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Original Research Article

Actions of *Persea americana* on Some Blood Parameters of Male Wistar Rats

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Abstract

The purpose of this study is to investigate the effects of the ethanolic extract of *Persea americana* (avocado) on the haematological parameters of male Wistar rats. The rats were randomly divided into three groups of five rats each. They were treated with ethanolic extract of *Persea americana* (except the control group). Group 1 received distilled water, Group 2 received 200mg/kg of the extract and Group 3 received 400mg/kg of the extract. The administration was done for 21 days. At the end of the administration, the rats were sacrificed under chlorofoam aneaesthesia and blood samples obtained and sent to the laboratory for analysis. The statistical analysis was done using the Statistical Package for Social Sciences software version 21.0. The analysis of variance (ANOVA) test was used to compare means. There was a significant ($p<0.5$) increase in packed cell volume (PCV), red blood cell count (RBC) and haemoglobin (Hb) concentration. There was no significant change in platelet count, white blood cell count, mean corpuscular haemoglobin, mean corpuscular haemoglobin concentration, mean corpuscular volume, neutrophils count, lymphocytes count, eosinophil and monocyte count, Result of the present study has shown that the ethanolic stem bark extract of *Persea americana* improved the red cell series and may be useful in treatment of anaemia because of its ability to cause a significant increase in PCV, RBC and Hb concentration.

Keywords: Haematological parameters, *Persea americana*, Wistar rats, Anaemia.

INTRODUCTION

Natural materials produced from plants, animals, and minerals are used to treat human ailments. Medicinal plants are a diverse group of plants that have medicinal properties. As medicinal plant components, various types of seeds, roots, leaves, fruit, skin, flowers, and even the entire plant can be used (Jamshidi-Kia *et al.,* 2018). Medicinal plants have become one of the oldest sciences in countries such as China, Greece, Egypt, and India (Jamshidi-Kia *et al.,* 2018). The study of medicinal plants contributes to our understanding of plant toxicity and our ability to protect humans and animals from natural toxins. These medicinal plants contain substances that can be used to treat ailments and can also be used in the production of medications as precursors (Adebayo *et al.,* 2010). Secondary metabolites are produced by plants and are responsible for their medicinal properties (Dar *et al.,* 2017). Medicinal herbs have a promising future with more than half a million plants around the world that have not yet been studied in medical practice. These plants are currently being utilized to treat diseases and future study of their medicinal activities could be beneficial (Jamshidi-Kia *et al.,* 2018). Traditional medicinal methods, which involve the use of herbal drugs and cures, have gained popularity in developing countries in recent years.

Persea americana, also known as avocado, is a commercially valuable tree native to Central America and Mexico. It is grown in humid and Mediterranean climates all over the world (Galindo *et al.,* 2007). It belongs to the Lauraceae family. Antioxidant, antihypertensive, fungicidal, larvicidal, hypolipidemic, and, more recently, amoebicidal and giardicidal actions have been discovered in *Persea americana* seeds (Jimenez *et al.,* 2013). In human lymphocytes, fruit and

leaf extracts have also been evaluated for mutagenicity (Kulkarni *et al.,* 2010).

Haematological parameters are those that have to do with blood and the organs that produce it. Blood serves as a pathological indicator of the health of animals that have been exposed to toxicants and other circumstances (Etim *et al.,* 2014). The existence of various metabolites and other constituents in the body of the organism can be clinically investigated using a blood examination. During normal clinical evaluation, haematological markers are useful diagnostic tools. It is important for an organism's physiological, nutritional, and pathological condition. It also provides useful information about the animal's immunological condition (Etim *et al.,* 2014). The majority of blood illnesses reduce or impair the number of cells, proteins, platelets, or nutrients in the blood. Red and white blood cells, as well as hemoglobin concentration, are the most common clinical indications of illness condition. In healthy people, these indicators are under control (Stern, 1989). Any gene mutation that affects hematological parameters, not to mention numerous variants that influence disease susceptibility, has major phenotypic effects. The majority of blood variability, on the other hand, is continuous and impacted by several factors (Josef, 2007).The haematopoietic system is one of the most sensitive targets for hazardous chemicals, and it is a useful indicator of physiological and pathological condition in humans and animals, as it assesses the extent of blood damage (Omodamiro *et al.,* 2016). It gives critical information on bone marrow activity as well as intravascular consequences including haemolysis and anemia (Adeneye *et al.,* 2006).

Anaemia is a type of blood condition in which there aren't enough red blood cells or the cells aren't functioning properly. Anaemia is a disorder that can range from mild to severe (very bad). It could be a short or long-term problem. It is the most common blood condition, affecting approximately one-third of the world's population (Janz *et al.,* 2013). Nearly 1 billion people suffer from iron deficiency anaemia (Vos, 2012). The aim of the present study is to investigate the effect of the stem bark extract of *Persea americana* on the haematological parameters of male Wistar rats.

MATERIALS AND METHODS

Animal Models

Fifteen (15) adult male Wistar rats used for this study were bred in the animal house of the Faculty of Basic Medical Sciences, Rivers State University, Nigeria. They were placed in standard cages and acclimatized in two weeks while maintaining them in environmental conditions with proper ventilation and free access to food and water. Generally, the procedures conformed to the established principles for the care and use of laboratory animals published by the National Institute of Health, USA (National Institutes of Health, 1985). Appropriate institutional approval was obtained for this study.

Preparation of Plant Extract

A mature *Persea americana* (avocado) stem bark sample was collected from a tree in the Rivers State University in Port Harcourt, Rivers State, Nigeria. The bark was removed from the stem, rinsed, and dried at 40°C in the oven. The taxonomist in the Department of Plant Science and Biotechnology, Rivers State University identified and authenticated the plant (voucher number RSUPb041). Ground stem bark of *Persea americana* was packed into a tiny bag weighing about 40g of each sample and placed into the thimble of the soxhlet apparatus using the soxhlet method of extraction. A round-bottom flask containing around 250 mL of solvent (ethanol) was treated to minimal heat for 3 hours using a heating mantle. The resulting solvent-oil mixture was put through a large condenser that was cooled by a constant flow of fresh water. The extract was then decanted into sample bottles after being separated using a rotary evaporator. The process was repeated until a sufficient amount of extract was recovered for analysis.

Experimental Design/Procedure

After a two-week acclimatization period, the 15 male Wistar rats were divided into three groups. Group one was the control group which received distilled water, whereas groups 2 and 3 were experimental groups and received 200mg/kg and 400mg/kg of *Persea americana* ethanolic stem bark extract, respectively. Extract administration was aided with an animal gavage tube. The animals remained on standard pelleted feeds and clean water while extract administration lasted for 21 days. At the end, animals were sacrificed and their blood collected for analysis of haematological parameters.

STATISTICAL ANALYSIS

The differences between the treatment and control groups were calculated using the SPSS (Statistical Package for Social Sciences) software program for Windows XP (version 21.0). The analysis of variance (ANOVA) test was used to compare groups. Least significant differences (LSD) and post hoc testing were used to determine whether there were significant differences between the control and treatment groups. P-values less than 0.05 were considered significant and result presented as mean ±SEM.

RESULT

The result for the study is presented in Tables 1-4.

Table 1: Effects of extract of *Persea americana* on packed cell volume, red blood cell count and haemoglobin level

Groups (mg/kg)	Packed cell volume (%)	Red blood cell count (10^{12}/L)	Haemoglobin (g/dL)
Control	40.60 ± 1.86	13.14 ± 0.47	6.92 ± 0.17
200	45.20 ± 0.58*	14.60 ± 0.23*	7.80 ± 0.07*
400	45.20 ± 0.73*	14.40 ± 0.18*	7.68 ± 0.06

Values are presented as Mean ± SEM. *Differences are considered significant at P<0.05 when compared to the control.

Table 2: Effects of extract of *Persea americana* on Platelet count and White blood cell count

Groups (mg/kg)	Platelet count (10^{9}/L)	White blood cell count (10^{-9}/L)
Control	454.40 ± 66.11	6.40 ± 0.70
200	494 ± 23.20	6.80 ± 1.04
400	550.20 ± 49.9	4.36 ± 0.57

Values are presented as Mean ± SEM.

Table 3: Effects of extract of *Persea americana* on Mean corpuscular haemoglobin, Mean corpuscular haemoglobin concentration and Mean corpuscular volume

GROUPS (mg/kg)	MCH (fl)	MCHC (g/dl)	MCV (pg)
Control	18.12 ± 0.80	32.42 ± 0.55	58.60 ± 1.43
200mg/kg	18.16 ± 0.41	32. 36 ± 0.41	57.96 ± 0.56
400mg/kg	18.62 ± 0.26	31.74 ± 0.25	58.88 ± 1.00

Values are presented as Mean ± SEM.

Table 4: Effects of extract of *Persea americana* on Neutrophil, Lymphocyte, Eosinophil, and Monocyte counts.

GROUPS (mg/kg)	Neutrophils (%)	Lymphocytes (%)	Eosinophils (%)	Monocytes (%)
Control	17.00 ± 1.92	76.00 ± 2.54	2.40 ± 0.40	4.60 ± 0.87
200mg/kg	21.40 ± 1.63	72.40 ± 1.96	2.20 ± 0.20	4.00 ± 0.44
400mg/kg	20.00 ± 4.23	73.00 ± 4.21	2.40 ± 0.24	4.60 ± 0.24

Values are presented as Mean ± SEM.

DISCUSSION

In this study, the effect of extract of *P. Americana* on some haematological parameters was evaluated in Wistar rats. Haematological parameters are good indicators of the physiological states in animals (Etim, 2010). The levels of these parameters are often altered in relation to the degree of wellness of the animal. There was a significant (p<0.5) increase in PCV, Hb concentrations and RBC count (Table 1), following three weeks of *P. Americana* extract administration. The red blood cells also referred to as erythrocytes are the non nucleated formed elements of blood produced from the red bone marrow in adult life (Sembulingam and Sembulingam, 2016). The increase in the RBC count in this study strongly suggest that the extract of *Persea americana* may contain factors that stimulate erythropoiesis. An increase in RBC suggests positive erythropoesis (Iranloye, 2002; Mansi & Lahham, 2008) and so the increase in PCV seen in this study in treated rats could be due to an increase in red blood cell formation (Nancy *et al.*, 2004). The analysis of the fruit extract showed the presence of considerable amounts of vitamins A, B2, C, K, lutein and folic acid, Gouegni and Abubakar (2013). Local tissue anoxia, in normal circumstances possibly cause the creation of erythropoietin, a glycoprotein that stimulates the production of erythrocytes (Bowman and Rand, 1980). Cole (1986) reported that significant increase in Hb could indicate that blood formation and pigmentation are both adequate. This implies that the treated rats' blood developed a larger oxygen carrying capacity which will also improve tissue oxygenation than the control rats. The amount of oxygen that tissues receive depends on the amount and function of RBCs and haemoglobin (Wikipedia, 2013). The concentration of haemoglobin (Hb), the number of red blood cells, and the haematocrit or packed cell volume (PCV) measurements are used to diagnose anaemia in the laboratory (Aiello, 1998). The haematocrit method is the most straight forward and reliable way to measure anaemia, while evaluating the Hb concentration provides precise information on the kind of anaemia (Murray *et al.*, 1983).

Anaemia is a disorder in which the number of circulating red blood cells, the amount of haemoglobin in the blood or the volume of packed red cells is reduced, lowering the blood's ability to supply oxygen to body tissues and organs (Martin *et al.*, 1998).

Although anaemia was not induced in this study, the extract may be effective in treating anaemia as a result of its ability to significantly increase RBC count, PCV and Hb levels in normal rats.

The findings in this study agreed with the reports of Shaimaa and Alla (2020) where the results showed a significant increase in PCV, RBC and Hb concentration of rats in the treatment group compared to the control group. Haemoglobin is an oxygen carrying pigment in the red cells. The increased hemoglobin concentration observed in the treated groups could suggest that the extract was rich in iron and other precursor needed for haem and eventually hemoglobin production, thereby maintaining high concentration of hemoglobin in the blood. The extract did not cause significant alterations in platelets count, white blood cell level including differentials [Neutrophils, Lymphocytes, Eosinophils and Monocytes]. as well as MCH, MCV and MCHC. Mashi *et al.,* (2019) in a study on the biochemical indices and haematological investigations of ethyl acetate extract of *Persea americana* leaf in albino rats reported that the haematological parameters studied were not significantly altered in all treatment groups. However, in this study, there were significant changes in PCV, RBC and Hb concentration. This could be due to difference in the solvent used, dosage and duration of administration of the extract.

CONCLUSION

Results of the study has shown that the ethanolic extract of *Persea americana* stem bark have the ability to cause significant increase in PCV, RBC and Hb concentration in normal Wistar rats following 21 days of administration.

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