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The effects of snakebite on haematological and clotting parameters of snakebite victims attending the Snakebite Research, Training and Treatment Centre Kaltungo, Gombe State Nigeria

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ABSTRACT

Snakebite has diverse and serious consequences such as clinical, psychological and economical. It is often referred to as plague, pandemic and medical emergency; yet it has been long neglected. One of the clinical effects is haemotoxic effect. Although the exact prevalence of snakebite is not known and is usually grossly under estimated, it is said to be far more than 5 million annually and accounts for high prevalence of morbidity and mortality. The effect of snakebite is more pronounced in the Sahara and Sub-Saharan regions of the world and is common in at least 12 States of Nigeria. The aim of this study is to evaluate the effect of haemotoxic snakebite on some clotting and haematological parameters in Kaltungo, Gombe State. It is a cross-sectional study involving 200 snakebite victims and 100 control subjects. A total of 8ml of whole blood was collected from each participant, following pre-established standard protocols and used to determine the Clotting profile using Stago (Start Max) semi-automated machine; Full Blood Count (FBC) using MacJefferson's Haematology Analyzer. The data (subjects and control result obtained were analyzed using SPSS Statistic Version 20.0 software (SPSS) Inc. A p-value of ≤ 0.05 was considered significant in all comparism. Significant mean ranks were obtained for RBC ($P<0.0015$), platelet, Hb, lymphocyte and MXD ($P<0.0001$) while insignificant mean ranks were obtained for WBC ($P>0.532$) PCV ($P>0.073$) and neutrophil ($P>0.059$). Significant mean ranks were obtained for PT, INR, APTT, TT and FIB ($P=0.0001$). In conclusion, the result of this study has demonstrated that haemotoxic snakebite has effect on clotting and haematological parameters and shows the need for their inclusion in the management of haemotoxic snakebite victims.

Keywords: Snakebite, snake venom, coagulopathy, haemorrhage

Introduction

Snake (serpent) is one of the most popular animals to the human race even though many have never seen any and are likely no to throughout their lifetime. They are elongated carnivorous reptiles in nature. Snakes looks and behaves very gentle; seemingly harmless yet most feared and in actual sense very dangerous. From pre-historic time, snakes evokes fearful response to most people when they hear, think, see (even if it is just pictures) and worse is when they have any dream that is associated to snake. It has terrifying, antagonistic and negative clinical notation. Snakes are in most cases liken to the devil. At least 36% 62% of men and females fear snakes respectively (Mehrtens, 1987; Habib *et al.,* 2008; Abubakar *et al.,* 2010; Williams *et al,* 2011; *Ceriaco, 2012;* Francis *et al.*, 2018;).

They are unique in structure in the sense that they lack limbs, eyelids and ears. However, the functions of these organs (and others) are performed in some special ways. These functions include feeding, spitting, locomotion, reproduction, moulting among many others (Cogger, 1991; Bauchot, 1994; Hegdges, 2008; Young, 2010; Reeder *et al,* 2015; Robert and David, 2016). As a class of animals, there are many other unique inner and external structures as well as characteristics like size, length, weight and lifespan. Like most other animals, they are grouped into families (about 20), genera (about 500) and species (over 3,400). Snakes are widely distributed all over the globe except in places like the Arctic, Antarctic and many small Islands. Snakes employs different security measures like underground hiding, camouflaging with the environment, stays in a noiseless and folded positions away from sight as much as possible. There are over 400 snake species in Africa, with about 30 venomous species spread into four families – atractaspididae, colubridae, elapidae and vperidae (Mehrtens, 1987; Bauchot, 1994; Holliday and Kraig, 2002; Durand, 2004, Syed, *et al,* 2008; Appiah, 2012; Voelter, 2017).

Snakebite

"Bite" may be defined literally as the process of cutting something or someone with a sharp object. One of the major characteristics of snakes is its ability and attribute of biting man and other animals that it may come across using its very sharp teeth (called fangs). This process is referred to as "snakebite" when snake is involved. Snakebite involves attacking and perforation (cutting or pricking) of the body causing physical injuries and sometimes injection of the poisonous snake saliva containing the lethal venom (envenomation). It is predicted that there is at least one snakebite every four minutes globally, causing serious and diverse health complications. Hence, it is considered as the world's biggest hidden health crisis; yet no proper attention has been given to it ever since. Even the current efforts that are being made are not globally coordinated and grossly insufficient (Mehrtens, 1987; Dreyer and Dreyer, 2013; WHO, 2015). Although most snake species can bite, only about 25% can actually inject the venom into the victim. This act is called envenomation. However, only 15% of all snakes or snake venoms are capable of causing serious harms to man. Venomous snakebite is said to be the singular most important cause of human injury from all venomous animals worldwide. The remaining 75% percent of all snakes can only cause dry bite injury; they are less dangerous and are called non-venomous snakes. The body sites of bites are usually the lower and upper limbs and are mostly related to the type of activity (Gold *et al.*, 2002; Gutterez *et al.,* 2006; Daley and Torres, 2014; Kalana and Geofrey, 2014). The predominant species of snakes varies from one place to another including the dangerous ones. The viperidae (viper) species is the most common in Nigeria, accounting for over 90% of the total bites. Snake bites for two purposes – self-defense in an event of threat and in search for food by hunting. Aside these two reasons, snakes will prefer to avoid man even more than man avoiding it. The other option of attack by snakes is through forceful strangulation. The risk group of snakebite are the poor rural dwellers, outdoor workers like agricultural workers, herders, hunters, soldiers and builders; bare foot walkers (adults and mostly children) particularly at night, people living in poorly built houses, mostly due to poverty; dirty environments and people with limited education. Unfortunately, the best means of protection is avoidance of the snake, which is very difficult for the categories of people that are mostly affected (Serpentes, 2008; McDiarmid *et al.,* 1999; Syed *et al.,* 2008; Habib, 2013; Francis *et al.,* 2018).

Prevalence of snakebite – No part of the world is free of snakebites. The estimated global prevalence of snakebite is greatly under estimated to be far over 5 million per annum, over 100,000 developing diverse forms of severe complications and over 50,000 deaths despite the fact than 10 -80% of bites are dry bites (non-envenomated). This statistic varies from one place to another but it is high in Sub-Saharan and tropical regions of the globe (Africa inclusive), where over 1 million snakebites envenomation are recorded with over 10,000 morbidity and 20,000 deaths annually. Out of this, Africa account for about 315,000 per year, resulting in more than 7000 amputation and between 7000 and 32,000 death. West African poor statistic shows about 3,557 – 5,450 death yearly. Hence, a major public health issue in the continent and region as a whole. Snakebite in Nigeria is also a common and devastating medical issue. The annual incidence is about 497 out of every 100,000 with over 12.2% mortality. Twelve States are worse affected – Gombe, Plateau, Adamawa, Taraba, Benue, Bauchi, Borno, Nasarawa, Enugu, Kebbi, Oyo, Kogi and Federal

Capital Territory (Daniel, 1999; Habib *et al.,* 2001; David and Charles, 2002 Gutterez, *et al.,* 2006; Nasidi, 2007; Chippaux, 2011; Appiah, 2012; Habib, 2013; Kalana and Geofrey, 2014; Premiun Times, 2019).

Envenomation

Envenomation refers to a situation whereby the act of snakebite is followed or accompanied by the snappy injection of the poisonous/zoonotic saliva (venom) of the snakes. Envenomation is at the discretion of the snake involved based on several factors like necessity, size of the victim etc. It is purely a characteristic of venomous snakes, which constitute about 25% of all snakes on the earth. Out of this, only 15% can cause serious effect, death inclusive. The technicality in this process is better imagined because of the precision, speed (even fractions of a second), accuracy and quantity of the venom that are involved. Although the toxicity of snake venom varies great from one species to another, age and season. Variation also occurs within a single species. However, the volume (lethal dose) of venom usually injected into the victim may be as small as 0.25 - 120mg/Kg body weight yet capable of killing most human victims in less than an hour to few days, depending on the species (Syed *et al.*, 2008; Bottrall *et al.,* 2010; Reptile Venom Research, 2010; ARVU, 2014; Julien *et al.,* 2017).

Snake venom

Snake venom is highly complex and modified poisonous (zoonotic) saliva of snake. The venom differ from one species of snake to another and even within the same species; age, season and temperature. A lot of studies have been made on snake venom and its effects but it appears as if much need to be done on it because it seems like a magically incredible fluid, considering how very small quantity (about 0.4 - 0.5mg/Kg) of it can cause diverse irreparable inter-damages to man and other animal within minutes. Snake also uses its venom to immobilize and digest its preys and antagonists or enemies (Young *et al.*, 2002; Williams *et al.,* 2004; Bottrall *et al.,* 2010; AVBU, 2014; Bernardoni *et al.,* 2014). Snake venom is a very heterogeneous compound, comprising of over 20 compounds. The composition can be divided into two broadly – proteins (about 90% - 95%) and non-protein (about 5 - 10%). The non-proteins component comprises of water, metals, carbohydrates lipids, biogenic amines free amino acids, direct haemolytic factors, lethal peptides, glycoproteins, enzymes and other equally toxic and lethal substances; the main known lethal substance being murine LD_{50}. The lethal effects are named in accordance with the lethal substance involved such as haemotoxins (blood), neurotoxins (central nervous system), myotoxins (muscles), respiratory effect, renal effect among others (Bauchot, 1994; Ismail et al., 1993; Rosenberg, 2011; Broeckhoven and du Plessis, 2017; Julien et al., 2017).

Despite all these site effects of snake venom, it is still used for the product of some drugs like the anti-snake venom and diagnostic kits that are related to snake venom (Rosenberg, 2011; Schudel, 2011).

Effects of snakebite and envenomation

As earlier mentioned, there are many effects of snakebite that grouped into: -

i. **Psychological** – Also known as fear, is an inherent phenomenon of man in relation to snake with or without any contact, since pre-historic times. There is gender variation in the psychological effect of snakes, in the sense that at least 62% of men and 32% of females fear snakes. It becomes worse when there is an actual contact or bite. Some people can even faint or die because of this. Surprisingly, snakes even fear man much more and will always prefer to run away from man whenever possible (Habib *et al.,* 2008; Abubakar *et al.,* 2010; Williams *et al.,* 2011; Dreyer and Dreyer, 2013; Francis *et al.*, 2018).
ii. **Socio-economical** - There is a strong relationship between poverty and snakebite because it is negatively and strongly linked to economic activities. It occurs mostly in the rural areas where a lot of economic such as agriculture and other outdoor activities takes place. Furthermore, it affects mainly the active male youths who mostly the breadwinners of their families. Each snakebite, whether accompanied by envenomation or not lead to negative effect, more so that most bites occur during active

farming periods. Furthermore, each bite is followed by prolonged or short-term incapacitation leading to reduced economic activities and resultant low economic performance. In general, snakebite index show an inverse correlation between human development index, the per capita government expenditure on health and gross domestic product per capita and directly associated with the labour force in agriculture. Other economic impacts of snakebite are some of the ways by which snakebite affect the economy include high cost of care which is normally bore by the victim's family from their already lean resources, high mortality and morbidity rates of most victims, leaving behind a lot of dependants to suffer (Salako, 1994; Harrison *et al.*, 2009; Dalhat *et al.*, 2012; Habib, 20013; Habib and Brown, 2018; Kasturiratne *et al.,* 2021).

iii. **Clinical effect** – This can be subdivided into physical and systemic effects

(a) **Physical injury** – The physical, local and immediate manifestation or injury is usually a 2 – 3 rows scratches or punctures cause by the upper fangs of the snake's biting actions. It is characterized by punctured wound and accompanied by anxiety, vomiting, nausea, dizziness, blurred vision, diarrhea, redness, swelling, local bleeding, pains, headache, breathing difficulty, confusion, collapse among others (Gold *et al.*, 2002; Habib, 2013; U.S. NIOOH, 2015)

(b) **Systemic effect - Systemic effects or manifestations**: - These are effects that have to do with the various systems of the body. No any singular systemic effect is independent of the others as one systemic effect may lead to another. Furthermore, some snake has multiple systemic effects running concurrently. Some systemic effects include: -

- **Haematological effect**: - This is the inability of blood to clot (haemorrhage), pro-coagulant, anticoagulant and anti-platelet effects. Up to 93% of victims suffer coagulopathy while 57% suffers spontaneous (local or systemic) bleeding. Over 90% of haematological effects are caused by the carpet viper (Echis carinatus and many more species of viper), Taipan, Eastern Brown snake etc. Other snakes with haematological effect are rattlesnake, Taipan, cobra, Eastern Brown snake among many others (Kini, 2006; Emerg, 2008; Berling and Isbister, 2014; Juliet *et al*, 2017).

- **Cardiac effect:** - viper and most of the snakes with haemotoxic effects.

- **Neurotoxic effect:** - Neurotoxic effect has to do with the central nervous system. Snakes like cobra, Tiger snake, Death Adder, Black mamba, Eastern Brown snake and Taipan snake, cause this

- **Renal effect/failure:** - This is an effect of the renal system and the snakes involve include Bothrops, Crotalus, viper and Cobra genera.

- **Respiratory effect:** This has to do with the respiratory system. The common snake species with effect are the rattlesnake, viper, cobra, Tiger snake.

- **Myotoxic effect**: - This has to do with the rapid disruption of capillary vessels of the muscles and/or tissues. The common snake species with effect are the Rattlesnake, viper, cobra, Black mamba (Parikh, 1996; Klauber, 1997; Gold *et al.*, 2002; Williams *et al.,* 2004; Escalante *et al.*, 2011; US NIOSH, 2015; Eichacker *et al,* 2016)

Haematological effect

This is specifically the major effects of snakebite and envenomation, caused by haemotoxic snake. It occurs in form of venom-induced consumption coagulopathy (VICC) within the first one hour of bite mostly, not neutralization as postulated by some scholars. VICC excessively and uncontrollably activates the clotting pathways by pro-coagulant toxins of the venom, leading to rapid consumption of clotting factors in clot formation (coagulopathy). VICC and the resultant coagulopathy manifest clinically as haemorhage e.g. intracranial haemorhage, which is fatal. This coagulopathy is immediately followed by rapid defibrination. Lesser bleeding also takes place at the site of bite due to the physical wound (McDaiarmid *et al.,* 1999; Spawls *et al.,* 2004; Berling and Isbister, 2014; Juliet *et al.*, 2017). Up to 93% of victims suffer coagulopathy, out of which about 90% are caused by Carpet viper. About 57% suffer spontaneous (local and systemic) bleeding. Apart from the effect of snake venom on other systems like the renal, cardiac, respiratory, myotoxic effects etc, this haemorrhagic effect can also affect them because of excessive bleeding. Precious researches show variation in the haematology and clotting parameters, mostly in relation to the severity of the disease manifestation (Bick, 2003; Levi, 2005; Kini, 2006; Emerg, 2008; Sakai, 2013; Kalana *et al.*, 2014).

Management of the effects of snakebite

The deadly nature of snakebite within a short time calls for urgent management or treatment attention. Identification of the snake is a very important in the management of the victims because it helps to determine if the snake is a venomous or non-venomous type as well as the type of management to embark on. Unfortunately, most times the snakes run away after attacking their victims, particularly when the purpose of the bite is thread and self-defense and/or occur in the night when the victim or other people cannot see the snake. Hence, caregivers usually depend on their local knowledge of the snakes in their environment, the nature of the bite information given by the victims, their experience, knowledge and skill of snakebite to provide treatment. This is a big challenge in the management of snakebite cases (Gold *et al.*, 2002; Pathmeswaran *et al.*, 2006; Chris, 2007; Syed *et al.,* 2008).

That notwithstanding, the decision on how to manage snakebite victims may be grouped broadly into three –

- First aid
- Traditional
- Orthodox treatments
- Sometimes a combination two or the three

(Watt *et al,* 1988; Gold *et al.*, 2002; Isbister, 2006; Syed *et al.,* 2008; Habib, 2013; Sakai, 2013; Venomus Snakes USA NIOSH, 2015).

Material and Method

Study Area

The Snakebite treatment, Research and Training Centre is located in Kaltungo, the Headquarters of Kaltungo Local Government Area, Gombe State, North Eastern Nigeria. It has 11 Local Government Areas, a population of about 2.4 million people (2006 Census) and an area of about 20,265 square kilometers (NPC, 2006; Post Office Map of L.G.A., 2009; Agbo, 2013; Prime Times, 2019).

Study Population

One hundred and forty (140) subjects were selected for the study. These consist of subjects that met the inclusion criteria. The research took place between October 2020 and May, 2021.

Inclusion criteria

I. The subjects that were selected for this study must include –
II. Victims of snakebite that are considered to have been bitten venomous (haemotoxic) by the Clinician or any other means.
III. Victims that have not taken any specific medication for the snakebite.
IV. Those that are willing to be administered the questionnaire and voluntarily accept to be enrolled.
V. Subjects without liver disease or any other condition that can affect the parameters of interest.

Exclusion criteria

The following categories of victims of snakebites were excluded from the study: -

I. Victims that are considered not to have been bitten by venomous (haemotoxic) snake;
II. Victims that have taken any form of medication (traditional or orthodox);
III. Victims that were known to have any medical conditions that can affect any of the parameters of interest like liver disease.

Ethical Consideration -Ethical clearance was sought from the Ethical Committee of Ministry of Health Gombe, Gombe State.

Informed Consent - Written informed consent was sought from all the participants using standard protocol

Questionnaire - Short and concise questionnaires were administered to all willing subjects and controls to provide useful background information for the research.

Sample Size Determination
The sample size for the study was determined using a standard formula for calculating the minimum sample size (Daniel, 1999).

$$n = \frac{z^2 p(1-p)}{d^2}$$

Where, n = the required sample size

P = the prevalence rate of snakebite in Kaltungo (which is 8.5%)

Therefore, $p = \frac{8.5}{100} = 0.085$

z = the standard normal distribution of 95%, at the confidence limit = 1.96.

d = absolute precision at 5% = 0.05

Therefore, $n = \frac{1.96^2 \times 8.5\,(1-8.5)}{0.05}$

$= \frac{3.8416 \times 8.5(1 - 0.085)}{0.05^2}$

$= \frac{3.8416 \times 0.0778}{0.0025} = 119.55$ (approximately 120 samples)

The calculated sample size for the study sample is 120 samples. Attrition of 17% was added which is 20 samples. However, the total test sample size used is 200 with 100 controls.

Study Design
The study is a case-controlled study involving a total of 200 victims of venomous (haemotoxic) snakebite attending the Snakebite Treatment, Research and Training, Kaltungo alongside 100 controls. The determination of whether the snakebite is of the haemotoxic venomous type or not was determined by the Clinicians and/or the whole blood clotting time times. Whole blood samples were collected from all the suitable and willing subjects, processed and assayed within four hours of collection for clotting and haematological parameters at the General Hospital, Kaltungo.

Sample Collection and Processing
Sample collection took place between October, 2020 and May, 2021. Whole blood (8ml) of whole blood was collected from the antecubital vein and separated into three: -

a) Two milliliters (2ml) of the blood was dispensed into Ethylene Diamine-Tetra Acetic acid (EDTA) container for Full Blood Count, using 3-part differential MaCJefferson automated haematology analyzer manufacturer's protocol (McJefferson's, 2016).

b) Four milliliters (4ml) of whole blood sample was collected into sample container containing 0.5ml sodium citrate and mixed gently. It was then be spun and the plasma harvested into a plain container for analysis within four hours of collection, using Stago (start Max) automated Clotology machine according to Manufacturer's protocol to assay for prothrombin time (PT), Activated Partial Thrombin Time (APTT), **Thrombin time (TT) and Fibrinogen (FIB0 assay** (Stago – Start Max, 2016).

Statistical Analysis
The data (FBC, PT, APTT, TT and Fibrinogen) obtained were analyzed using SPSS Statistic Version 20.0 software (SPSS Inc, Chicago, IL, USA). Statistics include mean, standard deviation and standard error of mean. A p-value of ≤ 0.05 was considered significant in all comparism.

RESULT

Some Haematological Parameters in snakebite victims and control subjects.

Table 1: Some Haematology parameters in snakebite victims and control subjects

	Mean Rank				
Parameters	**Control (n=100)**	**Test (n=200)**	**U**	**Z-score**	**p-value**
Red Blood Cell (10^{12}/l)	167.69	141.91	8281.000	-2.427	0.015 (s)
White Blood Cell (x10^{9}/l)	154.93	148.29	9557.500	-.625	0.532 (ns)
Platelet (x10^{9}/l)	224.72	113.39	2578.000	-10.479	0.0001 (s)
Packed Cell Volume (%)	163.19	144.16	8731.000	-1.794	0.073 (ns)
Haemoglobin (g/dl)	123.45	164.03	7294.500	-3.820	0.0001(s)
Neutrophil (%)	137.12	157.19	8662.000	-1.890	0.059 (ns)
Lymphocyte (%)	189.55	130.98	6095.000	-5.516	0.0001 (s)
MXD (%)	87.52	181.99	3702.000	-8.921	0.0001 (s)

Values are presented as Mean Rank, U=Mann-Whitney test.

NB: - MXD= which is the total of eosinophils, monocytes and basophils

S= Significant different statistically

NS= Not statistically significant

The results in this Table showed that RBC (at p<0.015), platelets and lymphocytes (p<0.015); haemoglobin, and mixed (MXD) were significantly decreased (s) at p<0.0001 while WBC, PCV and Neutrophils were decreased but not significantly (ns) at p>0.05

Table 2: - Clotting profile among snakebite victims and control subjects.

This table shows the values of clotting profile among snakebite victims and control subjects. The result shows that a significant increase (p<0.0001) levels of PT, INR, APTT and FIB among snakebite victims compared with controls

Table 4.12: Clotting Profile in snakebite victims and control subjects

	Mean Rank (U-Mann Whitney test)				
Parameters	**Control (n=100)**	**Test (n=200)**	**U**	**Z-score**	**p-value**
TT (sec)	53.37	125.14	286.50	-9.561	0.0001(s)
PT (sec)	68. 93	101. 78	1842.50	-4.399	0.0001(s)
INR (sec)	68. 94	104. 98	1644.00	-5.147	0.0001(s)
APTT (sec)	64. 46	108. 99	1395.50	-5. 890	0.0001(s)
FIB (sec)	52. 85	129. 94	235. 00	-10.119	0.0001(s)

Discussion

Although the accurate data of the prevalence of snakebite is not known anywhere in the world because it usually occur in the rural areas where there are no health facilities and the people suffers in silence. However, it is far above 5 million bites globally, worse in the Tropical and Sub- Sahara regions. It is associated with rapid and diverse mostly irreversible health complications including mortality and morbidity; due to the highly zoonotic (lethal) nature of its salivary venom no matter how small is the venom. Hence, it is referred to as plaque, pandemic, health emergency and so on. It is a disease of the poor because the affluent (rich and highly privileged people) hardly get in-touch with snakes; that is one of the reasons why it has been neglected all this while. Efforts that are being made even now to tackle the disease are grossly insufficient. This study further reveals the severity of the burden and the need for more urgent and concerted efforts to containing the disease.

Statistically, $p \leq 0.05$ was considered significant in all comparism between snakebite victims and control variables using student's t-test to determine Mean, Standard Deviation and Standard Error of Mean. The relationship between mean ranks of snakebite victims and the controls shows significantly decreased in RBC ($p<0.0015$), platelet, Hb, lymphocyte and MXD ($p<0.0001$); despite the fact that the people believe that abstinence from drinking water and other liquids helps in alleviating snakebite complications, which may lead to dehydration. Significant decrease in platelet may be due to its consumption during haemorrhage, which will further contribute to more haemorrhage. The mean rank value of total WBC ($p>0.532$), PCV ($p>0.073$) and neutrophil ($p>0.059$) were not decreased. Researchers have showed varying effects of snakebite on haematological parameters like increase in haemoglobin, leukocytosis and fibrinogen; degradation products; decrease in packed cell volume (PCV), platelets and fibrinogen. Some Researchers also reported that increase in prothrombin time is always associated with leukocytosis (Han *et al.*, 1996 and Jae, *et al.*, 2003; Sakai, 2013; Kalana, 2014). This study agrees with some these previous findings. Decrease in platelet is understandable because it is usually involved (consumed) in blood coagulation (consumption coagulopathy). Furthermore, several other venom components are known to inhibit or activate platelets by different mechanisms. Snake venom also causes interaction with platelets and blood vessels. Decrease in RBC and PCV/Hb level are associated with haemolysis, in which haemoglobin (Fe^{2+}) or oxyhaemoglobin is oxidised (oxidize haemoglobin) to methhaemoglobin ($Fe^{3+)}$ by the snake venom (Williams *et al.,* 2018). The parameter could be relatively normal where the effect of the venom is not maximized yet, insufficient, or ineffective. Other undetected health challenges of the victims may also cause decrease in these parameters because post bite bleeding is usual acute in nature such that it may not indicate such decrease when tested.

The causes of the varying total and differential WBC results are even more diverse, more uncertain and worrisome. The different types of WBCs (differential count) are usually responsible for different physiological functions. Polymorphoneuclear neutrophils are the major types (60 – 70%) of WBCs. They participates in innate immunity, usually recruited to body sites of damaged tissues for defense, inform of anti-microbial activity, phagocytosis, degranulation, formation of reactive oxygen species (ROS), a process that is called respiratory burst; release of inflammatory mediators and formation of neutrophil extracellular traps (NETs) among other functions. On the other hand, excess release (activation) of neutrophils can lead to extensive release of toxins, inflammatory reaction, induced tissue injury and damage in some cases. Furthermore, the number of leucocytes and their subtypes (granulocytes, lymphocytes, eosinophils and monocytes) rates are used as markers of cardiovascular disease inflammation (Borregaard, 2020; Bilal *et al.*, 2017; El- Benna *et al.,* 2021).

Snake venom and indeed other venoms (bees, wasps, scorpions etc) as well as toxins induce neutrophil local and acute inflammatory reaction characterized by recruiting and activation of leucocytes with resultant leucocytosis and release of several inflammatory mediators like prostaglandins and cytokines. This leads to increase circulatory neutrophils, particularly in the first hour in some patients with shift to the left depending on clinical state due to inflammation. Venom can cause merely mild or non-significant recruitment of eosinophils (eosinophilia) if not preciously significantly exposed to the venom. Snakebite victims show lymphopenia in response to physiological stress and increase neutrophil-lymphocyte ratio (NLR) due to inflammation; with high possibility of death. Rabbit experimentation demonstrated that the snake venom rapidly deplete basophils due to the presence of lecithinase A in the venom. On the other hand, snake venom causes modulated monocyte – derived macrophages to a pro-inflammatory profile in vitro and induces phagocytes and many substance release, leading to decrease monocytes i.e. monocytopenia (Zuliani *et al.,* 2020; Acanfora *et al.*, 2001; Bernard and Daniel, 2002; Bilal *et al.*, 2017; Williams *et al.*, 2018). Against this background, this study found out that there was rather no significant decrease total WBC and neutrophils. This differs with most of the previous findings at varying degrees. Whereas, lymphocytes and mixed (eosinophils, basophils and monocytes), were found to be significantly decreased, agreeing with all the previous findings of other Researchers. It seems that many factors determine the level of these parameters such as time, stage and degree of the disease; the snake species and intra species variation. Unfortunately, the blood films were not examined; perhaps it could have given me a clue about what was happening. This calls for further studies in future

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