

HAEMATOLOGICAL AND SERUM BIOCHEMICAL PATTERNS IN LARGE WHITE PIGS RAISED IN GHANA.

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ABSTRACT

Haematological and serum biochemical parameters were determined for day-old, 6-, 16- and 24-week old Large White pigs raised in a humid tropical environment. The values for Packed Cell Volume (PCV), leucocyte count and differential white cells counts were not significantly ($P > 0.05$) different for the various age groups. The haemoglobin (Hb) level (g %) of the 24-week old pigs (13.7) was however significantly ($P < 0.05$) greater than that of the day-old (10.6), 6-week old (10.4) and 16-week-old (11.7) pigs. Blood glucose and serum urea levels of the day-old pigs were higher than those observed for the other age groups. Some differences existed between the blood picture of the pigs studied in this experiment and those reported in the literature.

Keywords; Haematology, Biochemical patterns, Pigs, Ghana.

INTRODUCTION

The indigenous pigs of the humid tropics are generally characterised by low growth and reproductive rates and poor carcass characteristics. In order to increase pork production, improved breeds of pigs from the temperate regions have been introduced by the countries in these areas and significant improvements have been achieved in the pork production programmes of the importing countries.

Several factors affect the blood profile of pigs. The effects of age, some management practices and nutritional factors have been clearly demonstrated [1,2,3,4,5,6,7]. Marple *et al.* [8] and Tewes *et al.* [9] have indicated that temperature and other environmental factors can influence the blood profile of pigs during all phases of their life cycle. There is a dearth of information on the haematology and serum biochemical

parameters of temperate breeds of pigs raised in a tropical environment. Information on the blood variables may be useful tools in assisting in the nutrition, health and management of pigs (Odink *et al.* [3]). This study was therefore conducted to determine the values for some of these parameters in the Large White herd at the University of Science and Technology, (U.S.T.), Kumasi, Ghana, and to compare the values thus obtained with those reported elsewhere.

MATERIALS AND METHODS

The experiment was conducted at the Livestock Section of U.S.T., Kumasi. The climate of the area has been described by Kabuga and Alhassan [10]. The 50-sow herd operation is an intensive unit with all pigs generally being fed on a restricted scale, on diets with crude protein levels varying from 14 to 20% depending on stage of growth. Water is however, available *ad libitum*. Creep feeding is usually initiated 2 weeks postpartum and piglets are weaned between 5 and 6 weeks of age.

A total of 48 Large White pigs of varying ages were randomly selected from 10 different litters on the basis of age, sex and weight. The age groups used were day-old, 6-16, and 24-week-old with respective mean weights of 1.0, 10.2, 25.0 and 57.1 kg. There were 12 pigs in each age group and each group had an equal number of entire males and females.

Blood Sampling and Analysis

Blood samples were collected between 0800 and 1200 h GMT as directed by Carle and Dewhirst [11]. Two samples were taken from each pig with the first sample being collected in a tube containing EDTA; this was subsequently used for the blood glucose and haematological determinations and the other sample was allowed to clot in order to obtain serum for the biochemical studies. The procedures adopted for the determination of blood glucose and serum urea, total



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protein, albumin, globulin, calcium (Ca), inorganic phosphorus (P), alkaline phosphatase, serum glutamic oxalotransaminase (SGOT) and cholesterol have been described by Varley [12]. The Hb content and the haematocrit (PCV) levels were estimated by the cyanomethaemoglobin and microhaematocrit methods respectively [13]. Total leucocyte counts were obtained using an improved Neubauer counting chamber [14] and blood smears stained with Giesma stain (BDH Chemicals Ltd., Poole, England) were prepared for the estimation of the differential leucocyte profile.

Statistical Analysis

All data obtained were subjected to the F-test for significance [15], and Duncan's Multiple Range Test was used to establish the differences between means.

RESULTS AND DISCUSSIONS

Haematology

The values obtained at the different ages for the 48 pigs for Hb, PCV, total leucocyte and differential leucocyte counts are shown in Table 1. The mean Hb concentrations in the day-old, 6-, 16-, and 24-week-old pigs were 10.6, 10.4, 11.7 and 13.7 g/100 ml, respectively. The mean value for the 24-week-old pigs was significantly ($P < 0.05$) different from those recorded in the younger pigs. Pond and Maner [16], quoting various sources, have reported haemoglobin values ranging from 8-11 in newborn to 9-14 g/100 ml in 20-week-old pigs. The large range in Hb values could be due to management factors; for example, the intensive rearing of pigs, if not accompanied by an extra source of iron, can cause a drop in Hb levels and lead to anaemia in piglets. Even though the PCV values tended to increase (27.8 to 30.5%) with age, the differences between the means for the various age groups were not significant ($P > 0.05$). Generally, the PCV values

obtained in this study were lower than those summarized by Pond and Maner [16]. The pattern of changes in total leucocyte count with age was quite erratic and there was a wide range within all the age groups. An increase in leucocyte count is associated with active defence against infection but the variation in leucocyte counts in this study could not be attributed to disease infection as none of the 48 pigs showed any clinical signs of illness and were thus assumed to be healthy. As expected, lymphocytes constituted the largest fraction of the leucocyte population in all age groups and no significant differences were observed when the results for the various age groups for each type of cell were compared. The concentration of neutrophils (Table 1) was considerably lower than the 40% that has been reported elsewhere ([16])

Biochemical Parameters

The mean blood glucose concentration in the day-old pigs was 101.6 mg/100 ml (Table 2). Morrill [17] reported a value of 102.6 mg/100 ml and indicated that at birth the pig had an appreciable reserve of carbohydrates. Tumbleson and Kalish [18] reported a value of 113.9 mg/100 ml for newborn pigs. The significantly lower level of 63.3 mg/100 ml in the 67-week-old pigs increased to 104.4 and decreased to 95.7 mg/100 ml at 16 and 24 weeks of age respectively. The lower blood sugar levels in the very young pig (6 week old) could be due to poor development of the mechanism for regulating metabolism in the young pig especially if there is nutritional stress (Pond and Maner 16). The mean serum urea concentration in the day-old pig was 34.2 mg/100 ml and it showed a steady and significant ($P < 0.05$) decline up to the 16 week age group. Morrill [17] had reported a value of 22.3 mg/100 ml which was considerably lower than those observed in the newborn pigs in this study. The high blood urea concentration of newborn pigs used in this study could be due to an

TABLE 1: MEAN VALUES FOR SOME BLOOD CONSTITUENTS IN PIGS OF VARYING AGES*

Age	Hb, g%	PCV, %	Leucocyte count, $\times 10^3/\text{cm}^3$	Neutrophils	Eosinophils	Lymphocytes	Monocytes	Basophils
Day-old								
Mean	10.6 ^a	27.8	18.9	31.3	6	58	4.2	0.3
Range	8.5-12.5	17-38	5.5-33.1	19.48	5-8	40-68	2-7	0-1
6-week-old								
Mean	10.4 ^a	29.7	19.7	30.5	6.2	59.4	3.8	0.2
Range	7.6-13.8	18-42	12.8-30.5	20-41	5-9	50-70	2-6	0.1
16-week-old								
Mean	11.7 ^b	29.9	15.8	30.3	6.5	59.3	3.8	0.2
Range	5.6-15.5	12-36	7.1-29.8	22-42	3-8	45-68	2-6	0-1
24-week-old								
Mean	13.7 ^b	30.5	17.4	31.2	6.7	56.6	4.5	0.3
Range	8.9-15.6	20-40	11.3-24	28-40	4-10	45-65	2-8	0-1

*Each value is the mean for 12 pigs/observation.

a,b. Means in each column with similar or no superscripts are not significantly different ($P > 0.05$).

TABLE 2: MEANS AND RANGES FOR SOME SERUM BIOCHEMICAL PARAMETERS IN PIGS OF VARYING AGES*

Age	Glucose mg/100ml	Urea mg/100ml	Total prot. g/100ml	Albumin g/100ml	Globulin g/100ml	Ca g/100ml	Inorg.P g/100ml	SGOT Units/ml	Alk.PTase KA units/100ml	Cholesterol mg/100ml
Day-old										
Mean	101.6 ^a	34.2 ^a	9.0	3.7 ^a	5.0 ^a	8.8 ^a	5.3 ^a	12.6 ^a	30.2 ^a	177.5 ^a
Range	88-114.3	16-52.6	6.8-10.7	3-4.4	306.7	3.7-14	3.7-14	5.2-18.1	20-50.6	112-258
6-week-old										
Mean	63.3 ^b	20.6 ^b	7.8 ^a	4 ^a	3.8 ^b	7.8 ^a	4.9 ^a	15.8 ^a	9 ^a	212.1 ^a
Range	40-92.9	11-31	6.7-8.9	2.3-5.2	5-5.2	5.4-11	4.1-5.7	6.7-22.6	4.2-19.4	141-291
16-week-old										
Mean	104.4 ^b	12.5 ^a	8.9 ^a	4.6 ^a	4.2 ^b	7.3 ^a	5.6 ^a	16.4 ^a	9.1 ^a	197.3 ^a
Range	55-115.7	3-19.4	8.1-10.2	3.5-11	2.3-5.8	3.5-11	4.1-6.7	10.4-26.7	5.9-13.2	147-235
24-week-old										
Mean	95.7 ^a	10.7 ^a	9.4 ^a	4 ^a	5.4 ^a	11.7 ^b	5.3 ^a	17.5 ^a	7.9 ^a	235 ^a
Range	67.5-152	5.5-18.1	8.1-11.2	2.9-5.3	2.9-6.9	7.6-14.6	4.5-6.7	6.3-27	3.7-16.3	70-402

*Each value is the mean for 12 observations.

a,b,c. Means within a column having different superscripts are significantly different (P<0.05).

increased metabolism of these pigs rather than it being a sign of renal dysfunction. The progressive drop in urea concentration of the pigs used in this study could be due to the reduction in protein content of the diets from 20% in the weaning diet to about 14% in the finishing diet (16-24 week old pigs). Garner *et al* [19] indicated that a drop in the protein level in the diet after weaning may lead to a reduction in the serum urea concentration. Puchal *et al* [20] had also observed that serum urea concentration decreased with age. The higher concentration of serum proteins at birth could be explained by the fact that in newborn pigs, there is direct absorption of proteins. The albumin level in the neonatal pig is influenced to a large extent by the ingestion of colostrum which supplies this component in such pigs and also initiates its synthesis. The absorption of colostrum also causes a rise in globulin levels.

Serum Ca levels of pigs showed a non-significant (P>0.05) decline from day old to 16 weeks old. However, Ca levels of pigs at 24 weeks were significantly higher (P<0.05) when compared to those of the earlier weeks (Table 2). Inorganic serum P levels were similar in all the pigs studied. However, the values for Ca and inorganic P are generally lower than the calcium levels of 10.8 and 10.6 mg/100 ml reported for young and mature pigs or the 5.3 and 7.1 mg/100 ml inorganic phosphate reported in the literature for both young and mature pigs [21]. Varley [12] indicated that the normal total serum cholesterol concentration could vary quite widely. In this study, cholesterol level tended to increase with increase in age. A similar pattern was observed by Megibben *et al* [22] and Pond and Maner [16]. However, the values obtained in this study (Table 2) were generally higher than those reported by these authors.

Serum GOT levels, as shown in Table 2, were not significantly (P>0.05) different in the four groups, but

tended to increase with age from day-old to 24 weeks of age. Serum alkaline phosphatase activity was, as expected, highest (P<0.05) in the day-old pigs, but was similar in the 6- and 16-weeks-old pigs with a slight decline in the 24-week-old pigs.

The results of this experiment have shown the extent of variation in the blood and other biochemical parameters in Large White pigs raised in a tropical environment. Further studies to establish a relationship between blood variables and health status may help in effective management of pig herds (Odink, 3).

CONCLUSION

This experiment has provided evidence that differences may exist in the values for some of the haematological and serum biochemical parameters of exotic pigs raised in a tropical environment. It is suggested that these differences may be due to either the diet or the climate or both.

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