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INVESTIGATION INTO THE LIPID PROFILE OF GOAT SERUM IN PANKSHIN TOWN

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Abstract
This study investigates the lipid profile of goat serum in Pankshin town. 50g of goat serum was collected from the abattoir of Monday market which is the major market servicing the people of Pankshin Local Government Area of Plateau State. It was stored aseptically in labeled EDTA bottle for laboratory analysis. Data collected from the lipid profile analysis were analyzed using One-Way Analysis of Variance (ANOVA) in SPSS version 23 computer software. The result revealed that the cholesterol level in the goat serum (31.60±1.50) falls within the range of the WHO standard (30-50mg/dL) for healthy cholesterol level. Triglyceride value in the goat serum (55.5±1.68) also fall within the range of the WHO standard (50-75mg/dL) for healthy triglyceride level. High density lipoprotein (HDL) value in the goat serum (10.00±0.20) falls within the range of the WHO standard (40mg/dL) for healthy HDL level. Low density lipoprotein (LDL) in the goat serum (9.80±0.10) also fall within the range of the WHO standard (5-10mg/dL) for healthy LDL level. In conclusion, cholesterols, triglycerides, HDL and LDL level in the goat serum falls within the range of the WHO standard for healthy consumption and living. Hence, goat meat can be very good for human consumption.

Keywords: Goat serum, Lipid profile, Cholesterol, Cardiovascular disease, Health

Background to the study
Meat globally served as a source of protein food for humans (Schönfeld *et al*., 2016). Meats on the market compete with each other for consumer preference. This preference is

historically associated with local tradition, as well as their preparation and consumption. Thus, the most consumed meat in Europe is pork, North America is poultry, Brazil and Argentina is bovine, New Zealand is sheep and Japan is fish meat (Schönfeld *et al*., 2016). Consumption of goat meat is associated with the appeal to satisfaction, under sensory and cost evaluation, where the demand for these products is highly influenced by cultural issues, even in low consumption conditions (Webb *et al.,* 2015).

Goat meat has been gaining acceptance over the past few years around the world (Devendra, 2019), especially in developed countries, mainly because of its low-fat content. Increased interest to enhance the nutritional quality of meat has stimulated research on fatty acid composition. The content and composition of intramuscular fat are important for human nutrition and health, as well as for meat quality and palatability (Babiker *et al*., 2018). Today, goats are spread throughout the world, with the exception of extreme cold areas. The goats are highly present in the countries with the extensive agricultural production, although their population rising in the richer countries, mainly due to the intolerance of certain groups of people to cow's meat. They live in small or large herds and in different regions and environments: plain, desert, hilly and mountainous areas. Globally, consumption of goat meat is lower than consumption of beef (Madruga and Bressan, 2011), but goats undoubtedly serve as a major source of red meat for the people (Webb *et al.,* 2015), particularly in developing countries. Because of its distinctive taste and desirable chemical composition, goat meat is increasingly consumed. As animal foods, it is rich in protein,vitamins and minerals, but contains very little fat, especially cholesterol. This typeof meat is no opposing religious and cultural aspects of consumption (Webb *et al.,* 2015).

Several factors influence the quality of goat meat, being classified as intrinsic (species, race, sex and age) and extrinsic to the animal (nutrition, environment and pre and post-slaughter management). These factors affect the muscle structure and biochemistry of the postmortem muscle, acting on the sensory and technological attributes of the meat (Teixeira, 2017). Physico-chemical characteristics of the meat determine its quality and acceptability, among them, the most relevant are color, softness and aroma.There is evidence that some branched-chain fatty acids are responsible for the characteristic aroma

of goat meat from uncastrated male animals. In the pioneering study by Wong (2018), they related the presence of fatty acids with branched chains with methyl group, present in the subcutaneous fat of goats, as components directly responsible for the characteristic odour of goats (Fonteles, 2018). Increase in goat meat production has expanded significantly in the last years, which can be attributed mainly to its dietary characteristics and its acceptability by the consumer. Regardless of the importance of goat as a source of lean meat, compared to other species, there are few studies about the lipid profile of goat meat and the factors affecting its composition (Parkand Washington, 2019).

A lipid profile or lipid panel is a panel of blood tests used to find abnormalities in lipids, such as cholesterol, low-density lipoprotein, high-density lipoprotein and triglycerides. The results of this test can identify certain genetic diseases and can determine approximate risks for cardiovascular disease, certain forms of pancreatitis, and other diseases. Lipid profile is usually ordered as part of a physical exam, along with other panels such as the complete blood count (CBC) and basic metabolic panel (BMP).

Statement of the problem

Goat meat has been gaining acceptance over the past few years around the world, especially in developedcountries, mainly because of its low-fat content. As animal foods, it is rich in protein, vitamins and minerals. Its usage is so important in Nigeria that it is as important as food or water to man, whereby it is beneficial for many activities such as slow cooking, packed full of vitamins, farming etc. Despites the economic and industrial importance of goat meat, the quantity and quality of goat meat are affected by genetic, environmentaland other factors such as breed, age, sex and nutritional factors on growth, carcass, and meat. More so, many people and household individuals who eat goat meat are ignorant about its lipid profile content which is responsible for monitoring and maintaining healthy levels of cholesterol's in the body.Also, oxidative stress in goat meat leading to lipid per-oxidation that causes increase in the pool of triglycerides, cholesterol, high density lipoprotein and low lipoprotein in the blood. Moreover, little or none has been done concerning the lipid profile of the goat serum in Plateau State.

So, this has prompted the researcher to investigate the lipid profile of the goat serum gotten from Pankshin market Abattoir in Pankshin Local Government Area of Plateau State.

Purpose of the study

The purpose of this study is to investigate the lipid profile of goat serum.

The specific objectives are:

1. to investigate the lipid profile of the goat serum as diagnostic markers to assess liver dysfunction
2. to determine the quality of the goat meat

Significance of the study

1. Goat farmers and intending goat rearers will find this study useful due to the fact that they will have useful information on the lipid profile of the goat meat thereby enabling goat farmers to make informed decision on alternative feeds to be used to improve the lipid profile of the goat meat
2. People who eat goat meat will also find this study useful because the content of the study will be educational as it will explore the various indices that determine the lipid profile of goat meat such as cholesterol, low-density lipoprotein, high-density lipoprotein and triglycerides to enhance the effective production and consumption of goat meat.
3. Researchers who are carrying out similar study will find this research useful as it could serve as relevant literature and empirical data. This study will also serve as reference material to students carrying out research on the lipid profile of goat meat.
4. In addition, it will provide data for the government and other relevant stakeholders, which they can be for public awareness campaign about the lipid profile of goat meat.

Research questions

1. To what extent can lipid profiles affects the production and consumption of the goat meat?
2. What is the quality of a goat meat?

Delimitation of the study

This study will cover the lipid profile of goat serum and limited to Pankshin Local Government Area of Plateau State.

Materials and methods

Study area

The study area is in Pankshin Local Government Area of Plateau State, Nigeria with its headquarters in the town of Pankshin. It has an area of 1,524 km^2 and a population of 191,685 at the 2006 census (National Population Census, 2006). The geographical co-ordinates of Pankshin are Latitude 9.3279^0 E and longitude $9,54312^0$ E, and an altitude of 1371 meters elevation above sea level. Pankshin enjoys a more temperate climate than much of the rest of the local government areas in plateau state. Average monthly temperatures range from $20\text{-}24^0$ ($70\text{-}79\ ^0$F) and the annual rainfall is at average of 1150 mm (45.26 inch) of rainfall per year, or 95.8 mm (3.77 inch) per month.

Figure 1: Map of Pankshin

Source: Google map retrieved January 29th, 2022

Materials/reagents used for the study

Equipments

Table 1: Equipments used for the biochemical assay of Goat Serum

Equipments	Manufacturer
-Jenway 6310 spectrometer	Cole-parmer, UK
- Thermo-scientific micro-pipette	Fisher scientific, UK
- Test tubes	Indiamart, India
-Test tubes rack	Indiamart, India
- 320 centrifuge	Hettich centrifuges, UK
- Stuart incubator	Cole-parmer, UK
- Cuvette	Olympus, England
- SPIN tissue processor, STP 120 (Thermoscientific):	Thermo fisher scientific,UK
- Rotary microtome (MICROM HM340E ThermoScientific)	Thermo fisher scientific,UK
- Embedding cassettes on a tissue Tek Embedding Centre (SLEE MPS/P2)	Thermo fisher scientific,UK
- Thin slices of 5mmX 2mm X 1mm thick.	Coverglass, India

Reagents

Table 2: Reagents used for the biochemical assay of Goat Serum

Reagents	Manufacturer	% purity
- Random reagents Kits, UK	Randox lab ltd, UK	100
- Agappe reagents kits, Switzerland	Aggape Diagnostic, Switzerland	100
- Spectrum reagents Kits, Egypt	Egyptian company For biotechnology, Egypt	100
- Teco Diagnostic Kits, U.S.A	Teco Diagnostics, U.S.A	100
- Paraffin Wax Oven	Fisher scientific, UK	75
- Xylene	Gujarat, India	95
- 10% buffered formalin	Poly-science, U.S.A	10
- Alcohol	May and Baker Ltd England	100

Research design

Purely laboratory based experimental design was used in this research work

Methods

Goat Meat Collection

50g of goat serum was collected from Monday Market located in Pankshin Local Government Area of Plateau State, and aseptically stored in labeled EDTA bottle according to method of (Okeme *et al.*, 2017) modified. The collected goat serumwas transported to the Biochemistry Department of National Veterinary Research Institute (NVRI), Vom for Lipid Profile Analysis.

Determination of lipid profiles serum

Procedures for the Serum Cholesterol Analysis

Serum cholesterol was determined using Agappe reagent Kits, Switzerland.

- In the determination of serum cholesterol, a set of test tubes were arranged in a test tube rack.
- Label blank, standard, samples etc
- To a set of clean labeled test tubes, 100ul of the working reagent was added.
- In each of the labeled test tubes, 0.001ml of samples and 0.001ml of standard were added
- Mix, and incubate for 5minutes at 37^{o}C. Measure the absorbance of sample and standard against reagent blank.

The cholesterol content of each of the samples was calculated using the following formula:

$$\text{Cholesterol concentration (mg/dl)} = \frac{\text{Absorbance of sample}}{\text{Absorbance of standard}} \times \frac{200}{1}$$

Procedures for Triglycerides Analysis

Triglycerides (TAG) was determined using Agappe reagent Kits, Switzerland.

- 1000ul of the working reagent was added to a set of labeled test tubes in a test tubes rack.

- Then, 0.001ml of samples and 0.001ml of standard were added
- Mix and incubate for 5minutes at 37^{o}C. Measure the change in absorbance of standard and sample against reagent blank.

Triglycerides content of each of the sample was calculated using the following formula:

$$\text{Triglycerides concentration (mg/dl)} = \frac{\text{Absorbance of sample}}{\text{Absorbance of standard}} \times \frac{200}{1}$$

High density (HDL) Lipoprotein (also called good cholesterol)

The High density (HDL) Lipoprotein was determined using Agappe reagent Kits, Switzerland.

- In this determination, 30ul of the serum sample was added to a set of clean labeled test tubes.
- To the serum inside the test tubes, 300ul of the HDL reagent solution was properly added.
- Mix well, allow standing for 10minutes at room temperature, the mixture was centrifuge for 10minutes at 4000rpm.
- After centrifugation, separate the clear supernatant from the precipitate within 1hour and determine the HDL concentration using the cholesterol reagent (which is not provided along with the kit).
- Then, 1000ul of working cholesterol reagent was added to a set of labeled test tubes.
- 50ul of HDL standard and 50ul HDL supernatant were also added.
- Mix well and incubate for 5minutes at 37^{o}C. Measure the absorbance of standard and sample against the reagent blank

The High density lipoprotein (HDL) content of each of the samples was calculated using the following formula:

$$\text{HDL concentration (mg/dl)} = \frac{\text{Absorbance of sample}}{\text{Absorbance of standard}} \times \frac{200}{1}$$

Low density lipoprotein (also called bad cholesterol)

The Low density (LDL) lipoprotein was determined using Agappe reagent Kits, Switzerland.

- In this determination, 30ul of the serum sample was added to a set of clean labeled test tubes.
- To the serum inside the test tubes, 300ul of the precipitant solution were added.
- Mix well, allow standing for 10minutes at room temperature, the mixture was centrifuge for 10minutes at 4000rpm.
- After centrifugation, separate the clear supernatant from the precipitate within 1hour and determine the LDL concentration using the cholesterol reagent (which is not provided along with the kit).
- Then, 1000ul of working cholesterol reagent was added to a set of labeled test tubes.
- 50ul of LDL standard and 50ul LDL supernatant were also added.
- Mix well and incubate for 5minutes at 37^{o}C. Measure the absorbance of standard and sample against the reagent blank.

The Low density lipoprotein (LDL) content of each of the samples was calculated using the following formula:

$$\text{LDL concentration (mg/dl)} = \frac{\text{Absorbance of sample}}{\text{Absorbance of standard}} \times \frac{200}{1}$$

Data analysis

Statistical analysis was carried out using One-Way Analysis of Variance (ANOVA). Data were analysed using SPSS Version 23 computer software. Data were expressed as the mean $\pm$ standard error of mean and values at $P< 0.05$ were considered significant.

Results

The biochemical analysis of goat serum

Results from this study in table 3 and figure 2 shows that the cholesterol level in the goat serum (31.60±1.50) falls within the range of the WHO standard (30-50mg/dL) for healthy cholesterol level. Triglyceride values in the goat serum (55.75±1.68) also falls within the range of the WHO standard (50-75mg/dL) for healthy triglyceride level. High density lipoprotein (HDL) values in the goat serum (10.00±0.20) falls within the range of the WHO standard (40mg/dL) for healthy HDL level. Low density lipoprotein (LDL) in the

goat serum (9.80±0.10) also falls within the range of the WHO standard (5-10mg/dL) for healthy LDL level.

Table 3: The Biochemical Analysis of Goat Serum

Group	Treatment	Chol	TG	HDL	LDL
A	Goat Serum	31.60±1.50	55.75±1.68	10.00±0.20	9.80±2.10
B	WHO Standard	30-50mg/dL	50-75mg/dL	9-20mg/dL	5-10mg/dL

Values are expressed as mean ± SEM, n = 2

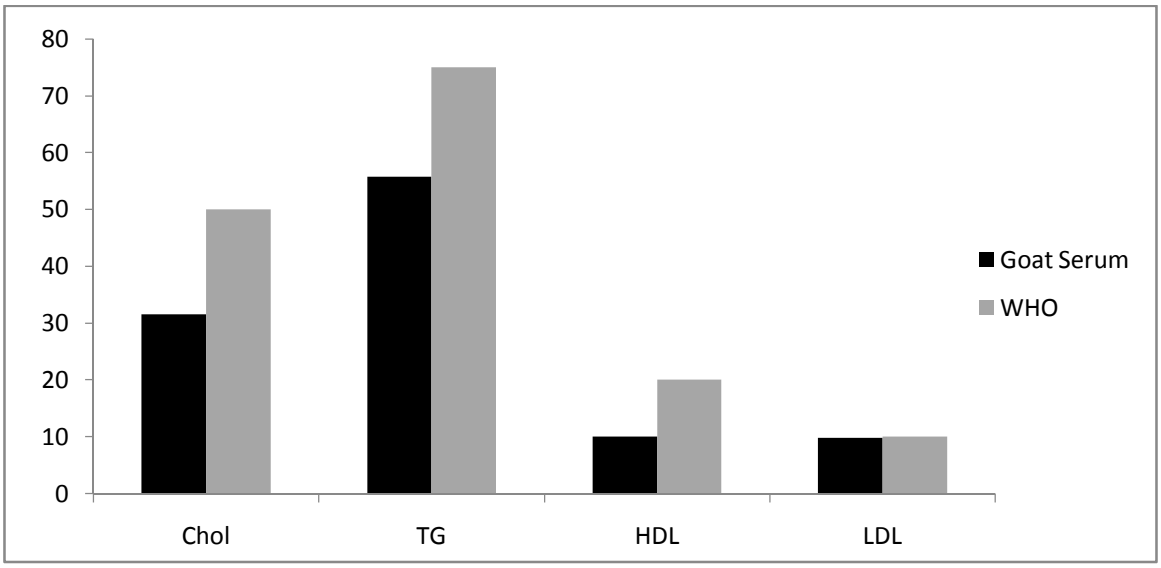

Figure 2: The Biochemical Analysis of Goat Meat Serum

Discussion

The intention for undertaking this study was to update current and or intending goat consumers on how Nigerian goat today compares with the indigenous goats and cattle in terms of lipid profile.Secondly, understanding the basic lipid profile of the Nigerian goat could help change the perception of people about goat and possibly increase its market demand.

In this study, the cholesterol level in the goat serum (31.60±1.50) falls within the range of the WHO standard (30-50mg/dL) for healthy cholesterol level. This values in the

cholesterol level resulted in low cholesterol and low saturated fat in the diet may help to decrease the risk of developing heart disease. This shows that goat is a good source of high quality protein. This result is in corroborating the earlier findings made by Biryomumaisho *et al.*, (2013) in *T. congolense* and *T. brucei* infectedsmall East Africa goats and revealed decreased in the level of the cholesterol.

Triglyceride values in the goat serum(55.75±1.68) also falls within the range of the WHO standard (50-75mg/dL) for healthy triglyceride level.This is an indication that the level of triglycerides in this present study reduces the risk of heart attack, strokes and pancreatitis. This agrees with the work of William (2017) observed that animal species normally experienced decreased or normal level of triglyceride except been exposed to any toxicity.

High density lipoprotein (HDL) values in the goat serum(10.00±0.20) falls within the range of theWHO standard (40mg/dL) for healthy HDL level.This values in HDL level results into the accumulation of cholesterol released into the plasma from dying cells and from membranes under-going turnover. HDL functions as a shuttle that moves cholesterol throughout the body binds esterified cholesterol released from the peripheral tissues and then transfer cholesterol esters to the liver or to tissues that use cholesterol to synthesize steroid hormones. This is an agreement with the findings Zampelas and Magriplis (2019).

Endogenous lipids and cholesterol from the liver are delivered to adipose and muscle tissue by VLDL (very low lipoprotein). Extraction of lipid from VLDL along with loss of some apolipoprotein, gradually converts some of it to LDL, which delivers cholesterol to extra hepatic tissues or returns to liver. Low density lipoprotein (LDL) in the goat serum(9.80±0.10) also falls within the range of the WHO standard (5-10mg/dL) for healthy LDL level. These values may reduce the impairment in the receptor-mediated endocytosis which prevents the binding of LDL to specific receptor that could lead to its degradation and release of cholesterol. This is in agreement with the work of Li *et al.*, (2014) who recorded a normal healthy level of LDL in some selected animals.

Summary of findings

Results from this study in table 3 and figure 2 shows that the cholesterol level in the goat serum falls within the range of the WHO standard for healthy cholesterol level. Triglyceride values in the goat serum also falls within the range of the WHO standard for healthy triglyceride level. High density lipoprotein (HDL) values in the goat serum falls within the range of the WHO standard for healthy HDL level. Low density lipoprotein (LDL) in the goat serum also falls within the range of the WHO standard for healthy LDL level.

Conclusion

This present study showed that cholesterol's, triglycerides, HDL and LDL level in the goat serum falls within the range of the WHO standard for healthy consumption and living. Hence, the goat meat can be very good for human consumption.

Recommendations

From the findings of the present study, the researcher outlined the following recommendations:

1. People should continue to take in goat meat as it is discovered to have good lipid profiles that is very essential for human consumption.
2. Precautionary measures and good dietary nutrition should be taking by the goat farmers to promote a good lipid profile level needed for the goat consumption by humans.
3. In addition, government and other relevant stakeholders should embark on massive orientation and public awareness campaign about the nutritional benefits of the goat meat in order to maintain its market value and demands.

Limitation of the study

Time and financial constraints were the measure limitation in this study. Other constraints faced during the research work was transportation from Pankshin to Jos for the analysis.

Contribution to knowledge

This research work has been able to bring out information on the lipid profile of goat in Plateau State. Providing data base which other researchers can use for further studies.

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