In vivo action of Mucuna pruriens and Millettia pinnata (Fabaceae) minerals on the biochemical parameters of Oryctolagus cuniculus

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Abstract: The general objective of this study was to evaluate the in vivo activity of minerals from both plants on biochemical parameters. During this study, twenty-seven rabbits including seventeen males and ten females were solicited. For its realization, two portions were carried out (experimental and control).The experimental portion consisted of seven lots of three rabbits (two males and one female); whereas the control portion consisted of two lots of three males and three females for each lot. Every rabbit of the two portions was collected separately in a red tube (dry tube) with the only difference that for the experimental portion, a given rabbit was first scarified and then a previously prepared precise potion (P) was separately applied to the scarified area of the rabbit and blood was collected from the 4th day onwards for analysis of biochemical parameters.The results of this study reveal in a general way the varied actions of the minerals from these plants and their combination on the biochemical parameters studied. Their effect on these biochemical parameters may be visible on one or two animals or rarely on all three of a given batch.Thus, those from Millettia pinnata, Mucuna pruriens and their combination can have actions on the glycemia, creatinine and urea of certain animals, or on the transaminases, triglycerides, total cholesterol, HDLc and LDLc of other animals and/or on the ionograms (sodium, chlorine and potassium) of still other animals. This variation in action can be the cause of many diseases such as diabetes, kidney, liver, heart and vascular diseases.

Keywords: Minerals, Mucuna pruriens, Millettia pinnata, biochemical parameters

1.0 INTRODUCTION

The annual number of ophid bites exceeds 5 millions and the number of people who die from an ophid bite is 125,000 (Chippaux and Goyffon, 1990; Larréché, 2007). Worldwide, 500,000 to 5,000,000 people are estimated to be victims of snakebite poisoning, of whom 50,000 to 150,000 die and 400,000 suffer serious functional sequelae: amputation, kidney failure, neurological sequelae (Pollet et al., 2000; Larréché, 2007; Chippaux, 2011).

Ophidic poisoning in Africa is a public health problem, not only because of its seriousness but also because of the difficulties in treating it (Larréché, 2007). Indeed, in urban Africa, patients with ophidic envenomas can be treated with serotherapy (immunotherapy). It comes from the specific study of venoms based on rigorous biochemical and toxicological analyses (Chippaux, 2002).However, immunotherapy, which remains the only specific therapy for ophid envenomation, is still very expensive, is available in only a few pharmacies and is constantly being discontinued (Dramé, 2000). For rural populations, venomous snake bites are a medical, social and economic problem because of their low income and the distance from medical centers (Grema and Koné, 2003). In the Maghreb, as in sub-Saharan countries, venomous snakes considered more dangerous are represented by Viperidae and Elapidae (Mion and Olive, 1998; Kassogué, 2006).

Naja melanoleuca, Naja nigricollis, Naja haje... are among the Elapidae found in Africa (Mion and Larréché, 2008). The Naja nigricollis has a venom containing toxins that can rapidly immobilize a (neurotoxic) prey (Larréché et al., 2008). These toxins are polypeptides and proteins, small in size (PM < 30 kDa) and represent 50 to 70% of the dry weight of Elapidae venoms (Larréché et al., 2008).These proteins can act alone or in synergy with other components of the venom to cause serious disturbances in the body's biological systems. These disturbances are responsible for the oedema, hematological, neurological, renal, pulmonary and tissue necrosis that are characteristic of ophid envenomation (Nelson, 1989; Brown and Warrell, 1993; Hamza, 2001). These major facts have led African populations to adopt traditional medicine as a therapeutic alternative.

Numerous studies have consistently shown that medicinal plants contain a variety of biologically active chemicals that have different pharmacological activities: antioxidant, anti-inflammatory, analgesic, etc. (Candan et al., 2003; Lagnika et al., 2012; Dinzedi, 2015; Okou and Yapo, 2018). In fact, according to Naceiri Mrabti, 2018, some natural bioactive substances can have effects on certain biochemical parameters.

According to the World Health Organization (WHO) in 2013, approximately 80% of the populations of developing countries use traditional medicine and in particular herbal medicine for their health care needs. The African floristic heritage is very rich in medicinal plants whose effectiveness is proven. In effect, it has been shown that the continent abounds in nearly 5,000 medicinal species (Adjanahoun and Aké-Assi, 1979; Okou, 2012; Okou and Yapo, 2018).

In West Africa, particularly in Benin, 80% of snake bites reported using traditional treatment rather than modern Western medicine (Chippaux and Goyffon 1989; Grema and Koné, 2003). In Côte d'Ivoire, studies conducted by some researchers have reported noteworthy results regarding the ethnomedical approach to treating snake bites with herbal medicines.According to these authors, the root of Securidaca longepedunculata (Polygalaceae) can be used in the case of Elapidae poisoning (Koné, 1980; Somé et al., 2002). In addition, in the Bouaké region (Côte d'Ivoire), some populations use two Fabaceae, namely Mucuna pruriens and Millettia pinnatta, to treat cases of ophid poisoning.

It is with the aim of rationally exploiting this heritage, to provide a scientific basis for the use of these plants and to contribute to the discovery of new drug leads that this study was carried out. Its objective was to know the in vivo effect of Millettia pinnatta and Mucuna pruriens on certain biochemical parameters of rabbits.

2.0 MATERIALS AND METHODS

2.1 Plant material

The plant material is composed of Mucuna pruriens and Millettia pinnata. They were harvested in December 2019 in Bouaké (Central Côte d'Ivoire).

2.2 Animal material

For this study, 27 rabbits including 17 males and 10 females of Hyplus breed, aged two and a half months were purchased from a breeder in the locality of Daloa (Côte d'Ivoire). After the acclimatization period of three weeks, the weight of the rabbits varied between 1.45 and 2.4 Kg. Beside this animal model, the viper skulls were provided by a medico-druggist.

2.3 Method of preparation of minerals

For its realization the various plants were harvested in Bouaké, washed, cut then dried in the shelter of the sun, at room temperature during one week. Then, the plant organs were dried in an oven at a temperature of 70°C for three days. After this drying time, the organs (plant and animal) obtained were incinerated in a muffle furnace for 13 hours at 550 °C. The ashes obtained were weighed using a precision balance. The ashes are unctuous with the exception of the viper skull, which is rough. The colors vary from gray to brown.

The combination of ashes from the various organic products resulted in the following potions:
- P1 consists of the ashes of the two plants and the skull of a viper;
- P2, P3 and P4 are respectively and only made up of ashes of Mucuna pruriens, Millettia pinnata and viper skull;
- P5 is composed of the ashes of Mucuna pruriens and Millettia pinnata;
- P6 is the ashes of the viper skull and Mucuna pruriens;
- P7 consists of the ashes of the skull of viper and Millettia pinnata.

2.4 Calculation of incineration efficiency

The formula below was used to calculate the weight of dry matter of the organs used.

$$Ac = \frac{Mass\ of\ ashes}{Dry\ matter} \times 100$$

Ac : Ash content

2.5 Method of scarification of experimental batches

To scarify the experimental batches, the following potions:
- P1 was used for lot 3;
- P2 has been used for lot 4;
- P3 served for lot 5;
- P4 was used for lot 6;
- P5 has been used for Lot 7;
- P6 served for lot 8 ;
- P7 was used for Lot 9.

Each experimental batch consisted of two males and one female. However, before scarification, the affected areas (toes of the left paw and tarsus of the right paw) were exposed with a pair of scissors. Then, a separate quantity of 0.45 mg of the potion prepared after scarification was applied to each affected area of every given batch. Experimental testing began four days after scarification.

2.6 Method of blood collection

In general, blood samples were taken from the short saphenous vein and/or the femoral vein. The restraint method was performed by three people. The areas where these veins were located were previously exposed with a pair of scissors. The vacutainers into which the needles were inserted allowed the sampling to be carried out using the red tubes (dry tubes). The resulting tubes were stored in a cooler containing ice and then transported to the laboratory for analysis.

3.0 RESULTS

3.1 Results of biochemical parameters of control rabbit batches

The results of the biochemical parameters of the control rabbit batches are reported in Table 1 below. In this table, the reference value for the biochemical parameters of:

- blood glucose is 193.8 ± 24.77 mg/dL for males and 152.32 ± 17.35 mg/dL for females;
- creatine values are 18.38 ± 1.44 mg/L for males and 15.87 ± 1.83 mg/L for females;l'urémie est de 45,93 ± 3,55 mg/L pour le mâle et de 39,66 ± 4,57 mg/L pour la femelle;
- GOT are 87.1 ± 75.99 IU/L for males and 124.57 ± 46.92 IU/L for females;
- the GPT are 81.12 ± 44.09 mg/L for males and 13.76 ± 15.81 mg/L for females;
- triglycerides levels are 344.71 ± 127.18 mg/dL for males and 154.16 ± 37.64 mg/dL for females;
- total cholesterol levels are 94.12 ± 23.08 mg/dL for males and 112.96 ± 16.26 mg/dL for females;
- HDL cholesterol is 26.16 ± 33.86 mg/dL for males and 68.07 ± 12.69 mg/dL for females;
- LDL cholesterol is 122.67 ± 184.78 mg/dL for males and 20.87 ± 12.88 mg/dL for females;
- sodium level is 132.87 ± 7.72 mmol/L for males and 141.9 ± 175 mmol/L for females;
- chlorine is 107.43 ± 10.22 mmol/L for males and 101.5 ± 0.62 mmol/L for females,
- potassium values are 3.93 ± 0.13 mmol/L for males and 4 ± 0 mmol/L for females.

Table 1: Biochemical parameters of control batches

Lots	Individuals	Gly	Creat.	Urea	Transaminases		TG	TC	HDLc	LDLc	Ionogram		
					GOT	GPT					Na	Cl	K
Biochemical parameters of the male control batch													
Lot 1	MW 07	185.2	17.38	43.45	121.41	126.52	198.02	69.33	9.09	20.63	124.5	116.4	3.78
	MW 16	221.72	17.74	44.35	139.88	78.37	411.98	98.04	4.23	11.42	134.4	96.3	4
	MW 10	174.47	20.03	50	0	38.47	424.12	114.98	65.15	335.97	139.7	109.6	4
	Average	193.8	18.38	45.93	87.1	81.12	344.71	94.12	26.16	122.67	132.87	107.43	3.93
	Standard deviation	24.77	1.44	3.55	75.99	44.09	127.18	23.08	33.86	184.78	7.72	10.22	0.13
Reference value		**169.03 - 218.57**	**16.94 - 19.82**	**42.38 - 49.48**	**11.11-163.09**	**37.03-125.21**	**217.53 - 471.89**	**71.04-117.2**	**-7.7-60.02**	**-62.11-307.45**	**125.15 - 140.59**	**97.21-117.65**	**3.8-4.06**
Biochemical parameters of the female control batch													
Lot 2	FW 01	134.02	14	35	80.78	0.56	120.62	106.19	64.83	17.24	143.6	100.8	4
	FW 10	154.4	15.94	39.85	118.83	31.29	194.87	131.47	57.32	35.18	142	101.7	4
	FW 12	168.53	17.66	44.14	174.09	9.44	147	101.21	82.07	10.2	140.1	102	4
	Average	152.32	15.87	39.66	124.57	13.76	154.16	112.96	68.07	20.87	141.9	101.5	4
	Standard deviation	17.35	1.83	4.57	46.92	15.81	37.64	16.26	12.69	12.88	1.75	0.62	0
Reference value		**134.97 - 169.67**	**14.04 -17.7**	**35.09 - 44.23**	**77.65-171.49**	**-2.05-29.57**	**116.52-191.8**	**96.7-129.22**	**55.38-80.76**	**7.99-33.75**	**140.15 - 143.65**	**100.88 -102.12**	**4**

Gly : glycemia (mg/dL) ; Creat. : Creatinine (mg/L) ; Urea (mg/L) ; Transaminases (GOT and GPT in UI/L) ; TG : triglycerides (mg/dL) ; TC : total cholesterol (mg/dL) ; HDLc : HDL cholesterol (mg/dL) ; LDLc cholesterol (mg/dL) ; Na : sodium (mmol/L) ; Cl : chloride (mmol/L) ; K : potassium (mmol/L). MW : male witness ; FW : female witness

3.2 Results of mineral tests on the biochemical parameters of rabbits treated as a preventive measure before poisoning

The results of the biochemical parameters of rabbits treated as a preventive measure are shown in Table 2. Analysis of the biochemical parameters in this table in comparison with the reference values in Table 1 reveals that:

- blood glucose levels are normal in a male of lot 3, lot 4, lot 5, lot 6, lot 7, lot 8 and lot 9 and in a female of lot 4, lot 8 and lot 9; while they are elevated in a male of lot 3 and a female of lot 3, lot 5, lot 6 and lot 7 in contrast to a male of lot 4; 5; 6; 7; 8 and 9.

- at the level of creatinine, it is normal in the two males of lot 3 and lot 6, one male of lot 4 and lot 7, the female of lot 4, lot 6 and lot 8; whereas it is increasing in the female of lot 3, lot 5 and lot 7 in contrast to one male of lot 4, lot 7 and one female of lot 9, and two males of lot 5, lot 8 and 9.

- at the urea level, compliance with its standard is found in two males of lot 3 and lot 6, one male of lot 4 and lot 7, and in the female of lot 6 and lot 8; in contrast, it is bred in the female of lot 3, lot 5 and lot 7 as opposed to that of one male of lot 4 and lot 7, two males of lot 5, lot 8 and lot 9, and one female of lot 4.

- at the GOT it is normal in all three individuals of lot 3, two males of lot 5, lot 6 and 8, one male of lot 7 and 9; at the time it is increased in two males of lot 4, one male of lot 7 and 9, and in the female of lot 4, lot 5, lot 6, lot 7, lot 8 and 9.

- at the level of GPT, it is increased in a female from lots 3; 4; 5; 6; 7; 8 and 9, and in a male from lots 4 and 7. Apart from these observations, it is normal in individuals from the other lots.

- at the triglycerides level, they are lower in a male of lot 3; 4; 5; 8 and 9, and in two males of lot 6 and 7 inversely in the female of lot 3; 4; 5; 6 and 8. Except for these findings, they meet their standard in the other cases.

- in total cholesterol, it is increased in the female of lot 3; 5; 6 and 8, and in a male of lot 4 and 9, which is the opposite in a male of lot 5 and 6. Other than these remarks, it is normal in the animals of the various batches made up.

- at the HDLc level, it is decreased in the female of lot 3; 4; 5; 6; 7; 8 and 9 as compared to a male of lot 4. In addition to these observations, the respect of its standard is noticed in the animals of the different batches carried out.

- at the LDLc level, it is superior in a male from lot 5 as well as the female from lots 3; 4; 5; 6; 7; 8 and 9. Independently of these findings, it is normal in the other individuals of the various lots.

- the sodium level is increased in the female of lot 6; 7, 8 and 9, and two males of lot 6; 7; 8 and 9; and is low in one female of lot 3; 4 and 5, and one male of lot 4. Except for these remarks, it is normal in the other animals.

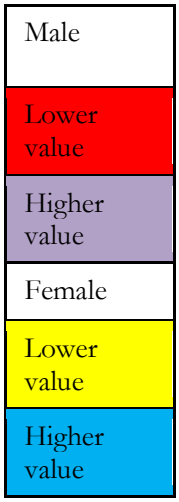
- chlorine levels are decreased in the female from lot 6; while they are increased in the female from lots 3; 4; 5; 7; 8 and 9, and one male from lot 6. Apart from these remarks, it obeys its norm in the other individuals of the different lots made.

- potassium levels are normal in the two males from lot 3, and one male from lots 4 and 8. It is lower in the female of lot 3; 4; 5 and 6, one male of lot 4; 6 and 7, and the two males of lot 5 as opposed to one male of lot 6; 7; 8, the two males of lot 9, and the female of lot 7; 8 and 9.

Table 2: Biochemical parameters of mineral treaties

Lots	Individuals	Gly	Creat.	Urea	Transaminases		TG	TC	HDLc	LDLc	Ionogram		
					GOT	GPT					Na	Cl	K
Lot 3 (P1)	M.3	180.09	17.6	44	40.59	66.17	177.34	104.59	42.25	26.88	137.6	112.8	3.8
	M.13	222.91	17.66	44.15	99.37	99.86	312.9	96.05	33.93	259.76	132.9	115.3	3.84
	F.3	192.27	19.14	47.85	133.67	181.21	335.66	137.4	20.85	49.42	132.9	109.1	3.95
Lot 4 (P2)	M.14	125.11	18.57	46.42	370.57	106.26	350.59	245.9	141.86	33.93	123.7	107.4	3.81
	M.9	187.08	7.1	17.75	253.07	212.66	77.96	76.72	40.15	21.03	132.6	112.1	3.66
	F.11	157.81	15.26	34.66	201.12	179.57	202.69	122.34	15.32	62.9	135.9	115.6	3.81
Lot 5 (P3)	M.8	179.3	16.24	40.6	103.78	112.65	349.48	102.06	11.9	317.17	127.8	114.7	3.78
	M.11	119.6	14.19	35.47	111.43	50.37	147.56	62.86	13.05	121.94	125.7	117.1	3.41
	F.7	190.88	23.84	59.6	231.24	192.35	281.81	138.31	23.96	230.19	129.4	117.6	3.65
Lot 6 (P4)	M.1	131.61	17.01	42.52	69.39	84.95	146.13	64.88	7.23	28.22	183.3	127.5	6.93
	M.6	206.25	19.03	47.57	71.55	66.34	116.55	116.09	13.06	79.72	183.6	110	2.91
	F.6	188.94	15.8	39.5	175.82	109.94	319.96	163.16	14.94	84.23	165.3	98.7	3.36
Lot 7 (P5)	M.5	181.2	11.82	29.53	57.97	48.83	120.15	90.81	8.88	57.9	171.1	110.6	3.1
	M.12	154.25	19.39	48.47	219.32	172.52	75.73	104.27	25.89	67.23	165.4	105.2	7.54
	F.14	172.19	20.64	51.6	381.85	171.08	173.81	116	30.91	50.33	229.3	129.6	9.83
Lot 8 (P6)	M.15	141.39	14.53	36.32	71.68	76.64	234.56	98.29	13.39	37.99	188.3	111.5	4.03
	M.2	186.8	16.83	42.07	129.51	122.88	211.36	93.53	13.33	37.93	171.8	112.9	6.27
	F.13	142.83	14.83	37.05	604.59	245.89	287.09	155.16	24.08	76.66	181.9	118.1	5.66
Lot 9 (P7)	M.7	170.88	16.68	41.7	104.16	79.86	158.49	90.82	13.15	79.86	160.37	113.33	4.2
	M.4	132.7	16.7	41.75	170.54	89.28	243.76	136.36	54.16	33.38	165.1	115.47	4.92
	F.2	158.78	16.34	40.85	342.09	484.52	133.92	118.42	16.73	74.91	168.4	114.1	5.84
Reference value	M	**169.03 - 218.57**	**16.94 - 19.82**	**42.38 - 49.48**	**11.11-163.09**	**37.03 - 125.21**	**217.53 - 471.89**	**71.04-117.2**	**-7.7-60.02**	**- 62.11-307.45**	**125.15 - 140.59**	**97.21-117.65**	**3.8-4.06**
	F	**134.97 - 169.67**	**14.04 -17.7**	**35.09 - 44.23**	**77.65 - 171.49**	**-2.05-29.57**	**116.52 -191.8**	**96.7-129.22**	**55.38 - 80.76**	**7.99-33.75**	**140.15 - 143.65**	**100.88 - 102.12**	**4**

Legend



Gly : glycemia (mg/dL) ; Creat. : Creatinine (mg/L) ; Urea (mg/L) ; Transaminases (GOT and GPT in UI/L) ; TG : triglycerides (mg/dL) ; TC : total cholesterol (mg/dL) ; HDLc : HDL cholesterol (mg/dL) ; LDLc cholesterol (mg/dL) ; Na : sodium (mmol/L) ; Cl : chloride (mmol/L) ; K : potassium (mmol/L).

4.0 DISCUSSION

4.1 Result of biochemical parameters of control rabbit batches

Comparison of the results of the reference values in Table 1 shows that with the exception of the parameters of GOT, total cholesterol, HDLc and sodium, the parameters of males are generally higher than those of females. According to Djerrou, 2011, the variation in the blood content of these different biochemical elements is a function of sex, reproductive cycle, age and growth of rabbits. However, all the biochemical parameters of the control batches obtained during this study are, with a few exceptions, consistent with those of Coulibaly et al., 2007.

4.2 Results of mineral tests on the biochemical parameters of rabbits treated as a preventive measure before poisoning

The increase in blood glucose levels in M13 and F3 from lot 3, F7 from lot 5, F6 from lot 6 and F14 from lot 7 treated respectively with P1 (ash from both plants and viper skull), P3 (ash from Millettia pinnata), (P4 ash from viper skull) and P5 (ash from Mucuna pruriens and Millettia pinnata) would indicate hyperglycemia according to Siby, 2008 and Okou et al., 2020. According to these authors, hyperglycemia would be due to insulin-dependent or non-insulin-dependent diabetes, pancreatic diseases: acute or chronic pancreatitis, endocrine diseases: pheochromocytoma, hypercorticism, corticosteroid therapy, and hypothyroidism.As for their decrease in M14 in lot 4, M11 in lot 5, M1 in lot 6, M12 in lot 7, M15 in lot 8 and M4 in lot 9 treated respectively with P2 (ash from Mucuna pruriens), P3 (ash from Millettia pinnata), P4 (ash from viper skull), P5 (ashes of Mucuna pruriens and Millettia pinnata), P6 (ashes of viper skull and Mucuna pruriens) and P7 (ashes of viper skull and Millettia pinnata) would translate hypoglycemia according to the same authors.It would be due, among other things, to malnutrition or prolonged fasting, an excess of insulin secreted by the body: insulinoma, polyadenomatosis, endocrine insufficiency: adrenal, pituitary, and a liver disorder: acute hepatitis.Also, according to Isler, 2007 and Okou et al., 2020; blood glucose levels are also low in cases of anorexia and high in cases of diabetes. Thus, it can be said that anorexia would be observed in M14 of lot 4, M11 of lot 5, M1 of lot 6, M12 of lot 7, M15 of lot 8 and M4 of lot 9; while diabetes would be observed in M13 and F3 of lot 3, F7 of lot 5, F6 of lot 6 and F14 of lot 7.

Creatinine elevation in F3 from lot 3, F7 of lot 5 and F14 of lot 7 treated respectively with P1 (ashes from the two plants and the viper skull), P3 (ash from Millettia pinnata) and P5 (ash from Mucuna pruriens and Millettia pinnata)

could be explained by the decrease in creatinuria, i.e. the elimination of creatinine by the kidneys, since this excretion by the kidneys is more specific to creatinine than urea (Zabré, 2013; Okou et al., 2020).This decrease in creatinuria therefore shows a dysfunction of the kidney. As for the decrease in creatinine in M9 of lot 4, M8 and M11 of lot 5, M5 of lot 7, M15 and M2 of lot 8, and M7, M4 and F2 of lot 9 treated respectively by P2 (ashes of Mucuna pruriens), P3 (ashes of Millettia pinnata), P5 (ashes of Mucuna pruriens and Millettia pinnata), P6 (ashes of viper skull and Mucuna pruriens) and P7 (ashes of viper skull and Millettia pinnata), it could be the sign of cachexia (Pitel et al., 2006; Pritchard et al., 2009; Zabré, 2013; Okou et al., 2020).

The higher urea levels in F3 from lot 3, F7 in lot 5 and F14 in lot 7 treated respectively with P1 (ashes from both plants and viper skull), P3 (ashes from Millettia pinnata) and P5 (ashes from Mucuna pruriens and Millettia pinnata) would indirectly reveal renal and liver dysfunction (Grenier-Michaud et al., 2011; Diaby, 2017; Okou et al., 2020).Relatively to its bass in M9 and F11 of lot 4, M8 and M11 of lot 5, M5 of lot 7, M15 and M2 of lot 8, M7 and M4 of lot 9 treated respectively by P2 (ash of Mucuna pruriens), P3 (ash of Millettia pinnata), P5 (ashes of Mucuna pruriens and Millettia pinnata), P6 (ashes of viper skull and Mucuna pruriens) and P7 (ashes of viper skull and Millettia pinnata) would indicate hypo-uremia. This hypo-ureaemia would indicate severe hepatic insufficiency or a deficiency in the urea cycle enzyme (Diaby, 2017; Okou et al., 2020).

According to Abenga and Anosa, 2005; Hilali et al., 2006; Zabré, 2013 and Okou et al., 2020, the increase in serum urea concentration associated with that of creatinine would indicate renal failure. Thus, it can be deduced that F3 from lot 3, F7 from lot 5 and F14 from lot 7 treated respectively with P1 (ashes from both plants and from the viper skull), P3 (ashes from Millettia pinnata) and P5 (ashes from Mucuna pruriens and Millettia pinnata) obey this assertion.

The growth of GOT in M14, M9 and F11 in lot 4, M12 and F14 in lot 7, M4 and F2 in lot 9, F7 in lot 5, F6 in lot 6 and F13 in lot 8 treated P2 (ashes of Mucuna pruriens), P5 (ashes of Mucuna pruriens and Millettia pinnata), P7 (ashes of viper skull and Millettia pinnata), respectively, P3 (ash from Millettia pinnata), P4 (ash from viper skull) and P6 (ash from viper skull and Mucuna pruriens) would show hepatocyte destruction even though in addition to the liver, it is found in the heart, skeletal muscles, lungs and kidneys (Dufour et al., 2000; Gomé et al., 2011; Okou et al., 2020).

The increase of GPT in F3 from lot 3, M9 and F11 from lot 4, F7 from lot 5, F6 from lot 6, M12 and F14 from lot 7, F13 from lot 8 and F2 from lot 9 treated respectively with P1 (ashes of both plants and viper skull), P2 (ashes of Mucuna pruriens), P3 (ashes of Millettia pinnata), P4 (ashes of viper skull), P5 (ashes of Mucuna pruriens and Millettia pinnata), P6 (ashes of viper skull and Mucuna pruriens) and P7 (ashes of viper skull and Millettia pinnata) would reveal hepatic cell necrosis because GPT is a cytosolic enzyme secreted into liver cells. It is released in the blood in case of hepatic cell necrosis (Kaneko et al., 1997; Dufour et al., 2000; Gomé et al., 2011; Okou et al., 2020).

According to Diaby, 2017 and Okou et al., 2020, elevated transaminases (GOT and GPT) could reflect hepatocellular damage or disruption of bile flow. Therefore, elevated transaminases would be observed in acute hepatitis. So, M9 and F11 of lot 4, F7 of lot 5, F6 of lot 6, M12 and F14 of lot 7, F13 of lot 8 and F2 of lot 9 treated respectively by P2 (ash from Mucuna pruriens), P3 (ash from Millettia pinnata), P4 (ash from viper skull), P5 (ashes of Mucuna pruriens and Millettia pinnata), P6 (ashes of viper skull and Mucuna pruriens) and P7 (ashes of viper skull and Millettia pinnata) would obey this observation.

Triglyceride decay in M3 in lot 3, M9 in lot 4, M11 in lot 5, M1 and M6 in lot 6, M5 and M12 in lot 7, M2 in lot 8 and M7 in lot 9 treated respectively with P1 (ashes from the two plants and the viper skull), P2 (ashes of Mucuna pruriens), P3 (ashes of Millettia pinnata), P4 (ashes of viper skull), P5 (ashes of Mucuna pruriens and Millettia pinnata), P6 (ashes of the skull of viper and Mucuna pruriens) and P7 (ashes of the skull of viper and Millettia pinnata) contrary to their elevation in F3 of lot 3, F11 of lot 4, F7 of lot 5, F6 of lot 6 and F13 of lot 8 treated respectively by P1 (ashes of the two plants and of the skull of viper), P2 (ashes of Mucuna pruriens), P3 (ashes of Millettia pinnata), P4 (ashes of viper skull) and P6 (ashes of viper skull and Mucuna pruriens) correspond to hypertriglyceridemia in the females of the above-mentioned lots. According to Al-Shinnawy, 2008; Djeffal, 2014 and Okou et al., 2020, this hypertriglyceridemia is a risk factor for predicting cardiovascular disease. Indeed, triglycerides are the main constituents of cell membranes and the increase in their concentration would probably be the result of apoptosis. Consequently, F3 from lot 3, F11 from lot 4, F7 from lot 5, F6 from lot 6 and F13 from lot 8 would be exposed to cardiovascular disease as opposed to M3 from lot 3, M9 from lot 4, M11 from lot 5, M1 and M6 from

lot 6, M5 and M12 from lot 7, M2 from lot 8 and M7 from lot 9 treated respectively with P1 (ashes from the two plants and the viper skull), P2 (ashes of Mucuna pruriens), P3 (ashes of Millettia pinnata), P4 (ashes of viper skull), P5 (ashes of Mucuna pruriens and Millettia pinnata), P6 (ashes of viper skull and Mucuna pruriens) and P7 (ashes of viper skull and Millettia pinnata).

The increase in total cholesterol is noticed in F3 of lot 3, M14 of lot 4, F7 of lot 5, F6 of lot 6, F13 of lot 8 and M4 of lot 9 treated respectively by P1 (ashes of both plants and viper skull), P2 (ashes of Mucuna pruriens), P3 (ashes of Millettia pinnata), P4 (ashes of viper skull), P6 (ashes from the skull of viper and Mucuna pruriens) and P7 (ashes from the skull of viper and Millettia pinnata), contrary to their regression in M11 of lot 5 and M1 of lot 6 treated respectively with P3 (ashes from Millettia pinnata) and P4 (ashes from viper skull).According to Eastham, 1978, Diaby, 2017 and Okou et al., 2020, a decrease would designate a hypocholesterolemia. It is observed in liver damage, serious infections, anemia, treatment with specific drugs (hormones such as clofibrate and androsterone), mental retardation and congenital acyl transferase deficiency. According to the same authors, an increase in cholesterol levels would signal hypercholesterolemia. It is found in hepatic, renal, pancreatic and thyroid disorders. According to Heuillet, 2013 and Okou et al., 2020, hypercholesterolemia is characterized by chronic inflammation of the arterial wall that develops in response to damage to the vascular endothelium.Atherosclerotic lesions develop on large and medium-sized arteries, about 3 to 0.5 cm in diameter.

The reduction of HDLc is observed in F3 from batch 3, F11 from batch 4, F7 from batch 5, F6 from batch 6, F14 from batch 7, F13 from batch 8 and F2 from batch 9 treated respectively with P1 (ashes of both plants and viper skull), P2 (ashes of Mucuna pruriens), P3 (ashes of Millettia pinnata), P4 (ashes of viper skull), P5 (ashes of Mucuna pruriens and Millettia pinnata), P6 (ashes of viper skull and Mucuna pruriens) and P7 (ashes of viper skull and Millettia pinnata) in opposition to M14 of lot 4 treated by P2 (ashes of Mucuna pruriens).Lahoz and Mostaza, 2007 and Okou et al., 2020, found that a 1% increase in HDLc is associated with a 3-4% decrease in coronary risk, and a level below 0.40 g/L in humans is considered a risk factor for cardiovascular disease. Similarly, the work of Bidié et al., 2016 and Okou et al., 2020 showed that an increase in HDLc levels would indicate a protective factor for the heart muscle, thus revealing its beneficial effect against cardiovascular complications, particularly atherosclerosis.So, M14 from lot 4 treated with P2 (Mucuna pruriens ash) would be more protected against atherosclerosis than F3 from lot 3, F11 from lot 4, F7 from lot 5, F6 from lot 6, F14 from lot 7, F13 from lot 8 and F2 from lot 9.

LDLc elevation is observed in M8 from batch 5 treated with P3 (ash from Millettia pinnata) as well as in F3 from batch 3, F11 from batch 4, F7 from batch 5, F6 from batch 6, F14 from batch 7, F13 from batch 8 and F2 from batch 9 treated respectively with P1 (ash from both plants and viper skull), P2 (ashes of Mucuna pruriens), P3 (ashes of Millettia pinnata), P4 (ashes of viper skull), P5 (ashes of Mucuna pruriens and Millettia pinnata), P6 (ashes of viper skull and Mucuna pruriens) and P7 (ashes of viper skull and Millettia pinnata).According to Lewington et al., 2007, Heuillet, 2013 and Okou et al., 2020, a reduction of 0.38 g/L of LDLc would be associated with a one-third reduction in coronary mortality. Thus, M8 in lot 5 would be more prone to coronary mortality as would F3 in lot 3, F11 in lot 4, F7 in lot 5, F6 in lot 6, F14 in lot 7, F13 in lot 8 and F2 in lot 9.

Sodium increase in M1, M6 and F6 of batch 6, M5, M12 and F14 of batch 7, M15, M2 and F13 of batch 8, and M7, M4 and F2 of batch 9 treated respectively by P4 (viper skull ash),), P5 (ashes of Mucuna pruriens and Millettia pinnata), P6 (ashes of viper skull and Mucuna pruriens) and P7 (ashes of viper skull and Millettia pinnata) in opposition to F3 of lot 3, F11 and M14 from lot 4 and F7 from lot 5 treated respectively with P1 (ashes from the two plants and from the viper skull), P2 (ashes from Mucuna pruriens) and P3 (ashes from Millettia pinnata) would, according to Sidy, 2008, manifest hypernatremia and hyponatremia respectively.According to the same author, hypernatremia can result from a decrease in the quantity of water, diarrhea, vomiting, heavy sweating, heavy water loss (diabetes insipidus, diabetes mellitus), intense exercise. Therefore, M1 and M6 and F6 of lot 6, M5, M12 and F14 of lot 7, M15, M2 and F13 of lot 8, and M7, M4 and F2 of lot 9 would obey this assertion. Hyponatremia can result from a decrease in the amount of salt during digestive losses (vomiting, diarrhea), renal losses, skin losses (extensive burning, sweating), an increase in the amount of water during inappropriate secretion of anti-diuretic hormones, excessive water intake, kidney failure, heart failure, liver failure. Therefore, F3 from lot 3, F11 and M14 from lot 4 and F7 from lot 5 would comply with these observations.

The decrease in chlorine in F6 of lot 6 treated with P4 (ash from viper skull) as opposed to F3 of lot 3, F11 of lot 4, F7 of lot 5, M1 of lot 6, F14 of lot 7, F13 of lot 8 and F2 of lot 9 treated respectively with P1 (ash from both plants and viper skull), P2 (ash from Mucuna pruriens), P3 (Millettia pinnata ash), P4 (viper skull ash),), P5 (Mucuna

pruriens and Millettia pinnata ash), P6 (viper skull and Mucuna pruriens ash) and P7 (viper skull and Millettia pinnata ash) would announce, according to Sidy, 2008, hypochloremia and hyperchloremia respectively. Hypochloremia can be the result of a decrease in the amount of salt due to digestive losses (vomiting, diarrhea), kidney losses, skin losses (extensive burning, sweating), an increase in the amount of water during inappropriate secretion of antidiuretic hormones, excessive water intake, kidney failure, heart failure, liver failure.

While hyperchloremia can result from decreased water intake, diarrhea, vomiting, heavy sweating, heavy water loss (diabetes insipidus, diabetes mellitus), intense exercise. Thus F6 of lot 6 would approve the case of hypochloremia while the others would approve hyperchloremia.

The depreciation of potassium in F3 of lot 3, M9 and F11 of lot 4, M8, M11 and F7 of lot 5, M6 and F6 of lot 6, and M5 of lot 7 treated respectively by P1 (ashes of the two plants and the viper skull), P2 (ashes of Mucuna pruriens), P3 (ashes of Millettia pinnata), P4 (ashes of viper skull) and P5 (ashes of Mucuna pruriens and Millettia pinnata) inversely to M1 of lot 6, M12 and F14 from lot 7, M2 and F13 from lot 8, M7, M4 and F2 from lot 9 treated respectively with P4 (ashes of viper skull), P5 (ashes of Mucuna pruriens and Millettia pinnata), P6 (ashes from the skull of viper and Mucuna pruriens) and P7 (ashes from the skull of viper and Millettia pinnata) would declare hypokalemia and hyperkalemia respectively according to Sidy, 2008.According to the same author, dyskalemia (abnormalities: hypokalemia or hyperkalemia) is a frequent cause of cardiovascular disorders. Hypokalemia can occur during digestive losses (vomiting, diarrhea), in hyperaldosteronism (corticosteroid treatment), renal tubular acidosis, hyperglycemia, metabolic alkalosis.

While hyperkalemia is found in exogenous potassium intake, adrenal insufficiency (or antialdosterone treatment), hemolysis, crush syndrome, chemotherapy, intense exercise, chronic renal failure. Therefore, F3 from lot 3, M9 and F11 from lot 4, M8, M11 and F7 from lot 5, M6 and F6 from lot 6, and M5 from lot 7 would indicate hypokalemia, while M1 from lot 6, M12 and F14 from lot 7, M2 and F13 from lot 8, M7, M4 and F2 from lot 9 would indicate hyperkalemia.

5.0 CONCLUSION

This study, which aimed to understand the action that minerals from Mucuna pruriens and Millettia pinnata two Fabaceae used in traditional medicine as anti-venomous on the biochemical parameters of rabbits, revealed that:
- with the exception of GOT, total cholesterol, HDLc and sodium parameters, the parameters of males are generally higher than those of females;

- minerals from Millettia pinnata have a hyperglycemic action on a female of a batch while these minerals and those from Mucuna pruriens have a hypoglycemic activity on a male of a batch. As for the combination of Millettia pinnata and Mucuna pruriens minerals, it has a hypoglycemic activity on a male of one batch;

- minerals from Millettia pinnata and the combination of Mucuna pruriens and Millettia pinnata induce a decrease in creatinuria indicating kidney dysfunction in one female of a batch;

- minerals from Millettia pinnata show a sign of cachexia in two males in one batch, while minerals from Mucuna pruriens and the combination of Millettia pinnata and Mucuna pruriens minerals in one male in one batch;

- minerals from Millettia pinnata indicate renal and liver dysfunction in one female of a batch as do those from the combination of Millettia pinnata and Mucuna pruriens minerals;

- the minerals from Millettia pinnata and Mucuna pruriens reveal hypo-ureaemia in two males from a batch, and one male and one female from a batch, respectively, while their combination in males from a batch;

- minerals from Millettia pinnata and their combination show kidney failure in one female of a batch;

- minerals from Millettia pinnata and Mucuna pruriens indicate the destruction of hepatocytes respectively in a female of a batch and in all animals of a batch as well as those of their combination in a male and a female of a batch;

- the minerals from Millettia pinnata and those from Mucuna pruriens show hepatic necrosis respectively on a female from a batch, and on a male and a female from a batch identically those of their combination on a male and a female from a batch;
- the minerals from Millettia pinnata and those from Mucuna pruriens cause acute hepatitis respectively in a female from a batch, and in a male and a female from a batch as well as those of their combination in a male and a female from a batch;

- the minerals from Millettia pinnata and those from Mucuna pruriens are not favorable to cardiovascular disease in one male of a batch, whereas their combination has the same effects on two males of a batch;

- the minerals from Millettia pinnata and those from Mucuna pruriens are not favorable to cardiovascular disease in one female of a batch;

- the minerals from Millettia pinnata and those from Mucuna pruriens cause hypercholesterolemia in a female of a batch;
- minerals from Millettia pinnata induce hypocholesterolemia in a male of a batch;

- minerals from Mucuna pruriens have a protective effect against atherosclerosis on a male of a lot unlike minerals from Millettia pinnata, those from Mucuna pruriens and their combination;

- the minerals from Millettia pinnata have no protective action against coronary mortality in a male of a batch as do those from Millettia pinnata, Mucuna pruriens and their combination on a female of a batch;

- the minerals resulting from their combination are at the origin of hypernatremia in all the animals of a batch, while those resulting from Millettia pinnata and Mucuna pruriens favour hyponatremia in a female and a male of a batch respectively;

- minerals from Millettia pinnata, Mucuna pruriens and their combination have hyperchloremia in a female of a batch;

- minerals from Millettia pinnata, Mucuna pruriens and their combination have hypokalemia on all individuals of a batch, a male and a female of a batch and a male of a batch respectively, while minerals from their combination have hyperkalemia on a male and a female of a batch.

Thus, minerals from Millettia pinnata, Mucuna pruriens and their combination can have an effect on blood sugar, creatinine and urea in some animals, or on transaminases, triglycerides, total cholesterol, HDLc and LDLc in other animals and/or on ionograms (sodium, chlorine and potassium) in still other animals. This variation in action can be the cause of many diseases such as diabetes, kidney, liver, heart and vascular diseases.

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