of birds administered with coconut water and coconut oil relative to control treatment. For lipid profile, the result showed significant (P<0.05) reduction in serum total cholesterol, triacylglycerol and very low-density lipoprotein cholesterol with non-significant (P>o.05) changes in serum levels of high density lipoprotein and low-density lipoprotein cholesterols with birds that received 2.0ml/day administration of coconut water and oil relative to control. For the marker enzymes the result revealed significant increase in serum activities of ALT but reduction in ALP by birds that received coconut water whereas coconut oil caused a significant reduction in AST activity. One therefore, concluded that the numerous nutritional and health benefits of coconut water and oil as previously reported by researchers stand the test of time as their administrations to broilers have no negative effect on growth performance, lipid profile and marker enzymes activities.

Keywords: *Cocos nucifera water, coconut oil, growth performance, lipid profile and marker enzymes*

1. Introduction

Cocos nucifera water and oil having been widely used nutritionally and medicinally deserve further investigation of its effect on growth performance of broiler chicks and their serum biochemistry. Coconut (Cocos nucifera linn) tree due to its multi uses by man is tagged a tree of life arising from its huge contribution to human life (Abdulhameed and Igbal, 2011). Every part of the tree is utilized for the benefit of human race and its fruit provides important constituents of food which is very important in every household (Maga, 1999) husk fibres are used for brush, mats, twin rope, packing for mattresses and upholstery (Anon, 1990). Coconut fruits have extensive demands both for human consumption as the second most valuable commodity in the world trade today (Obasi *et al*, 2012; Ige *et al*, 1984). Nutritionally, coconuts are used freely as a refreshing drink and as an ingredient of confectionery as ice cream, biscuits, cakes and bread. There are many products made from Cocos nucifera out of which eight are important in world trade and these are whole coconut, copra, coconut oil, coconut oil cakes, coir, desiccated shredded coconut, coconut skim milk and coconut protein (Onifade and Jeff – Agboola, 2003). Coconut can also be used to produce desired textures in cookies, candies, cakes, pics, salads, and deserts (Akubugwo *et al*, 2008). Coconut water or juice is a sweet refreshing drink from the endosperm (Steiner and Desser, 2008). This differs from coconut milk which is the only white liquid extracted from the grated fresh coconut kernel. In most cases coconut water comes from small and scarce coconut tree plantation more related to garden (Alexia, *et al*, 2012). Coconut water remains a traditional and under used resource which could thus be considered as an exotic beverage by most people living far from the coconut production area (Joidana, 2000). This important beverage has multiple uses not only nutritional but also medicinal (Ediriweera 2003). It

has microbiological growth medium potential (Osazuwana and Ahonalkh 1989) and a ceremonial gift (Rethinam *et al*, 2001) and can be processed into vinegar (Sanchez *et al*, 1985) or wine (Augustine, 2007). These various uses are possible due to original biochemical composition of the juice. The particular mineral composition and reasonable total sugar content make coconut water a natural isotonic liquid. The characteristics of coconut water make it an ideal rehydrating and refreshing drink after physical exercise. Medicinally it was traditionally prescribed for burning pain during urination, dysuria, gastritis, burning pain of the eyes, indigestion, hiccups or even expelling retained placenta. The biochemical composition of coconut water is enticing ranging from inorganic mineral such as potassium, chloride, iron and sulphur (Thampan & Rethinam, 2004) Santoso*et al*, (1996) observed and reported presence of potassium, copper and sodium in mature coconut water.

Organic substances present are the sugar, little quantity of oil, protein, amino acid, vitamin C (shivashankar, 1991, Sierra and Velasoo, 1976). Coconut (Cocos nucifera) oil which comes from the kernel of coconut has been claimed to improve outcome of different disease diagnosis, skin conditions and increase metabolism. Research shows that coconut oil is very high in saturated fat. The academy of nutrition and dietetics states that virgin coconut oil is very high in lauric acid which is capable of raising both good and bad cholesterol (Jane, 2013). The medium chain triglyceride or triacylglycerol of coconut oil revealed presence of lauric acid, capric acid and caprylic acid with their attendance antifungal, antibacterial and antiviral activities that make it beneficial for immune support. Coconut oil is a great fat for cooking does not undergo rancidity due to the presence of saturated medium chain triacylglycerol. There was not much report on the use of coconut water and oil on poultry ration apart from that reported by Ritchie (2016) on inclusion of 15-20% coconut oil meal as protein supplement, 5% coconut oil as fat and oil and coconut water as source of vitamin A and C. Coconut meal is however different in essential amino acid such as lysine, isoleucine, leucine and methionine (Sonaiya and swan, 2004). Not much is reported on the use of coconut water and coconut oil in veterinary practice. This study is therefore, set to investigate the effects of coconut water and oil on growth performance and serum biochemistry of broiler chicks.

2. Materials and Methods

2.1. Sample Collection

Cocos nucifera seeds weighing up to 10kg were purchased from Apiapum local market in Obubra Local Government Area of Cross River State of Nigeria. The seeds as identified belong to West African tall coconut variety which happen to be very popular in that community. The hard pericarp was pierced through a short metallic rod on the middle eye to gain access to the water domiciled in the endosperm. The water was ascetically collected into well labeled sample bottles and administered to the birds in not more than 20 minutes after collection.

2.2. Cocos Nucifera Oil Extraction

The hard shell was cut into two halves with a cutlass and kitchen knife was used to remove the kernel. The kernel was washed with few sacs of sachet water popularly known as pure water. The harvested kernel was cut into manageable sizes for effective grabbing with hand for purposes of manual grating. The cut kernel was grated using hand grater. The grated kernel (mash) was diluted with pure water under room temperature in a ratio of 1:10 milliliter of water i.e. 1 gram of mash to 10ml of sachet water. The content was thorough mixed with the handle of a table spoon. This was quickly transferred to Musclin clothe and manually pressed to release or expel the white liquid (milk) and the residue discarded. The milk was allowed to stand for 1 hour in a 50ml test tube in test tube rack and the pale yellow coloured supernatant decanted into another test tube. This is the oil and is also administered to the experimental birds in not more than 20 minutes after collection.

2.3. Animal Procurement

One-hundred-day old broiler chick of anak 2000 breed was purchased from Abakaliki of Ebonyi State. The birds were brooded for 14 days and reared for another 7 days to acclimatize to the environment. Feed and drinking water were supplied adlibitum. Normal and regular vaccination schedule were carried out at appropriate time and recommended route and dosage of administration

2.4. Animal Treatment

A total of 60 brooded birds was assigned into 3 treatments of 20 birds each which were replicated into 4 replicates of 5 birds each in a completely randomized design(CRD) fashion.

Treatment1 which is the control treatment received 0.0ml/kg body weight of experimental material.

Treatment 2 and treatment 3 received 2.0ml of coconut water/kg body weight of bird and 2.0ml of coconut oil /kg body weight of via an oral intubation respectively. The experiment (administration) was terminated at the end of 21st day after an overnight fast. Feed and water were supplied adlibitum, live weight of birds in kilograms were collected daily as well as feed consumption while the treatments were on going.

2.5. Sample Collections and Analysis

Blood samples were collected from the experimental bird via a venupuncture of the external jugular vein using a 5.0 ml syringe with needle and transferred into labeled sample bottles. The sample in the bottle were allowed to stand for 1 hour, and the supernatant decanted into clean labeled tubes for analysis of hepatic marker enzymes and lipid profile.

2.6. Carcass and Organ Characteristic

The experimental birds were slaughtered by decapitation, defeathered and eviscerated. The offals, heads and shanks were removed and the dressed weight taken. The organs (heart, kidney, liver and gizzard) were dismembered by deep incision and severed from the folding peritoneum and ligaments. The weights of various organs were taken from the different treatments and the weights compared with the control treatment.

2.7. Assay of Lipid Profile of Birds

Estimation of total cholesterol in serum was conducted using CHOP-PAP method of Richmond was conducted using CHOP-PAP method of Richmond, 1973. This method was based on the understanding that cholesterol esterase catalyses the hydrolysis of cholesterol esters into free cholesterol and fatty acids. The free cholesterol is then oxidized to 4 – cholesten – 3 – one and hydrogen peroxide in the presence of cholesterol oxidase. Phenol and 4-amino antipyrine then combine with the hydrogen peroxide in the presence of peroxidase to produce a red quinoneimine. The intensity of the colour thus produced is directly proportional to the total cholesterol concentration of the sample.

2.8. Assay of High Density Lipoprotein (HDL) Cholesterol.

This was carried out by CHOP-PAP – method of Richmond, 1973 and the procedure was same with that of total cholesterol.

2.9. Assay of Triglyceride

This was estimated by GPO-PAP-method of (Trinder, 1969). Triacylglycerol are determined after enzymatic hydrolysis with lipases. The indicator is quinoneimine formed from hydrogen peroxide, 4-amino phonazone and 4-chlorophenol under catalytic influence of peroxidases.

3. Determination of ast(aspartate amino transferase) activity

This was carried out according to the method of (Reitman and Frankel, 1957). AST was measured by monitoring the concentration of oxaloacetate hydrazone formed by the reaction with 2,4- dinitrophenyl hydrazine.

3.1. Determination of Alanine Amino Transferase (ALT)

This was estimated using the method of Reitman and Frankel, 1957. The principle is same as that of aspartate amino transferase. This was accomplished by monitoring the concentration of Ryruvate hydrazone formed by the reaction with 2,4-dinitrophenyl hydrazine. Coleman Junior II, a linear absorbance spectrophotometer model 6/20A USA which was UV-VIS-NIR spectropoto-meter was used for the absorbance measurement.

3.2. Determination of Alkaline Phosphatase Activity

This was carried out according to the method of belfield and Goldberg (1971).

3.3. Statistical Analysis

Data collected were subjected to statistical analysis using one-way analysis of variance and significant means separated by fisher's least significance difference.

4. Result and Discussion

The growth performance studies are carried out in animals to ascertain effects of treatments on body weight, dressed weight, dressed percentage and individual organs' response to the treatments. The result of this study as presented in Table 1 showed a non-significant (P>0.05) changes (increase or decrease) in body weight of birds administered with 2.0ml milliliter) of coconut per day per Kg body weight of bird (Cocos nucifera) water relative to control treatment coconut water has been reported of having low fat and very low carbohydrate content (Conis 2011; probir *et al*, 2014). Coconut water is also reported to be low in carbohydrate by Jane Hart, 2013. Coconut water having been poor in natural sources of energy does not have enough energy to convert to flesh and most likely cannot improve the body weight of broilers exposed to it. Although the result was not statistically significant yet there was a numerical decrease in body weight (1275 $\pm$100.53g)of birds administered coconut water relative to (1397$\pm$100.53g) control birds and (1575$\pm$100.53g)for birds on 2.0ml of coconut oil. This observation was however, at variance with the report of Tohala (2010) on blood lipid profile and performance traits in broilers where he reported a high positive correlation coefficient in body weight of broilers receiving a low metabolizable energy diet. Administration of 2.0ml /bird/ day of coconut (Cocos nucifera) oil to broilers for 21 days produced a non-significant (P>0.05) increase in body weight of (1575$\pm$100.53g) relative to (1397$\pm$100.53g)control treatment and

(1275±100.53g) to the birds that received 2.0ml coconut water. Coconut oil in a wider sense belongs to fat and oil which in human nutrition is referred to as lipid. The addition of fat (oil)to diets generally supplies energy to the experimental birds, improves the absorption of fat soluble vitamins increase the palatability of ration and increase the efficiency of consumed energy (Baiao and Lara, 2005). Furthermore, fat reduces passage rate of digesta in the gastrointestinal tract which allows better absorption of all nutrients present in the diets with corresponding increase in body mass. Higher body mass may be influenced by high percentage of endogenous fat of the birds as well as sex of birds with the female having higher percentage of endogenous fat (Baiao and Lara, 2005) Griffiths *et al*(1977)observe that birds fed corn oiland poultry fat were significantly heavier than birds non-supplemented with fat. Although there was a numerical increase in the body mass of birds administered with coconut oil relative to control and coconut water treatment in this study,the result was however statistically non-significant. The dressed weight(mass) of the birds follows the same pattern as the live mass of birds. There was no statistically significant difference among the treatments. The dressing percentage however produced a significant ($P<0.05$) decrease in birds that received 2.0ml/day of coconut oil (63 ±2.22) % relative to control (68.21±2.22) % and (70.81±2.22) % of coconut water treatments. The dressing percentage was affected by how much fat was trimmed off during the dressing exercise, how lean the birds were at the slaughter time and whether the birds have eaten shortly before slaughter. These factors may probably account for the significant reduction in dressing percentage of the birds that receive coconut oil compare to those of control and coconut water treatments.

Body parameters (g)	Control 0.0ml/bird/day	Coconut water 2.0ml/b/day	Coconut oil 2.0ml/b/day	SEM
Live Mass (weight)	1397.50	1275.00	1575.00	100.53
Dressed mass (weight)	950.00	900.00	1000.00	71.54
Dressing percentage (%)	$68.21a^{b}$	70.81^{a}	63.36^{b}	2.22

Table 1: Effective of oral administration of cocos nucifera (Water and Oil) on growth performance of broiler chicks

Means are ± SEM. Means values on the same row with different superscripts are significantly ($P<0.05$) different.

Assessment of organs' mass (weight) of birds was not different from those of the body mass since the trait is based on percentage of body mass. The following organs were dismembered from the body and their mass taken as presented in Table 2. the result showed that there was significant ($P<.0.05$) reduction in the mass of liver and gizzard of birds administered with 2.0ml bird/day of coconut oil but not with coconut water relative to control treatment. Coconut water with its reported low fat and very low carbohydrate content (Conis, 2011) may not be able to raise the organs' mass as it was observed in the general body mass. For the significant ($P<0.05$)reduction in percentage organ mass of the liver and gizzard as shown in Table 2, by birds administered orally with coconut oil, it must be noted from previous reports that fat deposition in modern broilers comes mainly from dietary lipids (Sanz,2000). Coconut oil is a highly saturated oil (about 90%) and 60% of its total fatty acid composition are medium chain fatty acid. Medium chain fatty acid (MCFA) with a chain length of 6-12 carbon atoms (Bhatnagar *et al*, 2009) which are absorbed into the portal circulation without re-esterification in the intestinal cells (Ferreira *et al*, 2012 and hence could not ad mass to the body tissue). Unlike MCFA, most long chain fatty acids (LCFA) are stored in the adipose tissue and probably add mass (weight) to the body system (Regocosta *et al*, 2012). As a result of their faster metabolism and reduced storage in adipose tissue, MCFA have been reported to reduce fat deposition (Han *et al*, 2003; St-onge et al, 2003; Takeuchi *et al*, 2006 and improve serum lipid profiles)(Xie *et al*, 2002)in human and rats. Few studies conducted in broilers revealed a decrease in weight gain (Solis de los Santos *et al*, 2008) in birds that received MCFA in comparison with LCFA. MCFA have also been reported to improve fat digestion and performance values during coccidiosis infection (Adams *et al*, 1996). Coconut oil being the major source of medium chain fatty acid and the oil that was used in this study seems to add credence to the above reports of the previous researchers however, the observation in this current study is at variance with the report of Miller *et al*(2009) on non-significant different in weight gain of growers and finisher pigs feed on 1%, 3% and 6% MCFA compared with the same amount of tallow. In studies with rats, no significant difference was observed between MCFA and LCFA with respect to feed intake Takeuchi *et al*(2006) or weight gain (Shinohara *et al*, 2005). Some studies showed an increase in feed intake after the addition of MCFA to the diet (Han *et al*, 2003) which probably may bring increase in body mass. The results of this study on organ mass run contrary to these finding. There were generally no significant differences in the body mass of lungs, kidneys and heart of the birds orally administered with either coconut water or coconut oil when compared with birds in the control treatment. Generally chronic imbalance between fat intake and fat oxidation canlead to changes in fat store of adipose tissues. Avoiding storage of the fat consumed in a high fat diet requires that dietary fats be oxidized (WHO, 1993). In clinical studies, low rate of fat oxidation in the basal state predict an increase inthe body mass (Zurlo *et al*.,1990)It is only when oxidation of fat equals the intake of fat that a stable body mass can be achieved. Fat oxidation is strongly related to energy balance with a negative energy balance promoting oxidation (Schutz *et al,* 1992). Creating a negative energy balance through exercise or dietary restriction can effectively increase fat oxidation as can reduce the fat content of the diet (FAO/WHO, 1993). Coconut oil with its 90% saturated fatty acid and 60% medium chain fatty acid enters

the portal circulation directly avoiding the carnithine transport system and therefore, do not undergo re-esterification in the enterocyte which may be part of the reasons for not storing fat in adipose tissues and hence may not improve weight gain.

Organ's mass (weight)g	Control 0.0ml/bird/day	Coconut water 2.0ml/b/day	Coconut oil 2.0ml/b/day	SEM
Lungs	11.00	16,25	11.00	2.84
Liver	38.75[a]	36.25[ab]	24.50[b]	4.28
Kidney	2.25	2.50	3.50	0.81
Heart	9.25	10.73	7.75	1.76
Gizzard	48.75[a]	37.50[b]	36.25[b]	0.79

Table 2: Effect of oral administration of Cocos nucifera (water and oil) on organ mass (weight) of broiler chicks

Means are ± SEM. Means values on the same row with different superscripts are significantly (P<0.05) different

Plasma or serum biochemical investigations are carried out to ascertain the levels of some biological as well as toxic chemical wastes' accumulation in the body and their effects to the organ of production or organs in which they act. The serum biochemistry of interest here in the current study is the lipid profile as presented in Table 3 showed a significant (P<0.05) reduction in serum level of total cholesterol (TC) of birds orally administered with 2.0ml/day of coconut water and 2.0m/day of coconut oil. The presence of saponins in the coconut oil (Sani *et al*, 2014) aid in reducing cholestro and bile acids which prevent them from being absorbed through the small intestine and hence lowers the cholesterol level in the blood and liver. This same presence of Saponins accounts for its use as in maintaining high density lipoprotein cholesterol (HDL-c) and lowers low density lipoprotein cholesterol (LDL-c) as reported by WHO (1992). Coconut oil produces substances called phytosterol which have the structure similar to cholesterol. Phytosterol can block the absorption of cholesterol during digestion causing the displaced cholesterol to be eliminated from the body (Sandi busch, 2014). It has been suggested that the cholesterol lowering potential of the coconut oil may be mediated by their ability to decrease levels of hydroxyl methyl glutaryl – COA reductase activity (Qureshi, 1986). However, the observation in current study of reduction of total cholesterol by coconut oil is at variance with that of carter *et al* (1997) who reported that medium chain triacylglycerol has the potential of raising total cholesterol (TC) and low-density lipoprotein cholesterol (LDL-c) by half of what is obtained in palmitic acid in human study.

Both coconut water and coconut oil revealed significant (P<0.05) decrease in serum triacylglycerol in this research relative to control treatment. Coconut water with its low-fat content may probably be not able to raise serum triacylglycerol content of the birds that received coconut water. Coconut oil on the other hand could not raise the serum level of triacylglycerol but rather caused a significant (P<0.05) decrease relative to control and coconut water treatments. The state of oxidation of dietary coconut oil may have influenced the result of this study. Previous report has shown that there was a significant reduction in total triglyceride when MCFA and LCFA were fed to experimental animal. Fat oxidation is more strongly related to energy balance and also to the degree of endogenous fat(Zurlo, *et al*, 1990; Schutz *et al*, 1992). Reduction in fat deposition (Han *et al*, 2003' St-Onge *et al*, 2003) as a result of faster metabolism (oxidation) lends credence to this observation in the current study. Low rate of fat oxidation may however increase serum triacylglycerol despite the weak relationship existing between fat balance and fat intake (Flat, 1988). The treatments did not however affect serum lipoprotein cholesterol levels. There were no significant changes (rise or fall) in serum high density lipoprotein cholesterol (HDL-c) and low-density lipoprotein cholesterol (LDL-c) in both administration of coconut water and coconut oil to the experimental birds. This observation runs contrary to the report of Muller *et al*(2003) on significant increase on serum levels of both HDL and LDL cholesterol. This observation also disagrees with the report of Zock, (1994) who showed that myristic acid(acid from coconut oil raised LDL cholesterol relative to oleic acid).Studies in normolipidemic volunteers showed lauric, myristic and palmitic acid are considered to be the principal hyper cholesterolemic fatty acid although they may differ in potency (FAO/WHO, 1993. The observation is however, in consonance with the report of peterm et al (1992) who showed that MCFA consumption has no effect on HDL-c and LDL-c in human study. These variations may be accounted for by the degree of endogenous fat and animal model. The observation in this current study showed that there was significant (P<0.05) decrease in serum level of very low-density lipoprotein cholesterol (VLD-c). this result may be linked to the rescued serum level of triacylglycerol observed in birds orally administered with coconut water and coconut oil. Since VLDL is the carrier of triacylglycerol and is always calculated by dividing the value of triacylglycerol by 5, it means that whatever affect triacylglycerol may also affect the VLDL.

Lipid profile (Mg/dh)	Treatment Schedule Control 0.0ml/bird/d of coconut water/oil	2.0ml/b/day coconut water	2.0ml/b/day coconut oil	SEM
Total cholesterol	82.05[a]	59.21[b]	52.13[b]	3.23
Triacylglycerol	101.74[a]	81.54[b]	62.75[c]	3.69
High densitylipoprotein Cholesterol (HDL[C])	27.85	33.28	25.46	2.18
Low density lipoprotein Cholesterol (HDL.[C])	23.59	17.12	25.05	7.19
Very low-density lipoprotein Cholesterol (VLDL)	30.58[a]	24.42[a]	17.33[b]	1.93

Table 3: Effective of oral administration of cocos nucifera (Water and Oil) on lipid profile of broiler chicks

Means are ± SEM. Mean values on the same row with different superscripts are significantly (P<0.05) different.

In respect of hepatic marker enzymes assessed, the result showed a significant (P<0.05) increase in the activities of alanine aminotransferase (ALT) by coconut water relative to control and coconut oil treatments. This observation is at variance with the report of Offor et *al*(2014) on effect of cocos nucifera water on liver enzymes where a dose dependent decrease in the activities of alanine aminotransferase (ALT), aspartate aminotransferase (AST) and alkaline phosphatase (ALP) was recorded. Invitro agitation of blood sample at the point of collection may lead to lysis and leakage of the enzymes since the distribution of this enzyme is favoured by the erythrocytes. There was however, no significant changes in the activities of ALT as a result of coconut oil administration. Coconut oil administration produced a significant (P<0.05)reduction in serum activities of aspartate aminotransferase (AST) but no changes in ALP. This observation supports the cardiotonic effect of coconut oil. This observation is in agreement with the report of Offor *et al*(2014) who reported a dose department decrease in AST and ALP activities of rats administered with Cocos nucifera water. Coconut water also produce a significant decrease in the activities of ALP. The leakage of enzymes into the circulation following membrane damage to the organs of storage is often monitored by measuring the activities of such enzymes in plasma or serum. Elevated levels of serum enzymes are indicative of cellular leakage and loss of functional integrity of cell membrane in organs such as liver and heart (Saskia *et al*, 2014) whereas decreased level of activities indicates intact and normally metabolizing cells which are impermeable to enzymes (Numakami, *et al*, 1999).

Marker enzymes (U/L)	Treatment Schedule 0.0ml/b/day	2.0ml/b/day Coconut water	2.0ml/b/day coconut oil	SEM
Alanine aminotransferase (ALT)	34.24	43.09	35.86	2.25
Aspartate aminotransferase (AST)	51.58[a]	51.94[a]	39.13[b]	3.08
Alkaline phosphase	50.38[a]	43.53[b]	50.89[a]	3.31

Table 4: Effect of oral administration of cocos nucifera (water and oil) on selected hepatic marker enzymes of broiler chicks

Means are ± SEM. Means value on the same row with different superscripts are significantly (P<0.05) different.

5. Conclusion

Broilers are meat producing birds for human consumption. The consumption of lean meat by the teaming population is paramount due to the attendant rish of coronary heart disease (CHD) associated with the consumption of fatty meat. Analysis of growth performance indices and selected serum biochemical parameters have produced safe landing spot for the people who are afraid that oral administration of coconut water (cocos nucifera)and coconut oil impact negatively on the nutritional as well as numerous health benefit of coconut water and oil previously reported. Having neither affected the body mass (weight) nor serum hepatic marker enzymes negatively, their positive impacts on lipid profile is a welcome development. One can therefore, conclude that there is nothing wrong in taping from the numerous nutritional as well as health benefits of coconut water and coconut oil on broiler production as previously reported.

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