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Age dependent variation of blood metabolites of Mizo local pig (Zovawk)

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Abstract
Present study reports the reference values of blood metabolites in different age groups of Zovawk pigs, an indigenous pig of Mizoram, India. It was observed that although the glucose level varied slightly between suckling and grower piglets, it was significantly the highest in case of adult pigs. The cholesterol and triglycerides also exhibited similar trend of variation. However, the LDL and HDL concentration did now show any significant difference amongst the experimental groups. Similarly, the total protein level was found to be significantly higher in adult pigs. However, the difference recorded in albumin concentration amongst the experimental groups was non-significant. Conversely, globulin concentration was apparently higher in adult stage. There was not much difference in the level of BUN, creatinine and uric acid between suckling and grower pigs, but uric acid concentration was found to increase as age advances. The variation observed in the creatinine concentration among the experimental groups was only numerical. Present study indicates nearly a constant level of total bilirubin, direct bilirubin and indirect bilirubin in different experimental groups of pigs irrespective of age.

Keywords: Zovawk, serum, metabolites, clinical, interpretation

Introduction
Pig farming occupies a unique place in Mizoram, since it is socio-culturally intermingled with the livelihood of tribal people of the state. Pigs are reared by almost every family in Mizoram as a backyard venture. Zovawk is an indigenous small size local pig of Mizoram and attain 30-40 kg body weight at one year of age. Although it attains puberty at an early age of about 3-4 months, in practice they are normally bred at 8-9 months of age. Litter size varies from 6-10 piglets, with individual weight between 200-300g. Due to unique physical character and hardiness, these small sized pigs might be a source of gene pool for future breeding strategies. Further, with the ever-increasing interest in indigenous livestock breeds as a possible solution to increase efficiency of production in harsh conditions, there is an urgent need of basic physiological database on such indigenous breeds so as to plan and implement health and disease monitoring program to ensure sustainable development of piggery farming and its economic viability.

Blood biochemical parameters are indices of health status of animals (Yaqub *et al*., 2013) [18]. Hence, reference values for such indices become imperative for any disease diagnosis, prevention and controlling program as it forms the very basis for clinical interpretation of laboratory data. It is univocal that physiological values of blood meabolites are influenced by various factors such as age, sex, breed and physiological stages (Mirzadeh *et al*., 2010) [13]. Therefore, it becomes utmost necessary for a clinician/veterinarian to know the detail picture of physiological values of metabolic parameters so as to diagnose any deviations of the same in the presence of diseases, so that appropriate therapeutic regimen may be prescribed. In view of the above considerations, present study was attempted to establish physiological baseline data for major blood metabolites of Zovawk pig as well as to study their variation due to advancement of age.

Material and methods
A total of 30 clinically healthy Zovawk pigs maintained in the pig farms of the college and AICRP, College of Veterinary Sciences & Animal Husbandry, Central Agricultural University, Selesih, Aizawl, Mizoram were selected and broadly categorized into three groups (n=10) irrespective of sex: group-I (suckling piglets ≤ 42-56 days of age), group-II

(>grower pigs 160- 200 days of age) and group III (adult breeding pigs ≥ 8months of age). All the experimental pigs were reared along with other animals under standard management practises and fed as per the routine feeding schedule followed in the Livestock Farm of the college.

About 10 ml of blood was collected aseptically from each animal by venipuncture of anterior venacava using pre-sterilized polypropylene disposable syringes with 18G 1.5" hypodermic needle, out of which 5 ml was poured into Heparin coated tubes and was used for hematological analysis. Cold chain was maintained for collected blood samples during the transit from the farm to the laboratory for hematological studies. Whereas, the remaining 5 ml was transferred into 10 ml capacity sterile screw-capped centrifuge tubes. The tubes were kept in a slanting manner for 1 hour at room temperature for clot formation and the serum was separated immediately after coagulation of the blood by centrifugation at 2,500 rpm for 10 minutes. The supernatant serum samples were aspirated by positive displacement 1000 µl pipettes changing the pipette tip for each sample and transferred to sterile screw capped cryo-vials. The serum samples were subsequently subjected to biochemical analysis in research laboratory of Veterinary Physiology & Biochemistry Department, College of Veterinary Sciences & A.H., CAU, Selesih, Aizawl.

Results and discussion

The Mean ± SE values of major metabolites of the different experimental groups of Zovawk pigs have been presented in Table-1.

Table 1: Mean ±SE of blood metabolites in different experimental groups of Zovawk pigs

Parameters	Group-I	Group-II	Group-III
Glucose (mg/dl)	111.10±6.07^a	109.19±6.81^a	120±7.24^b
Total Cholesterol (mg/dl)	90.01±2.46^a	91.08±2.31^a	94±1.89^b
Triglycerides (mg/dl)	38.02±3.21^a	38.26±3.11^a	42.88±3.41^b
HDL-Cholesterol (mg/dl)	34.5±5.1^a	34.1±5.6^a	35.5±5.5^a
LDL (mg/dl)	48.0±6.1^a	48.1±6.4^a	47.5±5.2^a
Total protein (g/dl)	6.36±0.19^a	6.23±0.22^a	8.78±0.29^b
Albumin (g/dl)	3.05±0.17^a	3.07±0.19^a	4.01±0.27^a
Globulin (mg/dl)	3.31±0.22^a	3.16±0.19^a	4.77±0.16^a
A:G ratio	0.95±0.11^a	0.97±0.09^a	1.18±0.0.7^a
BUN (mg/dl)	27.11±1.12^a	26.51±1.15^a	31.84±1.20^b
Uric acid (mg/dl)	0.75± 0.09^a	0.78± 0.04^a	1.42± 0.15^b
Creatinine (mg/dl)	1.66±0.15^a	1.50±0.12^a	1.74±0.23^a
Total Bilirubin (mg/dl)	0.06±0.02^a	0.05±0.02^a	0.04±0.02^a
Direct Bilirubin (mg/dl)	0.03±0.11^a	0.03±0.13^a	0.03±0.10^a
Indirect Bilirubin mg/dl)	0.03±0.11^a	0.02±0.11^a	0.01±0.11^a

Means bearing different superscript (a, b & c) in a row differ significantly ($p<0.05$)

It is evident from Table-1 that the glucose level varied slightly between suckling and grower piglets, but significantly highest level was recorded in case of adult pigs. Similar type of age related changes was also reported in previous studies (Zvorc *et al*., 2006; Yeom *et al*. 2012) [21, 19]. An increase in glucose concentration similar to our study was also found by other authors (Rekiel *et al*., 2015) [17]. Changes in glucose concentration that occur during transition from piglet to adult breeding pigs are the result of physiological changes in metabolic processes (Komatsu *et al*., 2005) [12].

Similarly, the cholesterol and triglycerides also did not vary significantly between Group-I and group-II, but their level was found to increase significantly as age advances However, the LDL and HDL concentration did now show any significant difference amongst the experimental groups although slight decline of LDL was recorded during adult stage. Nonetheless, the concentrations of lipid parameters obtained in this study are in agreement with the reference values reported by other authors in pigs (Friendship *et al*., 1984; Brockus *et al*., 2005; Kaneko *et al*., 2008) [9, 2]. On the contrary to our study, hyper-cholesterolaemia have been reported in adult female, particularly during pregnancy, which is attributed to the changes in sex steroid hormones, hepatic and adipose metabolism (Chiang *et al*.,1995; Butte, 2000) [4, 3]. During pregnancy there is an increased production of sex steroids. The increased progesterone concentration contributes to the rise in LDL levels (Chiang *et al*., 1995) [4] and in return circulating LDL cholesterol is the chief substrate for placental progesterone synthesis (Edison *et al*., 2007) [8]. The elevated maternal oestrogen concentration in pregnancy causes an increase in total cholesterol, LDL cholesterol and triglycerides. LDL found in maternal serum during pregnancy is atherogenic, small and dense (Brizzi *et al*., 2000). Hepatic lipase activity also increases during pregnancy, which causes surges of triglyceride synthesis in the liver and is associated with raised LDL levels (Brizzi *et al*.,2000). The overall effects of altered lipid metabolism in pregnancy are accumulation of maternal fat stores in the first half and enhanced fat mobilization in the second half of pregnancy (Butte, 2000) [3].

The total protein level was found to be significantly higher in adult pigs. However, the difference recorded in albumin concentration amongst the experimental groups was non-significant. Conversely, globulin concentration was apparently higher in group-III. Our findings are in constituent with the report of Dutta and Dutta, (2019) [7]. The higher protein concentration recorded in the adult groups of Zovawk may be due to a possible increase in globulin and a slight decrease in albumin (Per and Lobl, 1960) [16]. The reduction in albumin and the increase in globulin concentrations is proportional to increase in age except during pregnancy and these have been associated with a reduction in protein synthesis (albumin) by the liver and an increased exposure to different antigens and/or diseases over time, hence stimulating more antibodies (globulins) into the blood stream to fight these antigens and/or diseases (Dubreuil *et al*.,2005) [6]. Paaby (1960) [14] reported that a fall in the concentration of plasma and serum proteins has been found during pregnancy in every study, but there is no agreement either about the extent of the fall or the actual pattern of change.

There was not much difference in the level of BUN, cretinine and uric acid between group-I and group-II. The BUN level increased significantly in group-III. There was also significant hike in uric acid concentration in the adult pig. Conversely, the variation observed in the creatinine concentration among the experimental group was only numerical. Similar trend of variation was also reported in sheep by Yokus *et al*. (2006) [20] and Doornenbal *et al*. (1988) [5]. The elevated urea/creatinine ratio is important indicator of the increased GFR which increases especially in late gestation due to the increased total blood volume. Uric acid, a metabolic product of purines is an antioxidant which scanvenges reactive oxygen radicals in the blood. Age might have increased the free radicals and in order to neutralize that uric acid might have been increased (Knapp *et al*.,2004) [11].

Present study indicates nearly a constant level of total bilirubin, direct bilirubin and indirect bilirubin in different experimental groups of pigs irrespective of age, which is in accordance with the report of Palacios *et al*. (2018) [15], who

stated that bilirubin were not affected by the physiological status or the genetic cross and remained in the range that is considered normal.

It may be concluded that age related alteration of blood metabolites do occur although the extent of variation depends on the particular parameters. Data generated may be of use as reference values for interpretation of laboratory results so as to monitor the health of zovawk pigs.

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