ERYTHROCYTE ANTIOXIDANT STATUS OF INDIGENOUS PIG FROM ARID TRACTS DURING HOT AND COLD AMBIENCES#

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ABSTRACT

An investigation was carried out to find out the erythrocyte antioxidants status of indigenous pig from arid tracts during moderate, hot and cold ambiences. Blood samples were collected to harvest erythrocytes from apparently healthy male indigenous pigs during slaughtering from private slaughter houses in and around Bikaner district, Rajasthan during moderate, extreme hot and extreme cold ambiences. The moderate mean overall values of erythrocytic vitamin A (µmol gHb^{-1}) and vitamin C (µmol gHb^{-1}) were 0.52±0.10 and 2.74±0.01, respectively. The mean values of erythrocytic antioxidants were observed to be significantly ($pM \leq 0.05$) lower during hot and cold ambiences as compared to respective moderate overall mean value. It was found that decline in the values during hot ambience was greater than that of cold ambience. Age effect showed a significant ($p \leq 0.05$) increase in the mean values in each ambience being highest in the pigs of 10-12 months of age and lowest in pigs of 4-6 months of age for all the indicators studied in the present endeavour. Effect of extreme hot and cold ambiences was evident on each group. Outcome of the present endeavour signified the association of erythrocyte antioxidants with extreme ambiences. It can be concluded that extreme hot and cold ambiences affected the erythrocytic antioxidant status in indigenous pigs of all age groups from arid tracts. Magnitude of impact was greater during hot ambience than cold ambience. Indigenous pigs of 4-6 months of age were affected with greater impact than other age groups. Archetype of variations of data implied the line of tactics in physiological gambits by pigs during the periods when possible development of oxidative stress was there. The observations obtained during study will colossally add up in improving the health status of indigenous pigs.

***Key words*:** Ambience, antioxidants, erythrocyte, indigenous pig, vitamin A, vitamin C

Introduction

Swine husbandry is brazen out by innumerable threats incorporating disease out breaks, thermal stress, malnutrition, famine etc. which can successfully lessen the growth, reproduction and production. Scientific attention concerning this facet is petite in indigenous pigs. Animals respond to heat stress with a series of reactions. Studies with chronic heat stress have demonstrated altered physiological, metabolic, biochemical and cellular responses in animal models (Kataria *et al*., 2014). Reactive oxygen species are extremely reactive in biological organizations and may incorporate peroxides and superoxide with others like hydroxyl radical, hydrogen peroxide and fatty acid. Reactive characteristics of antioxidant system are important to maintain the concentration towards lower side. Scientists have worked with various parameters to assess oxidative stress at laboratory level as it does not exhibit any symptom (Kataria *et al*., 2010a). Sufficient concentration of vitamin C is synthesized in the pig but under the conditions of stress, supplemental requirement of vitamin C is there to enhance growth performance. Antioxidant properties and biological functions of vitamin C are known to modulate iron homeostasis. Vitamin A is a chief governor of gene expression, influencing lipid metabolism in animals. Oxidative stress is known to be associated with various health disorders. Changes in ambient temperatures are considered as one of the stressors causing oxidative stress (Kataria *et al*., 2010b). Vitamin A and C are antioxidant markers used to appraise oxidative stress (Kataria *et al*., 2010c).

Indigenous pigs are thriving hard to seek the scientific attention. Commercial pig farming for the meat purpose needs scientific acceleration to improve the socio-economical status of poor pig raisers. There is dearth of study to explore the antioxidant status of these animals. It is not considered wise to extrapolate the values from other species or breed. Need of the hour is to set up reference values of indicators of antioxidant status in indigenous pigs to set up strategies for the supplementation of antioxidants. It is tricky for a clinician to ascertain magnitude of oxidative stress for appropriate treatment. Serious concern is shown by scientific community towards the conduction of investigations proving beneficial in making available the reference values for indigenous breeds helping in diagnosis and research (Singhal *et al*., 2016). Looking towards the scantiness of research to associate antioxidant status with extreme ambient ambiences, the present investigation was carried out with the aim to find out variations in erythrocyte antioxidants in indigenous pig from arid tracts during extreme hot and cold ambiences.

Materials and Methods

Apparently healthy male indigenous pigs from arid tracts in and around Bikaner district, Rajasthan, ageing 4 months to 12 months were screened in the investigation to find out antioxidant status of erythrocytes. Blood samples were collected from private slaughter houses during moderate, hot and cold ambiences. The samples were analyzed to determine erythrocyte antioxidants (Singhal, 2017). Moderate ambience

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(control period) encompassed the months of October-November; hot ambience included May and June and cold ambience comprised of December-January months. To appraise the influence of hot and cold ambiences on the erythrocyte antioxidants of pigs, the results of various variables determined were compared with those analyzed during moderate months serving as control. The animals were grouped according to age as 4-6 months, 6-8 months, 8-10 months and 10-12 months of age. Each group was comprised of 25 animals. In each ambience, 100 blood samples were collected. After collection of samples of blood in di potassium EDTA, stroma free haemolysates were prepared to determine vitamin A and vitamin C (Singhal, 2017). Quantity of haemoglobin present in haemolysate was used for calculations of different variables. Method as described by Varley (1988) was used with little modification (Singhal, 2017) to determine plasma vitamin A. Method described by Varley (1988) was used with little modification (Singhal, 2017) for determination of vitamin C. In the present investigation, prime variable were erythrocyte antioxidants of indigenous pig during moderate, hot and cold ambiences. Classification of the main effects was as ambiences and age groups. Further, the subsets of ambiences were moderate, extreme hot and cold periods and of age groups were 4-6 months, 6-8 months, 8-10 months and 10-12 months. For each subset data were expressed as mean ± SE of mean and the significance of the influences of ambiences and age groups was tested (Kaps and Lamberson, 2004) with the variations in the means (Duncan, 1955).

Results and Discussion

The present endeavour was launched to associate the erythrocyte antioxidants and iron indices in indigenous pig from arid tracts during extreme ambiences.

Vitamin A: The mean values of erythrocytic vitamin A were determined during hot and cold ambiences and found lower significantly ($p \leq 0.05$) as compared to moderate overall mean value (Table 1). It was found that decline in the values during hot ambience was greater than that of cold ambience. Assessment of the antioxidant status of the pigs in terms of blood levels of vitamin A has been investigated and vitamin A is found to be important in safeguarding the body from the risk of oxidant perils (Singhal *et al.*, 2016). Effect of extreme ambiences on serum vitamin A levels in animals has been reported (Kataria *et al*., 2013). Hot ambience is related with increase of oxygen derived free radicals and reduced blood antioxidants. Decline in antioxidant protection causes oxidative insult (Kataria *et al.,* 2010a). The reduced concentration of vitamin A was an indicative of probable oxidative stress in present endeavour. Lowered value of vitamin A indicated the depletion of vitamin A as it works as an antioxidant against free radicals. Pressure of extreme hot ambience was more prominent than cold ambience on the vitamin A concentrations in erythrocytes. The age effect was significant ($p \leq 0.05$) in moderate, extreme hot and cold ambiences. Age effect showed a significant ($p \leq 0.05$) increase in the mean values being highest in the animals of 10-12 months of age and lowest in pigs of 4-6 months of age. Observations clearly showed the greater impact of heat stress in youngest group in context with vitamin A value of erythrocytes as an antioxidant. Age linked alterations in serum vitamin A values have also been evidenced in animals by scientists (Kataria *et al*., 2012). Results obtained noticeably shown the reduction in erythrocytic vitamin A in animals of all age groups reflecting depletion of antioxidant status. It was lucid that influence of extreme ambiences on erythrocytic vitamin A concentration was higher in younger pigs of 4-6 months of age than other older age groups. Observations showed greater influence of extreme ambiences on comparatively younger animals.

Vitamin C: When compared with moderate ambience, the mean values of erythrocytic vitamin C in indigenous pigs were found to be significantly ($p \leq 0.05$) lower during hot and cold ambiences (Table 2). Magnitude of decrement in the mean value during hot ambience was greater than that of cold ambience. Pattern of variation was comparable to that reported by earlier workers (Kataria *et al.,* 2010d). Role of vitamin C is imperative in shielding the body from the peril of oxidative stress (Kataria *et al.,* 2010a). Researchers have attempted to explain the role of vitamin C in sustaining the veracity of erythrocytes by dodging the oxidative stress (Singhal, 2017). Lowered erythrocytic vitamin C levels during hot and cold ambiences established the development of oxidative stress. Hot ambience swayed decrease of antioxidant level has made efforts to make up strong scientific attention to make lucid the primary mechanisms intricate. Scientists are of the view that vitamin C in erythrocytes is proposed to be vital in the detoxification of superoxide radicals and hydrogen peroxide formation during metabolism in erythrocytes. Changes of vitamin C levels authenticated the presence of oxidative stress. Kataria *et al.* (2010d) also assumed the utilization of antioxidants in the situations having hazard of oxidative stress. The findings of present endeavour showed the exhaustion of vitamin C to scuffle against free radicals authorizing the perpetuation of oxidative stress. The age effects were significant ($p \leq 0.05$) in moderate, extreme hot and cold ambiences, the mean values being highest in the indigenous pigs of 10-12 months of age. Per cent variations due to extreme ambiences were highest in 4-6 months of age group. Earlier researchers have also found age associated variations (Kataria *et al*., 2012). When the observations were congregated in the present endeavour, the cutback in erythrocytic vitamin C in indigenous pigs of all age groups was displayed and it was illustrated that running down of antioxidant status was lucid. It was cogent that effect of extreme ambiences on erythrocytic vitamin C concentration was greater in younger indigenous pigs of 4-6 months of age than other older age groups.

Pattern of alterations in the mean values of indicators of erythrocyte antioxidant status uncovered the presence of oxidative stress during hot and cold ambiences. Impact of oxidative stress was bigger during hot ambience in comparison to cold ambience. According to age, pigs of 4-6 months of age were found to be more affected based upon the lowest values found for all the indicators investigated. These changes in general showed the depletion of the endogenous antioxidants. It can be concluded that antioxidant status of older age group investigated in the endeavour was comparatively superior to youngest age group. Situation was similar in cold ambience, wherein a better antioxidant status was observed in pigs of all age groups than that in hot ambience. It can be proposed that nutrition of indigenous

Table 1: Mean ± SEM values and per cent changes of vitamin A (µmol gHb^{-1}) in the erythrocytes of indigenous pig during extreme ambiences

Effects	Moderate ambience Mean ± SEM (100)	Extreme Hot ambience Mean±SEM (100)	Per cent Change in hot ambience	Extreme Cold ambience Mean ± SEM (100)	Per cent Change In Cold ambience
Ambience Overall Value(100)	0.52 [b]± 0.10	0.17 [b]± 0.07	-77.30	0.22 [b]± 0.06	-57.69
4-6Months age (25)	0.42 [bd]± 0.002	± 0.003	-76.19	0.14 [bd]± 0.003	-66.66
6-8 Months age (25)	0.48 [bd]± 0.003	0.15 [bd]± 0.003	-68.75	0.19 [bd]± 0.002	-60.41
8-10 Months age(25)	0.56 [bd]± 0.002	0.19[bd]± 0.003	-66.07	0.23 [bd]± 0.003	-58.92
10-12 Months age (25)	0.62 [bd]± 0.002	0.24 [bd]± 0.003	-61.29	0.32 [bd]± 0.003	-48.38

i. Figures in the parenthesis indicate number of pigs.
ii. Overall value is the mean value obtained from pig in an ambience irrespective of age.
iii. [b]marks significant ($p \leq 0.05$) differences among moderate, hot and cold ambience mean values for a row.
iv.[d] marks significant ($p \leq 0.05$) differences among mean values of age group within an ambience.

Table 2: Mean ± SEM values and per cent changes of vitamin C (µmol gHb^{-1}) in the erythrocytes of indigenous pig during extreme ambiences

Effects	Moderate ambience Mean ±SEM (100)	Extreme Hot ambience Mean ±SEM (100)	Per cent Change in hot ambience	Extreme Cold ambience Mean ± SEM (100)	Per cent Change In Cold Ambience
Ambience Overall Value(100)	2.74 [b]± 0.01	1.60 [b]± 0.01	-41.60	2.12 [b]± 0.01	-22.62
4-6 Months age (25)	2.47 [bd]± 0.002	1.10 [bd]± 0.002	-55.46	1.40 [bd]± 0.002	-43.31
6-8 Months age (25)	2.56 [bd]± 0.002	1.30 [bd]± 0.002	-49.21	1.90 [bd]± 0.002	-25.78
8-10 Months age (25)	2.85 [bd]± 0.002	1.42 [bd]± 0.003	-17.60	2.30 [bd]± 0.002	-19.29
10-12 Months age (25)	3.09 [bd]± 0.002	2.59 [bd]± 0.002	-16.18	2.90 [bd]± 0.002	-6.14

i. Figures in the parenthesis indicate number of pigs.
ii. Overall value is the mean value obtained from pig in an ambience irrespective of age.
iii. [b]marks significant ($p \leq 0.05$) differences among moderate, hot and cold ambience mean values for a row.
iv. [d]marks significant ($p \leq 0.05$) differences among mean values of age group within an ambience.

pigs is required to be supplemented with appropriate antioxidants to make the antioxidant status stronger particularly during extreme ambiences.

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