

## Hematological profile of Zovawk – an indigenous pig of Mizoram

Prava Mayengbam, T. C. Tolengkomba and M. Ayub Ali

College of Veterinary Sciences and Animal Husbandry,  
Central Agricultural University, Selesih, Aizawl, Mizoram, India

**Corresponding author:** Prava Mayengbam, email: [dr\\_prava@rediffmail.com](mailto:dr_prava@rediffmail.com)  
TCT: [drkhomba10@gmail.com](mailto:drkhomba10@gmail.com), MAA: [ayubali1969@gmail.com](mailto:ayubali1969@gmail.com)

**Received:** 10-04-2014, **Revised:** 08-06-2014, **Accepted:** 10-06-2014, **Published online:** 20-07-2014

doi: 10.14202/vetworld.2014.505-508

**How to cite this article:** Mayengbam P, Tolengkomba TC and Ayub Ali M (2014) Hematological Profile of Zovawk – an indigenous pig of Mizoram, *Veterinary World* 7(7): 505-508.

### Abstract

**Aim:** To generate baseline data on the hematological profile of local pig of Mizoram at different age groups.

**Materials and Methods:** 2 ml of blood samples were collected from 108 Zovawk pigs of three different age groups *viz.* pre-weaning, grower and adult groups reared in the Veterinary College, Aizawl Livestock Farm in order to find out the normal hematological profile. The hematological parameters were estimated by using an automatic blood analyzer.

**Results:** Total erythrocyte count (TEC), Total leukocyte count (TLC), Packed cell volume (PCV), Mean corpuscular volume (MCV) and Mean corpuscular hemoglobin (MCH) were significantly higher in adults as compared to the young ones ( $p < 0.05$ ). MCH declined significantly from the pre-weaning pigs to grower pigs and increased in adult pigs ( $p < 0.05$ ). There was no significant change in Hb and MCHC with age.

**Conclusion:** Hematological parameters of Zovawk, a locally available indigenous pig of Mizoram were investigated. Hematological profile changed with the age.

**Keywords:** hematology, Mizoram, pig, Zovawk.

### Introduction

Zovawk pig is one of the 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 weight. The first farrowing occurs at the age of 9-10 months when they are of about 40 kg body weights [1]. 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 perceived medicinal properties as conceived by local people. Out of the total livestock population of 3,28,135 in Mizoram, pig population is 2,67,361 in which indigenous pig population is only 47,143 and of these, this pig is being domesticated more in rural areas than in the urban areas of Mizoram (1,78,000 vs. 89,000) as per the Livestock Census [2]. Since this pig's population is very low as compared to other reared exotic breeds and crossbreeds 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. Therefore, there is 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, Aizawl, Mizoram, India [3].

Screening of health status of animals requires knowledge on the normal baseline data on various physiological parameters [4]. Hematological profiles are important indicators of health and disease status and have been used in disease diagnosis and treatment of many diseases [5]. Reference values for clinical, biochemical and hematological parameters are required for data interpretation of health and disease status [6]. Recently a few scientific studies have been reported in terms of the body conformation and electrolyte profile of Zovawk pigs [7-8].

The present investigation was therefore undertaken in order to find out the normal baseline data on hematological parameters since this pig had never been investigated earlier for its hematological profile. 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.

### Materials and Methods

**Ethical approval:** The present investigation was carried out after the approval of the Institutional Animal Ethics Committee.

Copyright: The authors. This article is an open access article licensed under the terms of the Creative Commons Attribution License (<http://creativecommons.org/licenses/by/2.0>) which permits unrestricted use, distribution and reproduction in any medium, provided the work is properly cited.

**Table-1:** Effect of age on erythrocyte picture of Zovawk pigs

Parameter	Pre-weaning group	Grower group	Adult group
	Mean $\pm$ S.E. (Min – Max)	Mean $\pm$ S.E. (Min – Max)	Mean $\pm$ S.E. (Min – Max)
TEC ( $\times 10^6/\mu\text{l}$ )	8.11 $\pm$ 0.17 <sup>a</sup> (9.90-11.02)	10.25 $\pm$ 0.29 <sup>a</sup> (7.62-14.65)	11.25 $\pm$ 0.69 <sup>b</sup> (5.7-21.70)
Hb (g/dl)	13.41 $\pm$ 0.30 (9.70-18.00)	14.48 $\pm$ 0.54 (9.80-21.10)	15.15 $\pm$ 0.70 (7.47-24.00)
PCV (%)	45.00 $\pm$ 1.00 <sup>a</sup> (33.32-61.11)	47.00 $\pm$ 1.58 <sup>a</sup> (31.35-66.08)	57.89 $\pm$ 1.52 <sup>b</sup> (40.63-81.73)
MCV (fl)	55.93 $\pm$ 1.14 <sup>b</sup> (32.38-77.63)	46.20 $\pm$ 1.17 <sup>a</sup> (32.00-58.00)	63.56 $\pm$ 1.47 <sup>c</sup> (51.00-105.00)
MCH (pg)	16.64 $\pm$ 0.33 <sup>b</sup> (9.62-23.16)	14.18 $\pm$ 0.38 <sup>a</sup> (10.00-18.40)	19.10 $\pm$ 0.53 <sup>c</sup> (12.20-30.53)
MCHC (%)	29.81 $\pm$ 0.24 (25.78-32.70)	30.71 $\pm$ 0.26 (28.10-34.00)	30.05 $\pm$ 4.30 (11.60-42.83)

a-c Values in the same row with different superscripts differ significantly ( $p < 0.05$ )

**Table-2:** Effect of age on leukocyte picture of Zovawk pigs

Parameter	Pre-weaning group	Grower group	Adult group
	Mean $\pm$ S.E. (Min – Max)	Mean $\pm$ S.E. (Min – Max)	Mean $\pm$ S.E. (Min – Max)
TLC ( $\times 10^3/\mu\text{l}$ )	14.11 $\pm$ 0.89 <sup>a</sup> (7.66-26.05)	17.71 $\pm$ 0.59 <sup>b</sup> (10.72-25.15)	17.68 $\pm$ 0.84 <sup>b</sup> (9.67-31.74)
Lymphocyte (%)	77.78 $\pm$ 3.51 (26.80-98.50)	74.14 $\pm$ 2.39 (42.40-98.40)	73.17 $\pm$ 2.27 (42.1-97.40)
Neutrophil (%)	20.43 $\pm$ 3.44 (1.00-65.50)	25.06 $\pm$ 2.37 (1.00-56.80)	25.92 $\pm$ 2.26 (1.70-57.20)
Monocyte (%)	1.79 $\pm$ 0.49 <sup>b</sup> (0.50-10.8)	0.80 $\pm$ 0.09 <sup>a</sup> (0.50-3.8)	0.94 $\pm$ 0.08 <sup>a</sup> (0.50-2.20)
Neutrophil : Lymphocyte	0.42 $\pm$ 0.23 : 0.01- 2.33	0.39 $\pm$ 0.30 : 0.01-1.34	0.41 $\pm$ 0.31 : 0.02-1.36

a-c Values in the same row with different superscripts differ significantly ( $p < 0.05$ )

**Selection and maintenance of the animals:** A total of 108 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 (5 to 6 weeks old), grower group (24 to 28 weeks old) and adults (12 to 14 months old) and each groups comprised of 36 animals. 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 60<sup>th</sup> day of age. The average body weight of pigs used in the present investigation in pre-weaning, grower and adults groups were 2.39  $\pm$  0.14 kg, 4.98  $\pm$  0.24 kg and 59.22  $\pm$  1.73 kg respectively.

**Collection of blood sample:** 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 leukocyte count (TLC), Packed cell volume (PCV), Mean corpuscular volume (MCV) and Mean corpuscular hemoglobin (MCH), Mean corpuscular hemoglobin concentration (MCHC), lymphocyte count, neutrophil count, monocyte count, eosinophil count and basophil count by using automatic blood analyzer Vetscan Hm5.

**Statistical analysis:** Data were analyzed using the SYSTAT 6.0.1 by applying one way ANOVA followed by Fisher's Least Significant Difference Test for post-hoc multiple comparisons to evaluate the effect of different age groups on hematological parameters.

## Results

The Mean  $\pm$  S.E. (Min – Max) values of erythro-

cyte and leukocyte pictures in different age groups of Zovawk are presented in Table-1 and Table-2, respectively.

**Erythrocyte picture:** The TEC increased with age with significantly higher values in the adults as compared to pre-weaning group and the growers ( $p < 0.05$ ). There was no significant difference between TEC of pre-weaning and grower groups. Zovawk pigs in the present study were found to have stable Hb from the piglet stage to the adult stage. PCV of Zovawk did not change from the pre-weaning stage till the growing stage but increased significantly in the adults ( $p < 0.05$ ). MCV and MCH declined significantly from the pre-weaning pigs to grower pigs and increased again in adult pigs ( $p < 0.05$ ). The three different groups of Zovawk pigs were found to have different MCH levels, highest being in the adult group followed by pre-weaning group and growers ( $p < 0.05$ ). Mean corpuscular hemoglobin concentration (MCHC) did not change significantly with age in Zovawk.

**Leukocyte picture:** The TLC increased significantly from the pre-weaning stage to grower stage ( $p < 0.05$ ) and remained stable to the adult stage. The lymphocyte count was not influenced by age. In the present study, neutrophil count increased slightly from the pre-weaning stage to grower as well as in adults, however, there was no significance in the increase. The monocyte count was found to be significantly higher in the pre-weaning group as compared to grower and the adult groups ( $p < 0.05$ ). There was no significant change in the neutrophil lymphocyte ratio of Zovawk pigs.

## Discussion

Since there is no literature available on the hematological profile of Zovawk pig, the findings of the present investigation are compared and discussed in relation to the data available for other exotic breeds of pigs. Due to its semi-domestication and scavenging

nature, the data obtained in the present investigation are also compared to other wild species of pig.

The TEC was found to be in an increasing trend from the pre-weaning to the grower and further to the adults similar to previous reports [9]. Compared to the physiological values of other domesticated exotic pig breeds [9-12] the Zovawk pigs were found to have higher ranges of TEC. The mean TEC of adult Zovawk pig was slightly higher than that of adult wild boar [13], captive Javan warty pig; *Sus verrucosus* [14] and Andaman wild pig [8]. Unlike in other pigs, Hb level in Zovawk pigs did not show any influence by age [9]. The Hb concentration of Zovawk pig was found to be higher as compared to that of other domesticated exotic pig breeds [9-12]. The range of Hb in adult Zovawk pig is comparable to that of 15.66±1.73 g/dl in adult wild boar [13] and 15.90-18.80 g/dl in captive Javan warty pig [14]. The PCV increased with age and the highest being in the adult ( $p<0.05$ ) like in other pigs [9]. The mean value of PCV of Zovawk pigs was found to be in the physiological ranges reported in other pigs [9, 11, 12, 15]. A comparative study on hematological profile 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 [15]. Higher values of RBC, Hb and PCV were reported in wild boar [13] and in wild piglets [16]. Higher PCV value was also reported in Javan warty pig (*Sus verrucosus*), an endemic pig to Java and Bawean Islands [14]. Elevations of Hb, PCV and RBC often occurred with physical exertion resulting in hemoconcentration [17]. 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 existing trained 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 in Zovawk was significantly influenced by age ( $p<0.05$ ). Like in other pig breeds, MCV decreased from the pre-weaning pigs to grower pigs and increased in the adult pigs [9]. The MCV of Zovawk was found to be in the physiological ranges reported in other pigs [9, 11, 12, 15]. Higher MCH in adult Zovawk pigs as compared to the pre-weaning and grower pigs was reported in the present study while the Hb concentration did not change with age. This indicated that adult Zovawk pigs had RBCs with higher content of hemoglobin. The MCHC of Zovawk pigs was found to be in the ranges reported earlier in other breeds [9, 11, 12, 15].

Higher ranges of TEC, MCV and MCH values in adult pigs suggested that number and size of erythrocyte and hemoglobin concentration correlated with age. These changes might be due to adaptive mechanisms for better oxygen carrying capacity of blood in adults than in young ones [16]. Presence of higher physio-

logical ranges of TEC and Hb in Zovawk pigs as compared to other domestic pigs and their resemblance to wild pigs indicated that due to its semi-domestication this type of pig requires higher number of erythrocytes with higher Hb content in the body. 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 [18]. 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.

The TLC of pre-weaning piglets in the present study was found to be in the higher ranges as compared to that of Burmese pig of subtropical hill agro-ecosystem [12]. The grower and adult Zovawk pigs were found to have TLC in the physiological ranges reported in other exotic breeds [9-12]. The lymphocyte count and neutrophil counts were not influenced by age in Zovawk pigs unlike in other exotic pigs where lymphocyte counts reduced with age while the reverse was true for neutrophil [9]. The Burmese pig of subtropical hill agro-ecosystem was also found to have no change in lymphocyte and neutrophil counts from the weaner pigs to sows through the feeder pigs [12]. The difference in the leukocyte picture might be due to breed variation, sampling age and analysis method. The monocyte count was significantly higher in pre-weaning piglets as compared to growers or adults. Eosinophils and basophils were not detected in the present investigation. Previous reports in domestic pigs [9-10] and wild boar [13] indicated that the number of eosinophils and basophils were very low and sometimes nil. It could be possible that eosinophils and basophils were not detected in the blood samples analyzed in the present study.

In controlled situations, an increase in neutrophil lymphocyte ratio was one indicator of the pig's response to stress [19]. The neutrophil to lymphocyte ratio was one of the indexes of stress and adaptability of animals to the social rank [20] and local environment which generally increased under the stress condition [21]. Decrease in lymphocyte and eosinophils and increase in neutrophils occurred in pigs under stress such as following marketing [22] and electric shock [23]. The neutrophil lymphocyte ratio of Zovawk pigs was found to be slightly higher than those reported in Nicobari pig and Andaman desi pig and lower than those reported in Large White Yorkshire [15]. The present finding of neutrophil lymphocyte ratio in the ranges between the exotic pigs and local indigenous pigs was indicative of good adaptability of Zovawk

pigs in the local environment.

### Conclusion

The hematological parameters changed with age. The study revealed that the physiological ranges of hematological profile of Zovawk pig were different from that of other domestic pigs. There were resemblances in some of the parameters like TEC and Hb to that of wild pigs. The present findings would help in proper monitoring of herd health and appropriate diagnosis of diseases.

### Authors' contributions

PM performed the analysis of blood samples and prepared the manuscript. TCT helped during the blood sample collection and the statistical analysis of the data. MYA contributed in designing the experiment and also in preparation of the manuscript. All authors read and approved the final manuscript.

### Acknowledgements

The authors are grateful to the Dean, College of Veterinary Sciences and A.H., Central Agricultural University, Selesih, Aizawl, Mizoram and Project Investigator, AICRP on Pigs, College of Veterinary Sciences and A.H., Selesih, Aizawl, Mizoram for providing the necessary funds and facilities to conduct the experiment and providing pigs for blood sampling, respectively.

### Competing interests

The authors declare that they have no competing interests.

### References

- Hmar, L., Saikia, P., Thazuali, L., Tolengkomba, T.C. and Samanta, A.K. (2010) Conservation of Zovawk-a small variety pig of Mizoram. Proceeding of National Symposium on Technology Management, Visioning and Up-scaling for Accelerating Livestock Production, Guwahati, India. p136.
- Livestock Census. (2007) Directorate of Economics and Statistics, and Animal Husbandry Statistics Division, Department of Animal Husbandry, Dairying and Fisheries, Ministry of Agriculture, New Delhi, India.
- Annual Report. (2012-13) National Research Center on Pig, Indian Council of Agricultural Research, Rani, Guwahati, India. p61-62.
- Oguike, M. A., Ilo, S. U. and Odika, I. E. (2011) Physiological responses of gilt to supplementation of selenium and V-vitamin E. *J. Adv. Dev. Res.* 2 (1): 115-122.
- Gong, Y. F., Lu, X., Wang, Z. P., Lu, F. and Luo, Y. R. (2010) Detection of quantitative trait loci affecting haematological traits in swine via genome scanning. *BMC Genetics* 11: 56-69.
- Chen, Y., Qin, S., Ding, Y., Li, S., Yang, G., Zhang, J., Li, Y., Cheng, J. and Lu, Y. (2011) Reference values of biochemical and hematological parameters for Guizhou mini pigs. *Exp. Biol. Med.* 236: 477-482.
- Tolengkomba, T.C., Saikia, P., Hmar, L., Lalthazuali, Prava, M. and Singh, N.S. (2013) Principal component analysis of body measurements in Mizo local pigs. *Indian J. Vet. Res.* 22(1): 26-31.
- Prava, M., Tolengkomba, T.C., Ali, M. A., Saikia, P. Singh, N.S. and Hmar, L. (2012) Electrolyte (Na, K, Cl, Ca, Pi and Mg) profile of Zovawk pigs of Mizoram, India in different age groups. *Int. Multidisciplinary Res. J.* 2(2): 49-51.
- Thorn, C.E. (2000) Normal hematology of the pig. In: Feldman, B.F., Zinkl, J.G. and Jain, N.C. editors. *Schalm's Veterinary Haematology*. 5<sup>th</sup> edn. Lippincott Williams & Wilkins, A Wolters Kluwer Company, Philadelphia, Baltimore, New York, London, Buenos Aires, Hong Kong, Sydney, Tokyo. p1089-1097.
- Swenson M.J. (1993) Physiological properties and cellular and chemical constituents of blood. In: Sewnson M.J. Reece W.O. editors. *Duke's Physiology of Domestic Animals*. 11<sup>th</sup> edn. Cornell University Press, Sage House, Ithaca, New York. p22-48.
- Blood, D.C. (1994) *Pocket Companion to Veterinary Medicine*. Bailliere Tindall, London, Philadelphia, Sydney, Tokyo, Toronto.
- Sarma, K., Konwar, B., Ali, A., Das, G., Kalita, G., Ahmed, F.A., Saikia, B., Bayan, H. and Nayan, V. (2011) Haemato-biochemical parameters of Burmese pig of subtropical hill agro ecosystem. *Indian J. Anim. Sci.* 81(8): 819-821.
- Harapin, I., Bedrica, L., Hahn, V., Sostaric, B. and Gracner, D. (2003) Haematological and biochemical values in blood of wild boar. *Vet. Arhiv* 73(6): 333-343.
- Semiadi, G. and Nugraha, R.T.P. (2009) Some notes on biological aspects of captive Javan wasrty pig (*Sus verrucosus*). *Biodeversitas* 10(3): 124-128.
- De, A.K., Kundu, A., Kundu, M.S., Sunder, J. and Jeyakumar, S. (2013) Comparative study on haematological traits of endangered Andaman wild pig and other indigenous pig breeds available at Andaman and Nicobar Islands, India. *Vet. World* 6(10):794-798.
- Tusek, T., Mihelic, D., First, L., Janicki, Z. and Opancar, D. (1994) Komprativni prikaz crvene krvne slike divlje domaće europske svinje. *Vet. Stanica* 25: 81-84.
- Delgiudice, G. D., Krausman, P. R., Bellantoni, E.S., Wallace, M. C., Etchberger, R. C. and Seal, U. S. (1990) Blood and urinary profiles of free-ranging desert mule deer in Arizona. *J. Wildlife Dis.* 26: 83-89.
- Lindahl, G. (2005). Colour characteristics of pork. Doctoral Thesis, Swedish University of Agricultural Sciences, Uppsala, Sweden.
- Widowski, T. M., Curtis, S. E. and Graves, N. (1989) The neutrophil:lymphocyte ratio in pigs fed cortisol. *Can. J. Anim. Sci.* 69: 501-504.
- Hjarvard, B.D., Larsen, O.N., Juui-Madsen, H.R., Jorgensen, E. and Jensen, K.H. (2009) Social rank influences the distribution of blood leukocyte subsets in female growing pigs. *Scand. J. Lab. Anim. Sci.* 36(4): 309-320.
- Minka, N. S. and Ayo, J. O. (2007) Physiological responses of transported goats treated with ascorbic acid during the hot dry season. *Anim. Sci. J.* 78(2): 164-172.
- Clemens, E. T., Schultz, B. D., Brumm, M. C., Jesse, G. W. (1986) Influence of market stress and protein level on feeder pig hematologic and blood chemical values. *Am. J. Vet. Res.* 47: 359-362.
- Maeda, Y., Tomioka, M., Hanada, M., Oikawa, M. (2011) Changes in peripheral blood lymphocyte and neutrophil counts and function following long term road transport in thoroughbred horses. *Int. J. Appl. Res. Vet. Med.* 9(3): 284-289.

\*\*\*\*\*