HEMATOLOGICAL PROLILE OL PIGS IN THE TROPICS AS AFFECTED BY LIVE WEIGHT CHANGES

I. A. Amata L. Bratte and D. O. Adejumo

Abstract

Hematological and clinico-chemical properties of swine can be used to establish herd health status, so in an experiment to determine the effect of weight changes in the blood chemistry of pigs reared commercially in the tropics, in Ibadan (7.38°N and 3.93°E) in South-west Nigeria, a number of randomly selected Yorkshire pigs were sorted into 8 body weight categories of 10 pigs each giving a total of 80 pigs. The pigs were slaughtered and hematological assays were carried out. The body weight categories were 21- 30, 31-40, 41-50, 51-60, 61-70, 71-80, 81-90 and 91-100kg. Both sexes were equally represented in each category. Results showed that animals within the 91-100kg weight range recorded the highest RBC, Hb and PCV values as compared to other weight categories. The WBC count was highest for animals within the 81-90kg weight range, while MCHC values were lowest for animals within the 21-30kg weight range and not significantly($P>0.05$) different from others. MCH and MCV values were highest for animals within the 21-30kg weight range. The serum chemistry results show that albumin and ALT values were highest for animals within the 61-70kgweight range, while animals within the 21-30kg weight range recorded the lowest ALT and urea values. Total serum protein and ALP values were highest in animals within the 51-60kg and 91-100kg ranges respectively. Cholesterol values were lowest in pigs within the 61-70kg range and not significantly ($P>0.05$) different from those within the 21- 30kg, 41-50kg and 71-80kg weight range.

Key Words: Pigs, hematology, WBC, MCHC, RBC, PCV, MCH, serum protein, ALT, ALP, urea and body weight.

Introduction

Food scarcity especially of animal protein origin poses a great challenge to many countries in tropical Africa, some Asian and South American countries (Loosi et. al., 1993). In an open market system such as we have in Nigeria, the price commodity is set by the laws of demand and supply. The existing gap between demand and supply of animal protein sources in the tropics can be said to be responsible for the high prices (Olayide et. al, 1992).

Pigs bred for production in temperate environments adapt well to the tropics, especially the Large White, and is therefore not necessary to crossbreed for maximum productivity. This boosted commercial pig production in the late 70's in Nigeria, as the government encouraged the importation of exotic breeds (Loosi et. ah, 1993). However, the recent economic situation in the country has greatly hampered the importation of exotic breed (Holness, 1991).

For maximum productivity, there is need to obtain information on the herd health status. One of the common criteria for assessing the health status of an animal is the examination of its hematological parameters (Brij et. al, 1977). The function of the blood in the transportation of hormones and metabolites, thermoregulation and general homeostasis cannot be over emphasized (Duke, 1975). These functions are made possible by its constituents, which when destabilized could lead to serious consequences. The results from the blood parameters can provide criteria for the selection of animals within the reference hematological values and for the study of pathological conditions of the animals (Brij et. al), and aid in the treatment of such animals. Blood is composed of red blood cells (RBC: erythrocytes), white blood cells (WBC: leucocytes), platelets (thrombocytes) and the liquid portion (plasma). Varied cells and fragments of cells are suspended within this liquid portion. Upon removal of cells such as fibrinogen and fibrin, the remaining fluid is called serum. Blood serum is composed of protein, albumin, urea, cholesterol and enzymes such as alanine transaminase (ALT) and alkaline phosphatase (ALP). Normal red blood cells and packed cell volume (PCV) in pigs ranges from 5.0×10^6 ml - 8.0×10^6 ml and 32% - 50% respectively (Schalm, et. ah, 1975). Mean corpuscular hemoglobin concentration (MCHC) which is one of the erythrocyte indices

refers to the percentage of hemoglobin in 100ml of red blood cells, as opposed to the percentage of hemoglobin in 100ml of whole blood, which gives the concentration of hemoglobin in cells. The normal porcine MCHC values range from 30-34% (Udo, 1987). The influence of diet and season on hematological traits of animals is very strong (Olayemi et. al., 2001).

Materials and Methods

Eighty Yorkshire pigs were slaughtered in Ibadan (7.38°N and 3.93°E) in Southwest Nigeria. The pigs were slaughtered in line with internationally acceptable standards. Random selection was carried out before slaughtering and classified into the following body weight categories of 10 pigs each: 21-30kg, 31-40kg, 41-50kg, 51-60kg, 61-70kg, 71-80kg, 81-90kg and 91-100kg. Both sexes were equally represented.

Fresh blood samples were collected from the animals for plasma, which was collected in bottles containing ethylene di-amine tetra-acetic acid (EDTA). Specific volume was 2mg/ml of blood. Red blood cells and white blood cells were counted using a hemocytometer and results expressed as X106/pl and $X10^3$/pl respectively. Packed cell volume (PCV) was determined using the microhematocrit method. Hemoglobin (Hb) concentration was measured using cyanomet-hemoglobin method and results expressed as g/dl. Mean corpuscular volume (MCV) mean corpuscular hemoglobin (MCH) and mean corpuscular hemoglobin concentration (MCHC) were calculated from RBC, PCV and Hb values.

$$\text{MCHC (\%)} = \frac{\text{Hb g/100ml blood x 100}}{\text{Hematocrit}}$$

$$\text{MCV (fl)} = \frac{\text{Hematocrit x 10}}{\text{RBC millions/mm}^3}$$

$$\text{MCH (pg)} = \frac{\text{Hb g/100ml blood x 10}}{\text{RBC millions/mm}^3}$$

Serum protein was determined using the biuret method and results expressed as g/dl, alkaline ' phosphatase (ALP) using spectrophotometric methods and results expressed as i.p/1, albumin using densitometer scanning and expressed as g/dl and ALT using spectrophotometrical link reactions and expressed as i.p/1, cholesterol using spectrophotometry and results expressed as mg/dl and urea nitrogen using spectrophotometric measurement of monoxime reaction and results expressed in mg/dl, as reported by Brij (1977).

All data were subjected to a two-way analysis of variance in a randomized complete block design. Means showing significant differences were separated using Duncan's Multiple Range Test (1955).

Results and Discussion

The results of weight related changes on the hematological parameters of pigs are presented in Table 1.

The results reveal that the RBC count is significantly ($P<0.05$) high in pigs within the 51- 100kg weight range, intermediate for those within the 41-50kg weight range and lowest for those within the 20-40kg weight range. However, animals within the 31-40kg weight range have higher RBC counts than those within the 21-30kg weight range. The WBC counts of all animals are not significantly ($P>0.05$) different, ranging between 16.45-18.07 x 10^3/ pi.

The PCV value is significantly ($P<0.05$) higher in pigs within the 21-30kg, 51-60kg and 91- 100kg weight ranges than those within the 61-70kg and 81-90kg weight ranges. Pigs within the 31- 40kg weight range recorded the lowest PCV values.

The Hb values are significantly ($P<0.05$) highest for animals within the 91-100kg weight range; however, similarity exists within the 21 -30kg and 61-80kg weight range. The Hb values of pigs within the 81-90kg and 41-60kg ranges are not significantly ($P>0.05$) higher than those within the 31- 40kg weight range.

The MCH values are highest for animals within the 21-30kg and significantly ($P<0.05$) different from those within the 31-40kg and 81-90kg weight ranges.

MCHC values are highest for animals within the 41-50kg weight range followed by pigs within the 51-60kg and 81-90kg weight ranges respectively.

MCV values are significantly (P<0.05) highest in animals within the 21-30kg weight range and lowest for those within the 51-60kg weight range.

The results show that RBC and WBC counts of all animals within the different weight ranges fell within the normal porcine ranges as recorded by Brij, et.al. (1977), these values increased with lives weights ranging from 5.47- 8.67 xl0^6/pl^3 and 10.3 - 20.7 x 10^3/pl^3 respectively.

High WBC counts could be a sign of infection and leukemia, the normal values recorded could be indications that tropical swine generally are free from infection or have developed high immunity against such infections. The MCV values of animals within the 21-30kg and 31-40kg weight ranges are within the normal values for pigs. However, a decreasing lower value with increasing live weight observed for other weight ranges could suggest iron deficiency in the animals. Decreased MCH values recorded with regards to live weight increase within the 41-100kg weight range could suggest iron deficiency anemia, while the higher values recorded within the 21-30kg ranges could suggest lung disease or excessive bone marrow production of blood cells (Brij et. ah, 1977).

The serum chemistry of the pigs as influenced by the different weight categories is shown in Table 2.

Results show that animals within the 51-60kg weight range recorded the highest total serum protein while those within the 61-70kg weight range recorded the lowest values. Animals within the 31-40kg, 71-80kg and 81-90kg ranges have significantly (P<0.05) higher values than those within the 21-30kg and 91-100kg weight ranges.

The serum albumin is higher in animals within the 61-70kg weight range than those within the weight ranges of 41-50kg and 71-90kg respectively. The animals within the 51-60kg and91-100kg weight ranges recorded the lowest serum albumin values.

Animals within the 61-100kg weight range recorded significantly (P<0.05) high Alp values. Animals within the 21-40kg weight range recorded the lowest ALP values.

The urea values are significantly (P<0.05) lowest in animals within the weight range of 21- ’ 30kg.

Cholesterol values are significantly (P<0.05) higher in animals within the ranges of 51-60kg and 81-100kg than animals within the 31-40kg and 71-80kg weight ranges.

ALT values are highest in animals within the 61-100kg weight range, however those within the weight range of 21 -30kg recorded the lowest ALT values.

Table 1: Hematological Parameters as Affected by Live Weight Changes

Parameter	21-30	31-40	41-50	51-60	61-70	71-80	81-90	91-100
RBC(xl0^6/gl)	6.466^{c}	6.894^	7.262^{b}	8.323^{a}	7.996^{a}	8.037^{a}	8.374^{a}	8.400^{a}
WBC(xl07pl)	17.75^{a}	17.81^{a}	16.45^{3}	17.96^{a}	17.68^{3}	17.24^{a}	18.07^{a}	17.60^{a}
PCV(%)	38.20^{a}	34.60°	35.03^{bc}	38.02^{a}	37.51^{ab}	37.61^{ab}	37.30^{abc}	40.20^{a}
Hb(g/dl)	12.76^{a}	11.58°	11.97^{bc}	12.28^{bc}	12.5.8^{abc}	12.48^{abc}	11.99^{bc}	13.38^{a}
MCH(pg)	20.63^{a}	17.17^{b}	16.50^{bc}	14.7.3 ^{bc}	15.75^{bc}	15.58^{bc}	14.37^{c}	15.96^{bc}
MCHC(g/dl)	30.30^{ab}	33.45^{ab}	34.24^{a}	32.25^{b}	33.75^{ab}	33.23^{ab}	32.13^{b}	33.43^{ab}
MCV(fl)	61.72^{a}	51.27^{b}	46.16^{bc}	42.41°	46.56^{bc}	47.09^{bc}	44.68^{bc}	47.75^{bc}

Weight Group (kg)

Parameter	21-30	31-40	41-50	51-60	61-70	71-80	81-90	91-100
Total protein(g/dl)	4.96^{cd}	5.40^{bcd}	6.23^{ab}	6.82“	4.7 l^{d}	5 ^Qabcd	5.99“^{bc}	4.96^{cd}
Albumin(g/dl)	1.52^{abc}	1.40^{bc}	1.86^{ab}	1.24^{c}	1.91“	1.84“^{b}	1.85^{ab}	1.25^{c}
ALP(i.g/l)	46.00^{d}	46.58^{d}	65.34^{c}	76.75^{b}	99.20“	91.97“	93.45“	95.93“
Urea(mg/dl)	19.30^{b}	30.65“	31.54“	38.59“	32.38“	35.49“	40.81^{a}	39.51^{a}
Across the rows, means with the same letter are not significantly (P>0.05) different.								

Table 2: Serum Chemistry as Affected by Live Weight Changes

Weight Group (kg)

Cholesterol(mg/dl	118.00^{bc}	138.94^{i,b}	114.82^{bc}	160.86“	106.94°	134.98“^{bc}	157.7“	157.7“
ALT(i.|i/l)	31.9 l^{c}	45.72^{ab}	36.06^{bc}	36.54^{bc}	56.46^{a}	52.59^{a}	55.45“	53.02“

Across the rows, means with the same letter^{-} are not significantly (P>0.05) different.

The influence of diet and season on hematological traits of animals is very strong (Olayemi et. ah, 2001). From this study there exists some weight related variations in the hematological parameters of swine reared commercially in the tropics. The RBC and WBC counts of all the animals within the different weight ranges fell within the normal pig ranges (Brij et. al). Results also show that PCV, MCHC and Hb'values were within normal ranges. Serum chemistry values are also within range as reported in literature (Altman et. ah, 1974). Cholesterol increased with live weight as with urea values. However the albumin values are not in accordance with reported values (Tumbleson, 1972) which report that albumin values increase with age and weight.

Conclusion

Hematology results do not show any variation with weight changes, values are within normal porcine ranges. Serum chemistry does not show any weight related changes except urea values, which were rather on the high side but not significant.

The experimental results suggest that tropical swine have hematological and serum values within ranges reported in literature.

References

Altman, P.L. and Dittmer, D.S. (1974). Biology Data Book. Washington D.C. Federation of American Societies for Experimental Biology

Brij, M. Mriruka and Noward, M. Rawnsley. (1977). Chemical, Biochemical and Hematological Reference values in normal Experimental Animals.

Duke, H.N. (1975). Duke’s Physiology of Domestic Animals 8th ed. Ithaca and London: Comstock Publishing Associates, A division of Cornell University Press.

Holness, H. David (1991). *The Tropical Agriculturist.* Pigs, pp 3-4 Macmillan Education Ltd Publishers London.

Loosi, J.K.; Oyenuga, V.A. and Babatunde, G.M. (1993). Animal Production in the Tropics.

Olayemi, F.O.; Oke, O.A.; Oyewole, J.O. and Ogunsomi, A.O. (2001). The effect of season on the blood profile of the African Giant Rat. Israel Vet. Med. Assoc. Vol. 50 n°4.

Olayide, S.O.; Olaosun, D. Idusogie, E.O. and Abiagom, J.D. (1992). A quantitative analysis on food requirements, supplies and demands in Nigeria, 1968-1985” Federal Dept of Agric, Lagos, Nigeria.

Schalm, O.W.; Jaine, N.C. and Caroll, E.J. (1975). Vet Hematology, 3rd ed. Lea and Febiger, Philadelphia.

Tumbleson, M.E. (1972). Protein-calorie under nutrition in young Sinclair miniature swine, serum biochemistry and hematological values. Ady. Automated. Anal. Technician. Int. Congr. 7:51.

Udo, H. (1987). Effects of cassava peel supplementation of swine ration on performance, hematological -and serum metabolites in growing pigs. Msc Thesis, Dept of Animal Sc. U.I. Ibadan, Oyo State.