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EFFECT OF RAW BEEF AND CHICKEN MEAT ON BIOCHEMICAL AND HAEMATOLOGICAL PARAMETERS OF WISTAR ALBINO RATS

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ABSTRACT

The study evaluated the effect of raw beef and chicken meat consumption on biochemical and hematological parameters of Wistar Albino rats. The study was conducted at the Animal Science Laboratory, Faculty of Agriculture, Bayero University, Kano. The experiment had 7 treatments each containing 6 Wistar albino rats, T1 was the control, T2 was fed 15% beef, T3 30% beef, T4 45% beef, T5 15% chicken meat, T6 30% chicken meat and T7 45% chicken meat. A total of 42 Wistar albino rats were used in 2×3 factorial arrangement of a completely randomized design (2 meat types and 3 inclusion levels of beef and chicken meat). The results reveal no significant differences ($p<0.05$) in the experimental animals with respect to serum protein and liver function tests. The major hematological parameters (red blood cell, white blood cell, mean corpuscular volume, mean corpuscular hemoglobin and lymphocyte) were significantly ($p<0.05$) affected by the consumption of the two meat types by Wistar Albino rats. Some electrolyte parameters (potassium, urea and creatinine) were also significantly ($p<0.05$) affected. However, it was found that the intake of beef had significant ($p<0.05$) effect on cholesterol level. It was concluded that meat types had no effect on biochemical and hematological parameters in Wistar Albino rats. Based on the result of this experiment consumption of red and white meat does not indicate variation with regards to biochemical and hematological parameters. And further research should be conducted by comprising red meat with another meat.

Keywords: Red meat, White meat, Wistar Albino Rat, Hematology

INTRODUCTION

Meat is an important source of protein. Proteins are complex organic compounds, and the basic structure of protein is a chain of amino acid. Protein is an important component of every cell in the body. Hair and nails are mostly made of protein. The body uses protein to build and repair tissues, and also use protein to make enzymes, hormones and other body chemicals. Protein is an important building block of bones, muscles, cartilage, skin and blood (Zieve, 2009).The Wistar rat is an out bred albino rat. This breed was developed at the Wistar Institute in 1906 for use in biological and medical research, and is notably the first rat developed to serve as a model organism at a time when laboratories primarily used the common house mouse (Clause, 1998).

Hematology, is the branch of medicine concerned with the study of the cause, prognosis, treatment, and prevention of diseases related to blood (Arakawa *et al.,* 2010). It involves treating diseases that affect the production of blood and its components, such as blood cells, hemoglobin, blood proteins, bone marrow, platelets, blood vessels, spleen, and the mechanism of coagulation. Such diseases might include hemophilia, blood clots, other bleeding disorders and blood cancers such as leukemia, multiple myeloma, and lymphoma. The laboratory work that goes into the study of blood is frequently performed by a medical technologist or medical laboratory scientist (Churchill *et al.,* 2004).

Consumption of red meat had been linked with incidence of heart disease, colorectal cancer and Type 2 diabetes (Micha *et al.,* 2010). It was further reported that the extent of the association was found to be higher for processed red meat. On the other hand white meat is perceived to be a low-fat food and healthier (Amanda, 2009). White meat from chickens, turkeys, ducks and geese has become the meat of choice for many people living in the West. The average consumer will eat at least 1,226 birds in a lifetime (O'Connor, 2016).

Constituents of red meat that have been proposed to be responsible for these associations include the fat content, fatty acid composition and the possible formation of carcinogenic compounds, such as heterocyclic amines (HCAs) as a result of cooking meat at high temperatures (Bingham *et al.,* 2002). Although there are many studies documenting these associations, results are not always consistent and there are several methodological issues which could limit the findings.

Therefore this research aimed at evaluating the effect of raw beef and chicken meat consumption on biochemical and hematological parameters of Wistar albino rat.

MATERIALS AND METHODS

The study was conducted at the Animal Science Laboratory, Faculty of Agriculture, Bayero University, Kano. Kano state covers an area extending between latitude 10°3°N and 1 2°4°N of equator and longitude 7°4'E and 9°3'E of the prime meridian. The mean annual rainfall is about 884mm varying greatly from as low as 600mm in the north to 1200mm at the southern tip on the average, the wettest month is August which has the highest number of rainstorms, while the mean annual temperature in the area ranges from 26 to 32°C with a relative humidity ranges of 17-90% (Kowal and Knabe, 1972).

A total of 42 Wister albino rats were used for the experiment. They were randomly grouped into 7 treatments with 6 replications as follows; Tl was the control, T2 was fed with 15% Beef, T3 with 30% Beef, T4 with 45% Beef, T5 15% Chicken meat, T6 30% Chicken meat, T7 45% Chicken meat.. Raw minced beef and chicken meat, grower mash (chicken grower mash) was used to feed the experimental animal, other experimental materials Include: Ethyl Alcohol, was used to clean the body area during blood collection. EDTA and non-EDTA sample bottle were used to put blood samples. Syringe, was also used to draw blood sample. Cotton wool was used for cleaning the animal after blood collection. Dettol was used as disinfectant. Detergent was used for general cleaning and washing. Hand gloves were used for protection and prevention of infection. Color was used as tagging material.

The experiment had 7 treatments each contain 6 replicates of Wistar albino rats, A total of 42 Wister Albino rats were used in a 2 by 3 factorial arrangement of Completely Randomized Design CRD (2 meat types and 3 inclusion rates of red and white meat).

The experiment lasted for 8 weeks, and one week acclimatization period at the beginning, for the experimental animals to adapt to the environment and the new food that was introduced to them (raw beef and chicken meat).

Blood was collected following collection site cleaning with 70% alcohol, the rat is restrained and blood was collected using a 21-23 gauge needle from the lateral tail vein. Blood flow is stopped by applying pressure to achieve hemostasis.

The blood collected in EDTA bottle was used to determine hematology at the end of the experiment at AKTH Kano, the following vitals were determined; they are White Blood Cells (WBC), Red Blood Cells (RBC), Hemoglobin (HGB), Hematocrit (HCT), Mean Corpuscular Volume (MCV), Mean Corpuscular Hemoglobin (MCH), Mean Corpuscular Hemoglobin Concentration (MCHC), Lymphocyte (LYM), Red Cell Distribution width (RDW).

At the end of the experiment blood sample was taken from 3 experimental animals in each treatment for blood chemistry in AKTH (Aminu Kano Teaching Hospital) Kano non EDTA sample bottle was used to put the blood used for chemistry analysis.

The following vitals were determine, total Cholesterol (TC), High Density Lipoprotien Cholesterol (HDL), Triglycerides (TRG), Low Density Lipoprotien Cholesterol LDL.

The data generated was subjected to analysis of variance (ANOVA) using SAS and the means were separated using Tukey post hoc test.

RESULT AND DISCUSSION

The result of the effect of feeding raw beef and chicken meat on blood electrolytes of Wistar albino rat is shown on Table 1. It was observed that Wistar albino rats fed raw beef and chicken

meat at different levels of inclusion had significant ($p<0.05$) effect on potassium (K), urea (UR), and creatinine (CRT). Wistar albino rats fed diet containing 45% beef had significantly ($p<0.05$) higher value of potassium while the control treatment group recorded the lowest value, the level of potassium increase with higher intake of beef and chicken meat. It was observed that wistar albino rats in the control treatment group had significantly ($P<0.05$) higher value of urea while those fed with 30% chicken meat recorded the lowest value. Wistar albino rats fed diet containing 30% beef had significantly ($p<0.05$) higher value of creatinine while rats fed 30% chicken meat recorded the lowest value. It was observed that sodium, chlorine and bicarbonate showed no significant ($p>0.05$) difference between the treatment groups.

The effect of consuming raw beef and chicken meat by Wistar albino rats on their liver functions test is shown on Table 2. It was observed that the intake of varying amounts of raw beef and chicken meat had no significant effect on liver function test except alkaline phosphatase (ALP). Wistar albino rats in the control treatment group recorded significantly ($p<0.05$) higher value for ALP while those fed 30% beef had the lowest value. ALT and AST increase with higher intake of beef and chicken meat except at 45% beef inclusion for ALT.

The effect of feeding raw beef and chicken meat on serum protein content of Wistar albino rat is shown on Table 3. It was observed that the consumption of varying amounts of raw beef and chicken meat had no influence on the levels of total protein (TP), albumin (ALB) and globulin (GLB) among the treatments. The control treatment group recorded the lowest value for all the parameters. Wistar albino rats fed diet containing 45% chicken meat had significantly ($p<0.05$) highest value of TP and GLB. It was observed that Wistar albino rats fed diet containing 15% beef had significantly ($p<0.05$) highest value of ALB.

The effect of consuming beef and chicken meat on cholesterol level of Wistar albino rat is shown on Table 4. It was observed that cholesterol level was significantly ($P<0.05$) affected by dietary treatments. Wistar albino rats fed diet containing 15% chicken meat had significantly ($p<0.05$) higher value of total cholesterol while rats that consumed 45% chicken meat recorded the lowest value, TC decrease with higher intake of beef and chicken meat. It was observed that Wistar albino rats fed diet containing 15% chicken meat had significantly ($p<0.05$) higher value of high density lipoprotein cholesterol while those that consumed 30 and 45% beef and chicken meat had the lowest value. Wistar albino rats fed diet containing 15% beef had significantly higher ($p<0.05$) value of TRG while those fed 30% chicken meat and the control treatment group had the lowest value. Wistar albino rats fed diet containing 15% chicken meat had significantly ($p<0.05$) higher value of low density lipoprotein while those fed 45% chicken meat recorded the lowest value.

The result of the hematological properties of Wistar albino rats fed diet containing varying levels of beef and chicken meat are shown on Table 5. It was observed that white blood cell (WBC), red blood cell (RBC), mean corpuscular volume (MCV), mean corpuscular heamoglobin (MCH) and lymphocyte (LYM) were significantly affected by dietary treatments. Wistar albino rats fed diet containing 30 and 45% chicken meat had significantly ($P< 0.05$) higher value of WBC while those that consumed 45% beef recorded the lowest value. It was observed that rats that consume 30 and 45% chicken meat had significantly ($P<0.05$) lowest levels of RBC while those fed 15% beef recorded significantly ($P<0.05$) highest values. The control experimental animals recorded significantly ($P<0.05$) highest value of MCV and MCH while those fed diets containing 30 and 45% beef of MCV recorded the lowest values also Wistar albino rats fed 45% beef of MCH had the lowest value. It was observed that Wistar albino rats fed 30% chicken meat had significantly ($p<0.05$) highest value of LYM while those consume 45% beef had the lowest value.

The value of sodium (107.67-132.00 mmol/L) is close to the value of 90-110 mmol/L reported by Rosenthal (2013) as normal sodium range. Shehani *et al*. (2018) reported 21.5-28.1 mmol/L which does not agree with 17.3-20.6 mmol/L in our result, it may be due to high temperature, because this experiment was conducted in March and Wistar albino rats have no gall bladder making them susceptible to heat stress. Potassium (4.57-7.17 mmol/L) value is very close to (4.3-5.8 mmol/L) reported by Rosenthal (2013).

Alkaline Phosphatase (ALP) (34.33-49.67 µ/L) it does not agree with 62-230 U/L reported by Marie *et al*. (2008), Huizen reported 20-140 U/L which is in harmony with our result. Marie *et al*. (2008),

reported that is normal to have low ALP, high indicates liver disease. Alkaline Aminotransferase (ALT) has a value of 4.67-7.67 does not agree with 10-35U/L by Rosenthal, (2013), low ALT is normal, liver secret them when there is damage in the liver (Charles *et al.,* 2019). The value of protein is in agreement with 60-83 g/L reported by Landry and Baziri (2016). High density lipoprotein cholesterol and triglyceride (0.1-0.40 and 0.27-0.77 U/L) does not agree with 0.38-1.52 U/L and 0.87-1.37 U/L respectively reported by Akpanabiatu, Umoh, Udosen, Udoh and Edef (2005), this may be due to difference in temperature, as reported by Dean and Hilditch (1933) that animal contain a greater proportion of fatty acids if the environmental temperature is low.

Red blood cells (RBC) values (2.95-9.29 × 10^6/ µL) are very close to 2.9-6.8 × 10^6/µL reported by Shehani *et al*. (2018). Hemoglobin (HGB) and hematocrit (HCT) (8.70-11.00 g/L and 26.47-34.33 %) are in agreement with 8.6-16.5 g/L and 10-48 % respectively as reported by Shehani *et al*. (2018)

Table 1: Effect of Feeding Raw Beef and Chicken meat (%) on Blood Electrolyte of Wistar Albino Rats

	Meat type/level of inclusion							
	Beef				Chicken meat			
Parameters	0	15	30	45	15	30	45	SEM
Na (mmol/L)	125.00	116.67	107.67	125.67	123.33	132.00	128.00	2.61
K (mmol/L)	4.57^{g}	5.17^{f}	6.93^{b}	7.17^{a}	6.27^{e}	6.43^{d}	6.57^{c}	0.21
HCO_3 (mmol/L)	20.67	18.67	19.00	17.33	21.33	21.00	17.67	0.48
Cl (mmol/L)	96.00	88.00	88.00	94.33	93.00	97.33	95.33	1.40
Urea (mmol/L)	2.40^{a}	1.73^{d}	1.90^{c}	1.70^{e}	1.90^{c}	1.60^{f}	2.10^{b}	0.06
Creat (µmol/L)	43.00^{b}	33.67^{d}	43.67^{a}	33.67^{d}	38.33^{c}	28.33^{f}	28.67^{e}	1.20

P= (P<0.05), SEM= Standard Error of Mean, Creat = Creatinine, HCO_3= Bicarbonate

Table 2: Effect of Consuming Raw Beef and Chicken meat (%) on Liver Function Test of Wistar Albino Rats

	Meat type/level of inclusion							
	Beef				Chicken meat			
Parameters	0	15	30	45	15	30	45	SEM
ALP U/L	49.67^{a}	38.33^{f}	34.33^{g}	40.00^{e}	41.67^{c}	40.33^{d}	42.67^{b}	1.21
ALT U/L	6.67	4.67	6.67	5.67	5.33	7.67	7.67	0.44
AST U/L	15.00	10.00	10.00	12.00	9.00	9.00	13.00	0.76
TBL mg/dL	7.33	8.67	10.00	6.00	7.33	8.00	8.67	0.43
DBL mg/dL	2.67	3.67	3.67	2.33	2.67	3.67	4.33	0.26

ALP=Alkaline phosphatase, ALT=Alanine transaminase, AST=Aspartate Aminotransferase, TBL=Total Billirubin, DBL=Direct Billirubin, P= (P<0.05), SEM= Standard Error of Mean

Table 3: Effect of Consuming Different Amount (%) of Raw Beef and Chicken meat by Wistar Albino Rats on Serum Protein Constituent (g/dL)

	Meat type/level of inclusion							
	Beef				Chicken meat			
Parameters	0	15	30	45	15	30	45	SEM
TP	67.67	73.33	79.67	74.33	71.67	74.33	88.66	2.70

ALB	42.00	45.67	44.00	42.67	42.00	41.67	42.33	0.66
GLB	25.67	27.67	35.67	31.67	29.67	32.67	46.33	2.89

TP=Total Protien, ALB=Albumin and GLB=Globumin, P= (P<0.05), SEM= Standard Error of Mean.

Table 4: Effect of Consuming Different Amount (%) of Raw Beef and Chicken Meat on Serum Cholesterol (mmol/L) Level of Wistar Albino Rats

	Meat type/level of inclusion							
	Beef				Chicken meat			
Parameters	0	15	30	45	15	30	45	SEM
TC	1.43^{d}	2.33^{b}	1.84^{c}	1.80^{c}	2.90^{a}	1.10^{e}	1.06^{f}	0.16
HDL	0.10^{c}	0.23^{b}	0.10^{c}	0.10^{c}	0.40^{a}	0.10^{c}	0.10^{c}	0.30
TRG	0.27^{f}	0.77^{a}	0.53^{c}	0.47^{d}	0.67^{b}	0.27^{f}	0.30^{e}	0.47
LDL	1.22^{d}	1.73^{b}	1.50^{c}	1.58^{c}	2.20^{a}	0.88^{e}	0.83^{e}	0.12

TC=Total Cholesterol, HDL=High Density Lipoprotien Cholesterol, TRG=Triglycerides, LDL=Low Density Lipoprotien Cholesterol, P= (P<0.05), SEM= Standard Error of Meat

Table 5: Effect of Consuming Raw Beef and Chicken meat (%) on Heamatological Parameters of Wistar Albino Rats

	Meat type/level of inclusion							
	Beef				Chicken meat			
Parameters	0	15	30	45	15	30	45	SEM
WBC 10^{3}/µL	12.37^{b}	11.50^{c}	11.97^{c}	9.57^{d}	11.87^{c}	14.13^{a}	14.00^{a}	0.35
RBC 10^{6}/ µL	2.95^{g}	9.29^{a}	8.73^{b}	8.27^{d}	8.65^{c}	3.32^{f}	3.97^{e}	0.61
HGB g/dL	9.43	11.00	10.56	9.47	10.43	8.77	8.70	0.25
PCV %	29.53	34.33	32.17	30.13	33.70	26.47	27.23	0.91
MCV f	111.93^{a}	40.07^{d}	40.50^{d}	39.33^{e}	39.43^{e}	99.90^{c}	100.13^{b}	7.17
MCH 10^{3}/µL	31.97^{a}	11.63^{e}	12.00^{d}	11.23^{e}	11.70^{e}	28.00^{b}	25.80^{c}	10.03
MCHC g/dL	29.00	29.40	26.73	28.17	29.63	27.40	26.40	1.16
LYM 10^{3}/µL	46.07^{b}	44.33^{d}	41.00^{e}	39.53^{g}	40.00^{f}	47.52^{a}	45.43^{c}	0.80
RDW %	20.47	19.70	19.50	19.10	20.03	20.70	20.33	0.22

WBC=White Blood Cells, RBC=Red Blood Cells, HGB=Hemoglobin, PCV=Packed Cell Volume MCV=Mean Corpuscular Volume, MCH=Mean Corpuscular Hemoglobin, MCHC=Mean Corpuscular Hemoglobin Concentration, LYM= Lymphocyte, RDW=Red Cell Distribution width, P= (P<0.05), SEM= Standard Error of Mean.

CONCLUSION

It was concluded that both beef and chicken meat did not affect biochemical and hematological parameters in Wistar Albino rats. Based on the result of this experiment consumption of red and white meat does not indicate variation with regards to biochemical and hematological parameters. It is recommended that further research should be conducted by comprising red meat with fish.

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