Assessment of Clinico-physiological and Haemato-biochemical Profiles in Hampshire Crossed Pigs

ABSTRACT:

This study investigated clinico-physiological and haemato-biochemical parameters in 18 healthy Hampshire-crossed pigs, classified into three age groups: Group-I (grower), Group-II (finisher), and Group-III (pregnant). Carried out at the 30 Sow Teaching Unit, the Departments of Livestock Production and Management and Veterinary Biochemistry, College of Veterinary Science, Assam Agricultural University, Khanapara, the study aimed to discern age-related variations in pig health. Clinico-physiological assessments encompassed body temperature, heart rate, pulse rate, respiration rate, mucous membrane appearance, feeding behavior, and pen-mate behavior. Group-I exhibited higher clinico-physiological values, with significant variations in the respiration rate ($p<0.05$) and highly significant variations in heart rate and pulse rate ($p<0.01$) compared to Groups II and III. The haematological parameters, including hemoglobin, PCV, TLC, and TEC, were evaluated. Group-II exhibited higher hemoglobin and total erythrocyte count, while Group-I had a higher packed cell volume. Total leucocyte count variation was non-significant, but packed cell volume significantly varied ($p<0.05$), and hemoglobin and total erythrocyte count highly significantly varied ($p<0.01$). Biochemically, Group-I demonstrated elevated markers; Group-II had higher ALT; and Group-III exhibited increased total protein, BUN, and creatinine levels. While blood glucose, total protein, and AST showed non-significant variations, ALT, creatinine, and cortisol exhibited significant differences ($p<0.05$), and ALP, LDH, and BUN displayed highly significant variations ($p<0.01$). This study provides comprehensive insights into age-associated physiological, haematological and biochemical variations in pigs, contributing valuable information for effective pig health management practices.

Keywords: Hampshire-crossed pigs, 30 Sow Teaching Unit, Clinico-physiological profile, Haematology, Serum biochemistry.

INTRODUCTION

Pigs are found all over the world except in Arab or Muslim-dominated countries and provide valuable products for humans, such as pork, lard, leather, glue, and a variety of medicines. Assam state had the highest pig population across India at over 2 million, ranking it in the first position in the country (Livestock Census, 2019). Pigs are extremely sociable and clever creatures that exhibit complex parental, communicative, and affiliative behaviour. They show similarities to humans in terms of anatomical size, structure, physiology, immunology, and genome, enhancing their potential as biomedical models for studying human developmental processes, congenital diseases, and pathogen response mechanisms (Lunney *et al*., 2021).

The normal physiological state of an animal can be assessed through its behaviour, gait, and feeding patterns. Physiological parameters, such as heart rate, respiration rate, mucous membrane appearance, and body temperature, provide information about the general health status of the animal. Haemato-biochemical analyses give us insight into the functional status of organs and various body systems.

Serum biochemistry is a well-established laboratory method in veterinary medicine that serves as clinical data for the diagnosis, prognosis, and treatment of livestock diseases, with wide ranges for the physiological processes including serum proteins, enzymes, hormones, and

electrolytes at any given point in time (Adenkola *et al*., 2009; Onasanya *et al*., 2015). However, it has been repeatedly observed that serum biochemical values in pigs are affected by environmental and physiologic circumstances such as age, gender, diet, additives, and physiological signs of heat stress in pigs, including the elevation of respiration rate, body temperature, pulse rate, and panting, as well as a reduction in feed intake, followed by decreased reproductive performance (Gomez-Prado *et al*., 2022). The present study focused on physiological, hematological, and biochemical investigations in various age groups of pigs, including growers, finishers, and pregnant pigs. The aim was to offer essential insights for improving the efficiency of managing pig health practices.

MATERIALS AND METHODS

A. Study period

The study was conducted on 18 healthy pigs from the 30 Sow Teaching Unit, the Departments of Livestock Production, College of Veterinary Science, Assam Agricultural University, Khanapara. All of which were maintained under identical management and environmental conditions. The selected pigs in this study were Hampshire crossed pigs and were separated and grouped based on their age. Specifically, the pigs were divided into three groups: Group-I consisted of six grower pigs, Group-II had six finisher pigs, and Group-III comprised six pregnant gilts or sows.

1. Clinical-physiological study:

Clinico-physiological parameters includes body temperature, heart rate, pulse rate, respiration rate, the appearance of the mucous membrane, feeding behaviour from the last week, pen-mate behavior.

Collection of blood samples

Blood samples (4 ml) were obtained from the ear veins of all the pigs (Fig.1) using a hypodermic needle and syringe. The samples were then transferred to dry, disposable, sterilized vials lined with ethylene diamine tetraacetic acid (K2 EDTA, LEVRAM LIFESCIENCES, 4 ml vial), and clot activator vials (PEERLESS BIOTECH, 4 ml vial). Hematological parameters were estimated within 24 hours using an auto-haemoanalyzer, and for biochemical parameters, the collected blood was centrifuged at 3500 rpm for 10 minutes using a laboratory centrifuge machine (Remi R-8C Laboratory Centrifuge) to separate the serum. The isolated serum was stored at -20°C for further biochemical analysis.

Fig. 1 Showing blood collection from the ear vein in pig.

2. Haematological analysis

Haematological parameters, such as haemoglobin concentration, packed cell volume (PCV), total leucocyte count (TLC), and total erythrocyte count (TEC) were estimated using an auto-haemo analyzer (Melet Schloesing Laboratories).

3. Biochemical analysis

Biochemical parameters, including blood glucose, total protein, alanine aminotransaminase (ALT), aspartate aminotransferase (AST), alkaline phosphatase (ALP), lactate dehydrogenase (LDH), blood urea nitrogen (BUN), creatinine, and cortisol, are assessed using kits obtained from Aspen Laboratories Pvt. Ltd.

RESULTS AND DISCUSSION

1. Clinical-physiological study:

The pig groups Group-I, Group-II, and Group-III exhibited normal pen behaviour and feeding behaviour, and they had normal mucous membranes and body coats. Respiration rate (breaths/min) mean ± SE for Group-I was 43.66±1.40, for Group-II was 39.33±1.02, and for Group-III was 39.16±0.94. A significant variation ($p<0.05$) was observed among the groups. The heart rates (BPM) of Group-I, Group-II, and Group-III were measured at 99.16±2.86, 85.83±1.47, and 81.5±1.58, respectively, A significant and substantial difference ($p<0.01$) was noted among the groups. The pulse rates (BPM) mean ± SE for Group-I, Group-II, and Group-III were recorded as 98.83±2.07, 85.5±1.45, and 81.1±1.19, respectively. A highly significant variation ($p<0.01$) was observed among the groups. The mean±SE of rectal temperatures (°F) for Group-I, Group-II, and Group-III was recorded as 102.88±0.24, 102.50±0.13, and 102.43±0.15, respectively. However, a non-significant variation was observed among the groups (Table.1). These findings align with the investigations conducted by Aiello *et al*. (2006), Jackson *et al*. (2002), and Sipos *et al*. (2013).

2. Haematological parameters

The mean±SE values of haemoglobin (g/dL) in Group-I, II, and III were measured as 10.12 ± 0.21, 12.03 ± 0.34, and 10.84 ± 0.09, respectively, findings aligning with Cooper *et al.* (2014) and Jezek *et al.* (2018) (Table.2).

The packed cell volume (%) mean ± SE values in Group-I, II, and III were 38.73±0.88, 36.88±0.49, and 36.16±0.43, respectively, noted significant ($p< 0.05$) variation among the groups due to heightened red blood cell production during rapid growth (Table.2). Outcomes align with findings documented by Ajala *et al.* (2016) and Rahman (2016).

The mean±SE values of total leucocyte count (10^3/µl) of Group-I, Group-II, and Group-III were recorded at 19.23±0.56, 18.07±0.46 and 18.25±0.69, respectively and they fell in the normal range. Noted non-significant variation between the groups (Table.2). Findings align with Rahman (2016) and Jezek *et al.* (2018).

The mean±SE values of total erythrocyte count (10^6/µl) in Group-I, II, and III were recorded as 6.34±0.12, 7.31±0.22, and 6.94±0.07 respectively, the analysis of variance for total erythrocyte counts and revealed highly significant differences between the groups (Table.2). Findings align to Ajala *et al.* (2016), Rahman (2016), and Jezek *et al.* (2018) (Table.2).

3. Biochemical parameters

The mean±SE blood glucose values (mg/dL) for Group-I, II, III were recorded as 136.98±1.91, 129.35±3.94, and 126±3.93, respectively, all falling within the normal range. The analysis of variance for blood glucose (mg/dL) revealed no statistically significant differences between the groups (Table.3). Findings align to Cooper *et al.* (2014), Dutta *et al.* (2020), and Rahman (2016).

The mean±SE total protein values (g/dL) for Group-I, Group-II, and Group-III were reported as 7.80±0.22, 7.76±0.20, and 8.02±0.26, respectively, noted non-significant variation

between the groups (Table.3). The findings are consistent with studies conducted by De *et al.* (2017), Dutta *et al.* (2020), and Rahman (2016).

The mean±SE values of alanine aminotransaminase (U/L) in Group-I, Group-II, and Group-III were 38.86±1.24, 42.21±1.80, and 36.92±0.74, respectively. Noted significant ($p< 0.05$) variation between the groups (Table.3). These findings are consistent with Dutta *et al.* (2020), Rahman (2016), and Zhang *et al.* (2022).

The mean±SE values of aspartate aminotransferase (U/L) in Group-I, II, and III were 40.61±0.51, 40.06±0.63, and 39.75±0.50, respectively, noted non-significant variation between the groups (Table.3). These study findings correlate with Cooper *et al.* (2014), Dutta *et al.* (2020), and Rahman (2016), Zhang *et al.* (2022).

The mean±SE values of alkaline phosphatase (U/L) in Group-I, Group-II, and Group-III were recorded as 143.96±1.72, 137.78±1.24, and 133.5±2.27, respectively, and were observed within the normal range. Noted highly significant variation between the groups ($p < 0.01$) (Table.3). These findings are in agreement with previous studies conducted by Cooper *et al.* (2014), De *et al.* (2017), Dutta *et al.* (2020), and Rahman (2016). Additionally, Khatun *et al.* (2011) and Tabatabaei (2012) reported decreased ALP levels during pregnancy.

The mean±SE values of lactate dehydrogenase (U/L) for Group-I, II, and III were 429.25±4.72, 408.63±4.74 and 394.6±5.15, respectively, noted highly significant ($p<0.01$) (Table.3) variation between the groups, possibly attributed to rapid growth, increased muscle activity, and elevated metabolic rates during this growth phase. Tabatabaei (2012) noted a decrease in LDH levels during pregnancy.

The mean±SE of BUN levels (mg/dL) in Group-I, Group-II, and Group-III were 17.55±0.50, 18.81±0.54, and 21.9±0.53, respectively. Noted highly significant ($p<0.01$) variation between the groups regarding BUN levels (Table.3). These findings are consistent with those of Cooper *et al.* (2014), De *et al.* (2017), Dutta *et al.* (2020), and Rahman (2016).

The mean±SE values of creatinine (mg/dL) in Group-I, Group-II, and Group-III were reported as 1.56±0.06, 1.66±0.10, and 1.88±0.08, respectively, all falling within the normal range. Noted significant ($p<0.05$) variation between the groups (Table.3). The findings align with De *et al.* (2017) and Dutta *et al.* (2020).

The cortisol levels (mean ± SE) in Group-I, II, and III were recorded as 2.87±0.33, 2.01±0.13, and 2.55±0.15, respectively, all falling within the normal range. Noted a significant ($p<0.05$) variation among the groups (Table.3). Elevated cortisol levels in Group-I pigs compared to adult pigs could be attributed to factors such as weaning stress, adaptation to new environments, and social interactions within the group. However, individual variations and proper management practices can also influence stress levels, as noted by Kluivers-Poodt *et al.* (2010).

Table.1 Showing mean±SE of clinic-physiological parameters.

Parameters	Group-I	Group-II	Group-III
Respiration rate	43.66 ± 1.40^{a}	39.33 ± 1.02^{b}	39.16 ± 0.94^{b}
Heart rate	99.16 ± 2.86^{a}	85.83 ± 1.47^{b}	81.50 ± 1.58^{b}
Pulse rate	98.83 ± 2.07^{a}	85.50 ± 1.45^{b}	81.10 ± 1.19^{b}

Rectal temperature	102.88±0.24	102.50±0.13	102.43±0.15

NB: Means with different superscripts differ significantly.

Table.2 Showing mean±SE of haematological parameters.

Parameters	Group-I	Group-II	Group-III
Hemoglobin	10.12 ± 0.21^{a}	12.03 ± 0.34^{b}	10.84 ± 0.09^{a}
Packed cell volume	38.73 ± 0.88^{a}	36.88 ± 0.49^{ab}	36.16 ± 0.43^{b}
Total leucocyte count	19.23±0.56	18.07±0.46	18.25±0.69
Total erythrocyte count	6.34 ± 0.12^{a}	7.31 ± 0.22^{b}	6.94 ± 0.07^{ab}

NB: Means with different superscripts differ significantly.

Table.3 Showing mean±SE values of biochemical parameters.

Parameters	Group-I	Group-II	Group-III
Blood glucose	136.98±1.91	129.35±3.94	126±3.93
Total protein	7.80±0.22	7.76±0.20	8.02±0.26
Alanine Aminotransaminase	38.86 ± 1.24^{ab}	42.21 ± 1.80^{a}	36.92 ± 0.74^{b}
Aspartate Aminotransferase	40.61±0.51	40.06±0.63	39.75±0.50
Alkaline phosphatase	143.96 ± 1.72^{a}	137.78 ± 1.24^{b}	133.5 ± 2.27^{b}
Lactate dehydrogenase	429.25 ± 4.72^{a}	408.63 ± 4.74^{b}	394.6 ± 5.15^{b}
Blood urea nitrogen	17.55 ± 0.50^{a}	18.81 ± 0.54^{a}	21.9 ± 0.53^{b}
Creatinine	1.56 ± 0.06^{a}	1.66 ± 0.10^{ab}	1.88 ± 0.08^{b}
Cortisol	2.87 ± 0.33^{a}	2.01 ± 0.13^{b}	2.55 ± 0.15^{ab}

NB: Means with different superscripts differ significantly.

CONCLUSIONS

This study provides a thorough examination of the clinico-physiological, haematological, and biochemical profiles of pigs at distinct stages of growth and pregnancy. The analyses of physiology and haemato-biochemical parameters offer valuable insights into the functional status of organs and various bodily systems. While the study revealed that clinico-physiological and haemato-biochemical parameters generally fell within normal ranges, notable variations among the groups were observed. This detailed study helps to understand the intricate dynamics of pig health across different developmental stages, contributing to a more comprehensive understanding of their well-being.

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