Haematological Parameters: Indicators of the Physiological Status of Farm Animals

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Abstract

This review examined haematological parameters as indicators of the physiological status of farm animals. Blood is important and reliable medium for assessing the physiological and health status of farm animals and haematology is the study of the morphology and physiology of blood. Haematological parameters are those parameters that are related to the blood and blood forming organs. Haematological analysis involves the determination of the various blood parameters and the parameters include erythrocyte (red blood cells (RBC)), leucocyte (white blood cells (WBC)), Packed Cell Volumes (PCV) among others. Haematological examination is among the methods which may contribute to the detection of some changes in health and physiological status, which may not be apparent during physical examination but which affect the fitness of the animal. Thus, haematological parameters are good indicators of the physiological status of farm animals. Furthermore, there is a great variation in haematological parameters of farm animals caused by several factors. There is therefore, the need to investigate these factors and how they affect blood parameters. This will help to establish appropriate physiological baseline values for various livestock.

Keywords: Haematology, parameters, indicators, physiology, farm animals.

1. INTRODUCTION

Haematology is the study of the morphology and physiology of blood (Institute of Biomedical Science, 2013). Wikihow (2013) reported that haematology is the branch of biology (physiology) that is concerned with the study of blood, blood-forming organs and blood diseases. According to Wikipedia (2013a), haematology is the study of blood, the blood-forming organs and blood diseases. Maxwell (2013) and Rasko (2013) posited that haematology deals with many aspects of those diseases which affect the blood such as anaemia. Blood is important and reliable medium for assessing the physiological and health status of individual animals (Oduye, 1976; Egbe-Nwiyi et al., 2000). According to James (2004), the life of all flesh is the blood and it is useful for atonement for human soul. Blood is useful for assessing the health status, clinical evaluation for survey of physiological/pathological conditions and diagnostic and prognostic evaluation of various types of diseases in animals (Taiwo and Anosa, 1995; Awah and Nottidge, 1997, 1998; Nottidge et al., 1999; Kral and Suchy, 2000; Padilla et al., 2000; Tambuwal et al., 2002; Singh et al., 2002; Obasoyo et al., 2005; Alade et al., 2005; Amel et al., 2006). Haematological parameters are those parameters that are related to the blood and blood-forming organs (Waugh and Grant, 2001; Bamishaiye et al., 2009). Blood parameters change in relation to the physiological status of an animal. The haematological examination is among the methods which may contribute to the detection of some changes in health and physiological status, which may not be apparent during physical examination but which affect the fitness of the animal (Kronfeld, 1969; Bamishaiye et al., 2009). Haematological analysis involves the determination of different blood parameters such as packed cell volume, Red Blood Cell count among others, which can be done using either the electronic quantification or manual quantification (Wikihow, 2013).

A lot of work has been carried out on the blood parameters of various domestic animals (Solomon et al., 1998; Kral and Suchy, 2000; Singh et al., 2002; Svoboda et al., 2005; Ahamefule et al., 2006; Chineke et al., 2006) but studies on the corpuscular elements of the blood have not been well documented in farm animals (Daramola et al., 2005). As a result of which there is a paucity of information on the reference haematological values/normal blood profiles of various farm animals, thus, making it difficult to easily evaluate the physiological status of farm animals, as data obtained from such studies could have been used for diagnosis of diseases for criteria of adaptability as well as to elucidate some physiological mechanisms in farm animals.

This review aimed to examine the importance of haematological parameters in assessing the physiological status of farm animals.

2. HAEMATOLOGICAL ANALYSIS

Haematological assessment can be considered as a practical diagnostic tool (Yasini et al., 2012). According to Wikihow (2013) haematological analysis involves the determination of different blood parameters, which can be done using either the electronic quantification or the manual quantification. The electronic quantification can be done with the use of the auto counter and these displace about 15 parameters, while manual quantification of Packed Cell Volume (PCV) for example is by the use of micro haematocrit centrifuge. This micro haematocrit centrifuge is used to determine the Packed Cell Volume (PCV), from which many parameters can be obtained (Wikihow, 2013). The best way to determine blood parameters is through the electronic device called autocounter because it gives accurate values and manual red blood cell counting is obsolete and inaccurate. Although the manual quantification is also used to confirm whether the values obtained from auto counter correlate with it for packed cell volume (PCV). With the exception of trace element analysis, routine haematology is less frequently performed in farm animal practice than small animal practice. This haematological investigations tend to be limited to selected test for flock problems and specific disease presentations in a more valuable individuals (Milne and Scott, 2006).

a. Haematological Parameters

Haematological parameters are good indicators of the physiological status of farm animals (Etim, 2010). The commonly used haematological parameters are erythrocyte (Red Blood Cells, RBC), leucocytes (White Blood Cells, WBC), haemoglobin concentration (HBC), Packed Cell Volume (PCV) and values which include Mean Corpuscular Volume or Cell (MCV), Mean Corpuscular Haemoglobin, Mean Corpuscular Haemoglobin Concentration (MCHC) (Carlson, 1996; Chineke, 2006).

i. Red Blood Cell Count

A Red Blood Cell Count (RBC) is a blood test that indicates the number of Red Blood Cells (RBC) an animal has (Wikipedia, 2013b). The RBC count is almost always part of the CBC (Complete Blood Count). The test can help diagnose anaemia, and other conditions affecting red blood cells (Gernsten, 2009; Bunn, 2011). Red blood cell indices are blood tests that provide information about the haemoglobin content and size of red blood cells. Abnormal values indicate the presence of anaemia and which type of anaemia it is

(Gernsten, 2009). Red Blood Cell (RBC) indices are part of the complete blood count (CBC) test. They are used to help diagnose the cause of anaemia, a condition in which there are too few red blood cells. Anaemia is defined based on the cell size (MCV) and amount of Hb (MCH). Red blood cells transport haemoglobin, which, in turn, transports oxygen. According to Awodi et al. (2005) and Chineke et al. (2006), the primary functions of the erythrocytes are to serve as a carrier haemoglobin. It is this haemoglobin that reacts with oxygen carried in the blood to form oxyhaemoglobin during respiration. The amount of oxygen tissues receive depends on the amount and function of RBCs and haemoglobin (Wikipedia, 2013b). The indices include:

- Average red blood cell size (MCV)
- Haemoglobin amount per blood cell (MCH)
- The amount of haemoglobin relative to the size of the cell (haemoglobin concentration) per red blood cell (MCHC) (Bunn, 2011).

Normal value ranges for RBC may vary slightly among different livestock. According to Merck Manual (2009), the normal range of values for RBC for cow is 5.0 – 10.0 (X106/mm3). Higher than normal numbers of RBC may be due to congenital heart disease, dehydration (such as from severe diarrhea), low blood oxygen levels (hypoxia), polycythemia vera among other. When an animal moves to a higher attitude, the RBC count increases for several weeks (Gernsten, 2009; Bunn, 2011). Lower than normal numbers of RBCs may be due to anaemia, bone marrow failure (for example, from radiation, toxins or tumour), erythropoietin deficiency (secondary to kidney disease), haemolysis (RBC destruction due to blood vessel injury or other causes) hemorrhage (bleeding), malnutrition, nutritional deficiencies or iron, copper, folate, vitamine B12, vitamin B6, overdehydration, pregnancy among others. Some drugs also decrease the RBC count (Gernsten, 2009; Bunn, 2011). Specific causes of erythrocyte abnormalities which might manifest in chronic blood loss include bloody diarrhea, bleeding, blood sucking parasites among others (Johnston and Morris, 1996; Chineke et al., 2006).

ii. Packed Cell Volume

The term haematocrit (Ht or HCT) also known as Packed Cell Volume (PCV) or erythrocyte volume fraction (EVF), is the volume percentage (%) of red blood cells in blood (Purves et al., 2004). Or the proportion of blood volume that is occupied by red blood cells (Wikihow, 2013). The term haematocrit comes from the Greek words, hema meaning “blood” and criterion. It was coined by Magnus Blix at Uppsala in 1891 as haematokrit (Hedin, 1891; Raser, 1981). According to Wikihow (2013), “haematocrit” was coined in 1903. Its root stem from the Greek words hema-blood and krites, judge – meaning to gauge or judge the blood. Wikipedia (2013c) reported that the word haematokirt was modeled after lactokrit which was used in dairy farming. The haematocrit is a test that measures the percentage of blood that is comprised of red blood cells (DeMoranville and Best, 2013). The haemotocrit or packed cell volume (PCV) is considered an integral part of an animal’s complete blood count result, along with haemoglobin concentration, white blood cell count and platelet count (Wikihow, 2013; Wikipedia, 2013c). In mammals, haematocrit is independent of body size (Wikipedia, 2013c). The Packed Cell Volume (PCV) can be determined by centrifuging heparinized blood in a capillary tube (also known as microhaematocrit tube) at 10,000 RPM for 5 minutes (DeMoranville and Best, 2013). This separates the blood into layers. The volume of Packed Red Blood Cells divided by the total volume of the blood sample gives the Packed Cell Volume (PCV). Because a tube is used, this can be measured by measuring the lengths of the layers. With modern laboratory equipment, the haematocrit is calculated by an automated analyzer and not directly measured. It is determined by multiplying the Red Blood Count (RBC) by the Mean Cell Volume (MCV). The haematocrit is slightly more accurate as the Packed Cell Volume (PCV) includes small amounts of blood plasma trapped between the red cells. An estimated haematocrit as a percentage may be derived by tripling the haemaglobin concentration in g/dl and dropping the units (Wikipedia, 2013c). According to Wikihow (2013c), the Packed Cell Volume (PCV) of animals can be determined to know their anaemia state; the haematocrit is used to screen animal to determine the extent of anaemia. A low haematocrit combined with other blood abnormal blood tests, confirms the diagnosis. The haematocrit is decreased in a variety of common conditions including liver and kidney diseases, malnutrition, vitamin B12 and folic acid deficiencies, iron deficiency, pregnancy among others (DeMoranville and Best, 2013). According to Wikipedia (2013c) the Mean Corpuscular Volume (MCV) and the red cell distribution width (RDW) can be quite helpful in evaluating a lower-than-normal haematocrit, since haematocrit is simply a measure of how much of the blood volume is made up of red blood cells. The MCV is the size of the red cells and the RDW is a relative measure of the variation in size of the red cell population. A low haematocrit with a low MCV with a high RDW suggests a chronic-iron-deficient anaemia resulting in abnormal haemoglobin synthesis during erythropoiesis (Wikipedia, 2013c). An elevated haematocrit is most often associated with dehydration, which is a decreased amount of water in the tissues, diarrhea etc. These conditions reduce the volume of plasma causing a relative increase in RBCs which concentrates the RBCs, called hemoconcentration. Kopp and Hetesa (2000) and Chineke et al. (2006) documented that high PCV haematocrit reading indicated either an increase in the number of circulating RBC or reduction in circulating plasma volume. An elevated haematocrit may also be caused by an absolute increase in blood cells, called polycythemia. This may be secondary to a decrease amount of oxygen, called hypoxia or a result of proliferation of blood forming cells in the bone marrow (Polycythemia vera) (DeMoraville and Best, 2013). RAR (2009) documented the following range of values; 24 – 45%; 24 – 48%; 30 – 50%; 37 – 48% as normal range of values for PCV for sheep, cow, rabbit and guinea pig respectively. Furthermore, Merck Manual (2012) posited the range of 30 – 45% (24 – 34 x 10-2l/l) as reference range for PCV for cow.

iii. Mean Corpuscular Volume

The Mean Corpuscular Volume or “Mean Cell Volume” (MCV), is a measure of the average red blood cell volume that is reported as part of a standard complete blood count. The MCV is calculated by dividing the total volume of packed red blood cells (also known as haematocrit) by the total number of red blood cells. The resulting number is then multiplied by 10. The red blood cells get packed together when they are spun around at high speeds in a centrifuge (Choladda, 2012; Wikipedia, 2013d). In animals with anaemia, it is the MCV measurement that allows classification as either a microcytic anaemia (MCV below normal range), normocytic anaemia (MCV within normal range). Macrocytic (MCV above normal range). Normocytic anaemia is usually deemed so because the bone marrow has not yet responded with a change in cell volume. It occurs occasionally in acute condition, namely blood loss and haemolysis.

To calculate the MCV, expressed in femoliters (fl, or 10-15L), the following formula is used: 10 x hematocrit (%) divided by RBC count (millions/µl); $MCV = \frac{Hct}{RBC} \times 10$.

- Use of volume-sensitive automated blood cell counters, such as the coulter counter. In this type of apparatus, the red cells pass one by one through a small aperture and generate a signal directly proportional to their volume (Wikipedia, 2013d).
- Other automated counters measure red blood cell volume by means of technique that measure refracted, diffracted, or scattered light (Stanley et al., 2011).

If the MCV was determined by automated equipment, the result can be compared to RBC morphology on a peripheral blood smear. Any deviation would usually be indicative of either faulty equipment or technician error, although there are some conditions that present with high MCV without megaloblatic cells. For further specification, it can be used to calculate red blood cell distribution width. Vitamin B12 and/or folic acid deficiency has also been associated with macrocytic anaemia (high MCV values). The most common causes of microcytic anaemia are iron deficiency (due to inadequate dietary intake, gastrointestinal blood loss), or chronic diseases among other (Wikipedia, 2013d).

iv. Haemoglobin

Haemoglobin is the iron-containing oxygen-transport metalloprotein in the red blood cells of all vertebrates (Maton et al., 1993) with the exception of the fish family Channichthyldae (Sidell and Kristin, 2006) as well as tissues of some invertebrates. Haemoglobin in the blood carries oxygen from the respiratory organs (lungs or gills) to the rest of the body (i.e. at the tissues) where it releases the oxygen to burn nutrients to provide energy to power the functions of the organism, and collects the resultant carbon dioxide to bring it back to the respiratory organs to be dispensed from the organisms. In mammals, the protein makes up about 97% of the red blood cell's dry content (by weight), and around 35% of the total content (including water) (Weed et al., 1963). Haemoglobin has an oxygen binding capacity of 1.34ml O2 per gram of haemoglobin (Dominguez et al., 1981) which increases the total blood oxygen capacity severity fold compared to dissolve oxygen in blood. The mammalian haemoglobin can bind (carry) up to four oxygen molecules (Costanzo, 2007).

Haemoglobin is involved in the transport of other gases; it carries some of the body's respiratory carbon dioxide (about 10% of the total) as carbaminohaemoglobin. The molecule also carried the important regulatory molecule, nitric oxide bound to a globinproteinthiol group, releasing it at the same time as oxygen (Epstein and Hsia, 1998). Haemoglobin is also found outside the red blood cells (Biagioli et al., 2009; Wikipedia, 2013e). Oxyhaemoglobin is formed during physiological respiration when oxygen binds to the heme component of the protein haemoglobin in red blood cells. The process occurs in the pulmonary capillaries adjacent to the alveoli of the lungs. Deoxygenated haemoglobin is the form of haemoglobin without the bound oxygen. Animals use different molecules to bind to haemoglobin and change its O2 affinity under unfavourable condition. Haemoglobin deficiency can be caused either by decreased amount of haemoglobin molecules, as in anaemia, or by decreased ability of each molecule to bind oxygen at the same partial pressure of oxygen (Wikipedia, 2013e). In any case, haemoglobin deficiency decreases blood oxygen carrying capacity. Haemoglobin deficiency is, in general, strictly distinguished from hypoxemia, defined as decreased partial pressure of oxygen in the blood (Wikipedia, 2013e). Other common causes of low haemoglobin include loss of blood, nutritional deficiency, bone marrow problems among others. High haemoglobin levels may be caused by exposure to high attitudes, dehydrations, tumours, among others (MedicineNet, 2009; Wikipedia, 2013e). The ability of each haemoglobin molecule to carry oxygen is normally modified by altered blood PH or Co2, causing an altered oxygen-haemoglobin dissociation curve. However, it can also be pathologically altered in, example carbon monoxide poisoning (Wikipedia, 2013e). If the concentration is below normal, this is called anaemia (Wikipedia, 2013e). Decreased haemoglobin, with or without an absolute decrease of red blood cells, leads to symptoms of anaemia (Wikipedia, 2013e). Normal levels of haemoglobin as reported by Merck Manual (2012) for cow is 10 – 15 (g/dl) and as reported by RAR (2009) are 10 – 16, 8 – 16, 8 – 15, 10 – 15 and 11 – 15 (g/dl) for swine, sheep, cow, rabbit and guinea pig respectively.

Laboratory haemoglobin test methods require a blood sample (arterial, venous, or capillary) and analysis on haematology analyzer and co-oximeter. Additionally, a non-invasive haemoglobin (SpHb) test method called pulse co-oximetry is also available with comparable accuracy to invasive methods (Wikipedia, 2013e). Concentrations of oxy and deoxyhaemoglobin can be measured continuously, regionally and non-invasively using NIRS (Wikipedia, 2013e). NIRS can be used both on the head as on muscles. This technique is often used for research in example, neurology and more.

v. **Mean Corpuscular Haemoglobin**

The Mean Corpuscular Haemoglobin or "Mean Cell Haemoglobin" (MCH), is the average mass of haemoglobin per red blood cell in a sample of blood (Wikipedia, 2013f). It is reported as part of a standard complete blood count. MCH value is diminished in hypochromic anaemia (Gersten, 2009). It is calculated by dividing the total mass of haemoglobin by the number of red blood cells in a volume of blood. MCH = (Hgb x 10)/RBC (Gersten, 2009). Conversion to SI-Units: 1pg of haemoglobin = 0.06207 femtomol (Gernsten, 2006).

$$MCH = \frac{Hb}{RBC} \times 10$$

vi. **Mean Corpuscular Haemoglobin Concentration**

Wikipedia (2013g) reported that Mean Corpuscular Haemoglobin Concentration (MCHC) is a measure of the concentration of haemoglobin in a given volume of packed red blood cells. MCHC is very significant in the diagnosis of anaemia and also serve as a useful index of the capacity of the bone marrow to produce red blood cells. It is reported as part of a standard complete blood count. It is calculated by dividing the haemoglobin by the haematocrit (Gernsten, 2011). It is a mass or molar concentration (BloobBook.com, 2009; Wallach, 2007; MedicineNet, 2012). Still many instances measure MCHC in percentage (%), as if it was a mass fraction (MHb/MRBC). Numerically however, the MCHC in g/dl and the mass fraction of haemoglobin in red blood cells in % are identical, assuming a RBC density of 1g/ml and negligible haemoglobin in plasma (Wikipedia, 2013g). MCHC is diminished ("hypochromic") in microcytic anaemia and normal ("normochromic") in macrocytic anaemia (due to larger cell size, though the haemoglobin amount or MCH is high, the concentration remains normal. MCHC is elevated ("hypochromic") in some cases (Rifkind and Cohen, 2002). This count is used to give a rough guide to what shade of red, RBC will be, (paler = lower than the standard) (Wikipedia, 2013g).

Because of the way automated analyzers count red blood cells, a very high MCHC (greater than about 300g/l) may indicate the blood is from an animal with cold agglutination. This means that when the blood gets colder than 37°C, it starts to clump together. As a result, the analyzer may incorrectly report a low number of very dense red blood cells for blood samples in which agglutination has occurred. This problem is usually picked up by the laboratory before the result is reported. The blood is warmed until the cells separate from each other, and quickly put through the machine while still warm. This is the most sensitive test for iron deficiency anaemia (Wikipedia, 2013g). Merck Manual (2012) reported that the normal range of values for MCV, MCH and MCHC and platelet for cow are 39 – 55(fl), 13 – 17(g), 30 – 36(g/dl) and 300 – 800 respectively and RAR (2009) documented that the normal values for MCV (fl), MCH (pg) and MCHC (g/dl) for swine are 50 – 68, 17 – 23, 30 – 36, respectively; sheep, 23 – 48, 8 – 12, 31 – 38, respectively; cow, 40 – 60, 11 – 17, 30 – 36, respectively and the normal range of values for MCV (fl) and MCHC (g/dl) for rabbit, 78 – 95 and 27 – 37 respectively and for guinea pig, 67 – 77 and 30 – 34 respectively.

vii. White Blood Cell Count (WBC)

White Blood Cells (WBC), or leucocytes are cells of the immune system involved in defending the body against both infections, disease and foreign materials (WebMD, 2012; Medline Plus, 2012; Wikipedia, 2013h). White Blood Cell Count is a test to determine the number of WBCs. Five (Lafleur-Brooks, 2008) different and diverse types of leucocytes exist, but they are all produced and derived from a multipotent cell in the bone marrow known as hematopoietic stem cell. The live for about 3 to 4 days in the average human and animal body. Leucocytes are found throughout the body, including the blood and lymphatic system (Maton et al., 1997). The number of leucocytes in the blood is often an indicator of disease. There are normally approximately 7000 white blood cells per microliter of blood. They make up approximately 1% of the total blood volume in a healthy mature animal (Alberts, 2005). An increase in the number of leucocytes over the upper limits is called leucocytosis and a decrease below the lower limit is called leucopenia. A high white blood cell indicate another problem, such as, infection, stress, inflammation, trauma, allergy, or certain diseases, for this reason, a high white blood cell count requires further investigation. Valencia (2012) and Braun (2013) reported that a high white blood cell count could be caused by infection, immune system disorders, stress among others. In other studies, it was reported that a high number of leucocytes may be due to anaemia, bone marrow tumour, infectious diseases inflammatory disease, severe physical stress, tissue damage (for example, burns) among others (Bagby, 2007; Dinaiers, 2008; Dugdale, 2011). A low white blood cell count, or leucopenia, is a decrease in disease-fighting cells (leucocyte) circulating in animal's body (Mayo, 2013; Kumar, 2010; Kilegman, 2011; Marx, 2010). A low number of WBCs may be due to bone marrow deficiency or failure (for example, due to infection, tumour or abnormal scarring), disease of the liver or spleen, radiation therapy or exposure (Bagby, 2007; Dinaver, 2008; Dugdale, 2011).

The physical properties of leucocytes, such as volume, conductivity and granularity, may change due to activation, the presence of immature, or the presence of malignant leucocytes in leukemia and may be reported as Cell Population Data (Wikipedia, 2013h). Several different types of white blood cells exist. They all have many things in common, but are all distinct in form and function. A major distinguishing feature of some leucocytes is the presence of granules; white blood cells are often characterized as granulocytes or agranulocytes. There are three types of granulocytes; neutrophils, basophils and eosinophils (Wikipedia, 2013h). Agranulocytes are leucocytes characterized by the apparent absent of granules in their cytoplasm. Although the name implies a lack of granules, these cells do contain non-specific azourophilic granules, which are lysosomes (Gartner and Hiatt, 2007). The cells include lymphocyte, monocyte and macrophages (Wikipedia, 2013h). The normal values for lymphocytes, monocytes, eosinophils and basophils reported by RAR (2009) for swine are 40 – 60, 2 – 10, 0 – 10 and 0 – 2(%) respectively; for sheep, 40 – 70, 0 – 6, 0 – 10 and 0 – 3(%) respectively; for cow, 40 – 70, 1 – 6, 0 – 4, and 0 – 2(%) respectively; for rabbit, 40 – 80, 1 – 4, 0 – 4, and 1 – 7(%) respectively and for guinea pig, 39 – 72, 2 – 6, 0 – 5, and 0 – 3(%) respectively.

3. SIGNIFICANCE OF DETERMINING HAEMATOLOGICAL INDICES

The significance of determining haematological indices of domestic animals has been well documented (Oduye and Adadevoh, 1976; Oduye and Otesile, 1977; Obi and Onosa, 1980). Haematological traits are essential parameters for evaluating the health and physiological status of animals and herds (Gong et al., 2010; Liu et al., 2010; Esonu et al., 2001; Madubuike and Ekenyem (2006); Kral and Sachy, 2007). According to Daramola et al. (2005), haematological values could serve as a baseline information for comparison in conditions of nutrient deficiency, physiology and health status of farm animals especially those kept under native husbandry system in Nigeria. The examination of blood provides the opportunity to clinical investigate the presence of several metabolites and other constituents in the body of animals and it plays a vital role in the physiological, nutritional and pathological status of an organism (Aderemi, 2004; Doyle, 2006). It also helps in distinguishing normal state from state of stress, which can be nutritional, environmental or physical (Aderemi, 2004).

Changes of these parameters have been studied in cattle (Ghergarieu et al., 1984); sheep (Kaushish and Anova, 1977; Vilian and Rai, 1987) and red Sokoto goats (Tambuwal et al., 2002). There is great variation in the haematological parameters as observed between breeds of farm animals (Azab and Abdel-Maksoud, 1999; Tambuwal et al., 2002) and in this regard, it may be difficult to formulate a universal metabolic profile test for animals. These differences have further underlined the need to establish appropriate physiological baseline values for various breeds of livestock in Nigeria which could help in realistic evaluation of the management practice, nutrition, diagnosis of health condition (Daramola et al., 2005) as well as in determining the physiological status of farm animals.

4. CONCLUSION

Haematological traits are essential parameters for evaluating the health and physiological status of farm animals. Haematological constituents reflect the physiological responsiveness of an animal to its internal environment which include feed and feeding. Haematological parameters have been reported to provide valuable information on the immune status of the animal. Blood profiles can be used as a diagnostic tool to assess the health and determine the physiological status of an animal. Therefore, the haematological assay of livestock suggests the physiological disposition of the animals. There is great variation in haematological parameters of farm animals the changes are caused by several factors, there is therefore, the need to investigate these factors and how they affect the haematological parameters. This will help to establish appropriate physiological baseline values for various livestock on the basis of the factors.

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