Content list available at http://epubs.icar.org.in, www.kiran.nic.in; ISSN: 0970-6429

Indian Journal of Hill Farming

2017, Special Issue, Page 100-105

Effect of Sex on Hematological Profile of Zovawk - An Indigenous Pig of Mizoram Hills

Prava Mayengbam[1*], Thingujam Chaa Tolenkhomba[2]

[1]Department of Veterinary Physiology and Biochemistry, College of Veterinary Sciences and Animal Husbandry, Central Agricultural University, Selesih, Aizawl-796014, Mizoram.

[2]Department of Animal Breeding and Genetics, College of Veterinary Sciences and Animal Husbandry, Central Agricultural University, Selesih, Aizawl-796014, Mizoram

ARTICLE INFO

Article history:
Received 10 June 2017
Revision Received 28 September 2017
Accepted 23 November 2017

Key words:
Indigenous, Zovawk, pig, sex, Mizoram

ABSTRACT

Hematological profile was investigated in three different age groups of Zovawk *viz.* pre-weaning (4 to 5 weeks old), grower (24 to 26 weeks old) and adults (14 to 16 months old) in three different phases of a year. Each of the groups consisted of 36 pigs with equal number of male and female. A total of 324 blood samples collected from different groups was investigated to find out the effect of sex on total erythrocyte count (TEC), hemoglobin (Hb), total leukocyte count (TLC), packed cell volume (PCV), mean corpuscular volume (MCV) and mean corpuscular hemoglobin (MCH), mean corpuscular hemoglobin concentration (MCHC) and differential leucocyte count (DLC) for lymphocyte, Neutrophil, monocyte, eosinophil and basophil by using automatic blood analyzer Vetscan HM5. Influence of sex on hematological profile was found only in pre-weaning group. Out of all the hematological parameters investigated, sex influenced TEC ($P<0.01$), PCV ($P<0.05$) and TLC ($P<0.01$). TEC, PCV and TLC of pre-weaning pigs were higher in females than in males. The study revealed hematological profile indicative of its wild origin in the past and its adaptability to the existing climatic conditions. The presented baseline hematological data of Zovawk could be used in monitoring the herd health and proper diagnosis of diseases.

1. Introduction

Zovawk pig is one of the deshi/local types of pig available in the North eastern states of India. The home tract of Zovawk is in different parts of Mizoram state in India. This pig is of scavenging type. The Zovawk pigs are of small size and attain puberty at the age of 2.5 months when they are about 4.5 kg body weights. The first farrowing occurs at the age of 9-10 months when they are of about 40 kg body weights (Hmar *et al.,* 2010). As per its behavior this pig is very alert to the social happening such as presence of any intruder in the farm by making immediate response to the sound or the gestures of the intruder.

Among all the livestock, pig is one of the most valued and popular as 100% tribal population in the region are pork eaters. Pork is the preferred meat amongst the people of Mizoram. The Zovawk pork is preferred to others by people of Mizoram due to its taste and its medicinal properties as conceived by local people. Out of the total livestock population of 3,11,856 in Mizoram, pig population is 2,45,238 in which indigenous pig population is only 32,286 and of these, this pig is being domesticated more in rural areas than in the urban areas of Mizoram (27,155 vs. 5,131) as per the 19th Livestock Census (2012). Since this pig's population is very low as compared to other exotic breeds and crossbreds reared and more of the animals are confined in rural areas of Mizoram, supply of Zovawk pork in the market is limited and it is almost negligible.

*Corresponding author:prava.mayengbam@gmail.com

There is, therefore, a need of the situation to increase the population and productivity of Zovawk in order to meet its demand in the market as well as a part of conservation of the pig. As a part of AICRP on Pigs, the Zovawk pigs were brought from different parts of Mizoram. They were being reared and taken care under AICRP on Pigs at the College of Veterinary Sciences and Animal Husbandry, Selesih, CAU, Aizawl, Mizoram, India (Annual Report 2012-13).Screening of health status of animals requires knowledge on the normal baseline data on various physiological parameters (Oguike *et al.,* 2011). Hematological profiles are important indicators of health and disease status and have been used in disease diagnosis and treatment of many diseases (Gong *et al.,* 2010). Recently a few scientific studies have been reported in terms of the body conformation and effect of age and season on hematological and blood biochemical profile of Zovawk (Prava *et al.,* 2012; Tolenkhomba *et al.,* 2013; Mayengbam *et al.,* 2014). Studies on effects of sex on hematological profile of pigs indicated different results depending on the breed, location and season (Aladi *et al.,* 2008; Eze *et al.,* 2010; Oluwole1 and Omitogun 2016). The present investigation was therefore undertaken in order to find out the effect of sex on normal baseline data of male and female Zovawk pigs in different age groups. The presented data could be utilized as reference values for examination of Zovawk pig as well as in diagnosis of diseases which will ultimately facilitate in management systems and averting the economic losses.

2. Materials and Methods

Ethical approval: The present investigation was carried out after the approval of the Institutional Animal Ethics Committee. Selection and maintenance of the animals: A total of 324 apparently healthy Zovawk pigs reared in the Livestock Farm, College of Veterinary Sciences and A.H., Selesih, Aizawl, Mizoram were selected based on the age and were divided into three age groups *viz.* pre-weaning group (4 to 5 weeks old), grower group (24 to 26 weeks old) and adults (14 to 16 months old). Each group comprising of 36 animals were used for blood sampling in three different phases of a year. Each of the groups was further divided into male and female groups comprising 18 animals each. The animals were maintained along with other animals and fed as per the routine feeding schedule followed in the Livestock Farm of the college. Weaning of the pigs was done on the 56^{th} day of age. The average body weight of pigs used in the present investigation in pre-weaning, grower and adults groups were 2.2±0.11 kg, 5.0±0.22 kg and 60.00±1.5 kg respectively.

Collection of blood sample: A total of 324 blood samples were collected from three different age groups in three different phases of a year *viz.* summer, rainy and winter periods. Adequate care and necessary steps were taken up to prevent any untoward stress to the animals. Blood samples were collected in 3 ml capacity Heparin coated tubes by venipuncture of anterior venacava. Cold chain was maintained for collected blood samples during the transit from the farm to the laboratory for hematological studies. The blood samples were analyzed immediately after the collection for the hematological parameters *viz.*total erythrocyte count (TEC), hemoglobin (Hb), total leukocytecount (TLC), packed cell volume (PCV), mean corpuscular volume (MCV) and mean corpuscular hemoglobin (MCH), meancorpuscular hemoglobin concentration (MCHC), and differential leukocyte count (DLC) for lymphocyte, neutrophil, monocyte, eosinophil and basophil by using automatic blood analyzer Vetscan HM5.Statistical analysis: Data were analyzed using SPSS version 17. Unpaired t-test was applied to evaluate the effect of sex on hematological parameters and $P<0.05$ was accepted as statistically significant.

3.Results and Discussion

The Mean ± S.E. values of erythrocyte and leukocyte pictures of male and female Zovawk pigs in different age groups were presented in Table-1 and Table-2 respectively. Statistical analysis revealed no significant effect of age except for TEC ($P<0.05$).

3.1 Erythrocyte picture

Erythrocyte picture of male and female Zovawk pigs was presented in Table 1. Influence of sex on erythrocyte picture was observed in pre-weaning group but not in grower or adult groups. Differences in erythrocyte profile in pre-weaning group could be due to dependency on mother's milk with minimal feeds unlike the growers and adults. The erythrocyte picture revealed significantly higher TEC ($P<0.01$) and PCV ($P<0.05$) in females than in males. The present finding was in contrast to previous reports that male pigs had higher TEC and PCV than females (Egbunike and Akusu 1983). Oluwole and Omitogun (2016) reported higher PCV in males than females at 9 weeks of age and higher in females than males at 25 weeks of age in Nigerian indigenous pigs and their hybrids. Previous studies in Nigerian pigs reared under intensive rearing system and humid tropical environment revealed no influence of sex on any of the hematological parameters at different age groups (Aladi *et al.,* 2008; Eze *et al.,* 2010). The authors suggest for further detail study to investigate the reason for higher TEC in females than in males in pre-weaning group.

Table 1. Erythrocyte picture of male and female Zovawk pigs in different age groups

Parameter	Pre-weaning		Grower		Adult	
	Male	Female	Male	Female	Male	Female
TEC ($x10^6/\mu l$)	8.73 ±0.41	14.32** ±0.97	9.08 ±0.28	8.77 ±0.40	8.73 ±0.41	9.62 ±0.43
Hb (g/dl)	13.01 ±0.59	11.55 ±0.81	15.46 ±0.52	14.54 ±0.58	13.01 ±0.59	17.89 ±0.77
PCV (%)	44.14 ±1.99	52.94* ±3.18	49.84 ±1.76	47.59 ±1.68	44.14 ±1.99	60.13 ±1.86
MCV (fl)	51.90 ±2.72	52.68 ±2.90	55.68 ±2.33	54.67 ±0.66	51.90 ±2.72	63.89 ±2.89
MCH (pg)	15.24 ±0.75	15.55 ±0.78	17.44 ±0.99	16.63 ±0.16	15.24 ±0.75	19.12 ±0.82
MCHC (%)	29.49 ±0.37	29.79 ±0.48	31.20 ±0.84	30.47 ±0.33	29.49 ±0.37	29.96 ±1.13

* and ** indicates significant differences between sexes of the same age group at $P<0.05$ and $P<0.01$ respectively

TEC recorded in both male and female Zovawk pigs were in the ranges reported earlier in different age groups of Zovawk (Mayengbam *et al.,* 2014) and Nigerian indigenous pig (Eze *et al.,* 2010) but higher than TEC of Nigerian indigenous pigs (Aladi *et al.,* 2008). Compared to the physiological values of other domesticated exotic pig breeds (Thorn 2000; Swenson and Reece 1993; Blood 1995; Sarma*et al.,* 2011) the Zovawk pigs were found to have higher ranges of TEC. The Hb concentration of Zovawk pig was in the ranges reported earlier (Mayengbam *et al.,* 2014) and Nigerian indigenous pigs (Aladi *et al.,* 2008) but were found to be higher as compared to that of Nigerian indigenous pig (Eze *et al.,* 2010), Nicobari pig and Andaman desi pig (De *et al.,* 2013) and other exotic pig breeds (Thorn 2000; Swenson and Reece 1993; Blood 1995; Sarma*et al.,* 2011). As high as 17.27±0.35 g/dl of Hb was recorded in Andaman wild pig (De *et al.,* 2013).

The PCV of Zovawk pigs was found to be in the ranges reported earlier in Zovawk pigs and other indigenous pigs (Aladi *et al.,* 2008; Eze *et al.,* 2010; Mayengbam *et al.,* 2014; Oluwole and Omitogun 2016; De *et al.,* 2013). A comparative study indicated presence of higher TEC, Hb and PCV in wild pig of Andaman as compared to that of indigenous pigs (Nicobari pig and Andaman desi pig) and Large White Yorkshire (De *et al.,* 2013). Higher values of RBC, Hb and PCV were reported in wild boar (Harapin *et al.,* 2003) and in wild piglets (Tusek *et al.,* 1994). Higher PCV value was also reported in Javan warty pig (*Sus verrucosus*), an endemic pig to Java and Bawean islands (Semiadi and Nugraha 2009). Elevations of Hb, PCV and RBC often occurred with physical exertion resulting into hem concentration (Delgiudice *et al.,* 1990). However, in the present study, blood samples were collected from the pigs maintained well with sufficient feed and water supply and the physical exertion to the pigs were minimal as these pigs were being handled by trained and existing animal handlers in the farm. It could be hypothesized that higher TEC and Hb in Zovawk pig might be due to its adaptation to semi-domestication and might also be specific for this particular type of pig. The MCV, MCH and MCHC of Zovawk was found to be in the physiological ranges reported in Zovawk pigs (Mayengbam *et al.,* 2014) and other indigenous pigs (Sarma*et al.,* 2011; De *et al.,* 2013). Lower ranges of MCV and higher ranges of MCH and MCHC had also been reported in other indigenous pigs when reared under intensive rearing system (Eze *et al.,* 2010). Very low ranges of MCV and MCH were also reported in Nigerian indigenous pig, Large White and their F1 crosses (Aladi *et al.,* 2008). Such variations could be due to its adaptation to the existing geographical and climatic conditions as hematological values were found to vary in Nigerian indigenous pigs depending on the regions (Eze *et al.,* 2010). Presence of higher physiological ranges of TEC and Hb and similar ranges of PCV, MCV, MCH and MCHC of Zovawk pigs as compared to other domestic pigs indicated the adaptive capability of this kind of pig to the existing geographical and climatic conditions of Aizawl. Mizoram is elevated by 1,132 m from the sea level. At this level of elevation from the sea level, Zovawk has probably adapted with high content of TEC and Hb. The high content of iron in the blood (data not presented here) in the presence of higher ranges of TEC and Hb might be the cause for the characteristic colour of the Zovawk pork as variation in the colour of pork is related to differences in pigment content and in muscle metabolism in different pig breeds (Lindahl 2005). As perceived by the local people of Mizoram the pork of Zovawk has medicinal properties in anemic individuals. The findings of higher iron content with higher TEC with Hb in the blood substantiated the medicinal value of the Zovawk pork amongst the Mizo people.

Table 2. Leukocyte picture of male and female Zovawk pigs in different age groups

Parameter	Pre-weaning		Grower		Adult	
	Male	Female	Male	Female	Male	Female
TLC (x103/µl)	12.09 ±0.76	21.57** ±1.03	14.73 ±0.46	17.00 ±1.42	12.09 ±0.76	16.38 ±0.77
Lymphocyte (%)	83.43 ±4.79	76.37 ±2.68	75.46 ±2.43	75.18 ±3.60	83.43 ±4.79	63.94 ±3.38
Monocyte (%)	1.32 ±0.54	1.14 ±0.19	0.94 ±0.11	1.66 ±0.66	1.32 ±0.54	0.65 ±0.04
Neutrophil (%)	15.24 ±4.83	22.55 ±2.60	23.61 ±2.39	23.17 ±3.69	15.24 ±4.83	35.40 ±3.36
N: L ratio	0.30 ±0.13	0.32 ±0.05	0.34 ±0.04	0.38 ±0.09	0.30 ±0.13	0.64 ±0.10

** indicates significant differences between sexes of the same age group $P<0.01$

3.2 Leukocyte picture

Leukocyte picture of male and female Zovawk pigs was presented in Table 2. The significant influence of sex on leukocyte picture was observed only in pre-weaning group. Such finding could be due to developing immune system in young ones unlike in growers and adults. TLC of Zovawk pigs in pre-weaning group was significantly higher ($P<0.01$) in females than in males pigs similar to the reports of Oluwole and Omitogun (2016) in Nigerian indigenous pigs and its crossbreds. The present finding was in contrast to the reports of Egbunike and Akusu (1983). On the other hand, leukocyte profile was not influenced by sex in Nigerian indigenous pigs, Large White and their F1 crosses (Aladi *et al.,* 2008). Such variation could be due to differences in rearing system, season and climatic conditions as revealed by Eze *et al.* 2010.

TLC of both male and female Zovawk pigs in different age groups were in the ranges reported earlier in Zovawk but were much lower than reports in other indigenous pigs (Aladi *et al.,* 2008; Eze *et al.,* 2010; Oluwole and Omitogun 2016). The remaining of the parameters *viz.* lymphocyte, Neutrophil, monocyte, eosinophil and basophil were in the ranges reported in Zovawk as well as other indigenous pigs (Aladi *et al.,* 2008; Eze *et al.,* 2010; Mayengbam *et al.,* 2014; Oluwole and Omitogun 2016). The difference in the leukocyte picture might be due to breed variation, sampling age and analysis method. The eosinophil and basophil were not detected in the present investigation. Previous reports in indigenous and other domestic pigs (Aladi *et al.,* 2008; Thorn, 200; Swenson 1993) and wild boar (Harapin *et al.,* 2003) indicated that the number of eosinophils and basophils were very low and sometimes nil. In controlled situations, an increase in neutrophil lymphocyte ratio was one indicator of the pig's response to stress (Widowski *et al.,* 1989).

The neutrophil to lymphocyte ratio was one of the indexes of stress and adaptability of animals to the social rank (Hjarvard *et al.,* 2009) and local environment which generally increased under the stress condition (Minka and Ayo 2007). Decrease in lymphocyte and eosinophils and increase in neutrophil occurred in pigs under stress such as following marketing (Clemens *et al.,* 1986) and electric shock (Maeda *et al.,* 2011). The neutrophil lymphocyte ratio of Zovawk pigs was found to be slightly higher than those reported in Nicobari pig and Andaman desi pig (De *et al.,* 2013) and lower than those reported in Large White Yorkshire (Aladi *et al.,* 2008). The present finding of neutrophil lymphocyte ratio in the ranges between the exotic and local indigenous pigs was indicative of good adaptability of Zovawk pigs in the local environment.

Conclusions

The study on physiological ranges of hematological profile of Zovawk pig revealed resemblances in some of the parameters to that of other indigenous pigs and wild pigs. Similar to other indigenous and exotic pigs, Zovawk pigs were found to have significant effects of sex on some of the hematological profiles in pre-weaning period. The study revealed hematological profile indicative of its wild origin in the past and its adaptability to the existing climatic conditions. The presented baseline hematological data of both the sexes of Zovawk could be used in monitoring the herd health and proper diagnosis of diseases.

Acknowledgements

The authors are grateful to the Dean, C.V. Sc. & A.H., CAU, Aizawl, Mizoram and AICRP on Pigs, C.V. Sc. & A.H., Selesih, Aizawl, Mizoram for providing necessary facilities for experiment and pigs for sampling respectively.

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