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Anti-radical mechanism of the antihypertensive effect of Wakouba an extract from palm oil

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ABSTRACT: Oxidative stress is a pathology responsible for several diseases. It is characterized by a relative increase of the reactive species of the oxygen (ERO) and can decrease the bioavailability of NO. The oxidative stress, having for consequence the appearance of several often irreversible damage at the level of cells, constitutes one of the important factors at the origin of the arterial high blood pressure. It so appears as a potential factor of arisen several diseases of which arterial blood pressure. Therefore, an efficacy treatment of the arterial high blood pressure could be also an antioxidant. From this perspective, this study allowed us to establish the anti-radical mechanism of Wakouba an antihypertensive product used in the traditional environment. The extracts of Wakouba are obtained after maceration in the methanol 96 %, during 48 hours in the ambient temperature (25°C), followed by double filtration on cotton then on paper tram driver 3 mm and evaporated with the rotavapor. So, the powder obtained allowed us to realize our antioxidant tests. Various doses of Wakouba and Tenordate the antihypertensive product used as reference were administered to rabbits made spontaneously hypertense has the hanging adrenalin for 7 days. The animals were then sacrificed to take the heart, the liver, the kidney and the aorta for the dosage of superoxide dismutase and the catalase. Furthermore, the inhibition of the lipid peroxidation was made by the method in the ferric thiocyanate and the method of the TBARS. It emerges from this study that the treatment by various doses of Wakouba and Tenordate in the hypertense animals decreases significantly until the normalization of the activity of the SOD and the catalase beforehand raised in the aorta, the heart, the liver and the loins. On other hand, Wakouba inhibits the lipid peroxidation in 78,3% as well as the Vitamin C reference molecule which exercises 81,00%. This consolidates us for its use as antihypertensive substance in the traditional environment.

KEYWORDS: Wakouba, Oxidative stress, blood pressure, antihypertensive.

1 INTRODUCTION

In the normal physiological conditions, free radicals are synthesized in the body and their rate is controlled by the production of antioxidants (such as catalase and superoxide dismutase). The overproduction of free radicals following the breakdown of this balance is called oxidative stress with consequences for the appearance of several often irreversible damage to the cells **[1, 2]**. Thus oxidative stress appears as a potential factor of occurrence of several diseases including hypertension **[3, 4]**. This pathology responsible for 49% of ischemic cardiac complications, 62% of strokes, 76% of events related to heart failure or renal disease, with approximately 30% of annual deaths worldwide, is a real health problem public **[5, 6]**. It was then that health authorities have introduced several classes of pharmaceutical substances, including antihypertensives, commercially available to treat hypertension **[7].** In addition, it is reported that many medicinal plants were used to treat hypertension in Africa and particularly in Côte d'Ivoire **[8, 9]** for their natural chemical constituents accessible and their low cost. In view of this use, the World Health Organization (WHO) has set up strategies to encourage member countries to integrate traditional medicine in their health systems **[10]**. That's when several research teams have invested in research plants antihypertensive effect in order to promote their use in primary health care. However, due to the

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multifactorial nature of hypertension, choosing a good antihypertensive should no longer be limited to a simple lower tensionelles values, but must cover its effectiveness to be treated all factors for developing the disease. This study therefore aims to evaluate the antioxidant activity of Wakouba a salt extracted from palm oil which proved very effective in the traditional treatment of arterial hypertension.

2 MATERIALS AND METHODS

2.1 PLANT MATERIAL

Elaeis Guineensis is a monocotyledon angiosperm in the family of Arecaceaes. It is an elegant palm tree consists of a single unbranched stem having at its top a couronne of 40 to 50 palms long leaves, 5 or 8 m **[11]**. It's fruit is a fleshy drupe, ovoid in shape and sessile. The yellow pulp or mesocarp color orange contains a seed oiled white endosperm. The plant part used is the palm of rank 7. These palms were harvested, washed and cut into small pieces and dried in the sunlight at room temperature (25-30 °C). Four weeks after drying, the fins have been incinerated in a muffle furnace at 400 °C until ashes. One hundred grams (100g) of ash is dissolved in one liter (1 L) of distilled water and homogenized for 2 h at room temperature (25-30 °C) using a magnetic stirrer. The homogenate was filtered twice over cotton wool and once on paper filter "Whatman". The filtrate obtained was evaporated in an oven at 60 °C for salt *Wakouba*.

3 DETERMINATION OF MINERAL CONSTITUENTS OF *WAKOUBA*

A quantity from 0.1 to 5 g of dry white ash was used. After digestion with hydrofluoric acid followed by complete evaporation, the residue is dissolved in hydrochloric acid. The resulting solution is brought to the determination of elements by atomic absorption spectrometry flame.

4 MEASUREMENT OF ANTI-RADICAL POWER *WAKOUBA*

4.1 MEASUREMENT OF ANTI-RADICAL POWER *WAKOUBA* BY THE DPPH METHOD

Measurement of the anti-radical activity of *Wakouba* was performed by the test 2,2- diphenyl-1-picrylhydrazyl (DPPH) according to the method by **[12]**. This study is to evaluate the ability of *Wakouba* to fix free radicals by measuring the decrease of the violet color due to the reduction of radicals produced by DPPH. Thus, from a stock solution 'Wakouba' to 0.1mg /mL, a concentration range is prepared by successive dilution twice. Then at each concentration of extract, the same volume of methanol solution of DPPH is added. After 30 minutes of incubation at room temperature (37 °C) and protected from light, absorbance read at 517 nm with a spectrophotometer against a blank sample (0 mg/mL of extract). Vitamin C (0.1 mg/mL) which is the reference substance and prepared under the same conditions is used as a standard. DPPH radicals inhibition percentages are calculated by the following formula:

Inhibition = [(White Abs - Abs sample) / Abs white] x 100

White Abs: absorbance of the blank sample.

Abs sample: absorbance of the plant extracts and vitamin C.

4.2 EFFECT OF 'WAKOUBA' ON THE INHIBITION OF LIPID PEROXIDATION

4.2.1 DETERMINATION OF HYDROPEROXIDES BY THE FERRIC THIOCYANATE (FTC) METHOD

The antioxidant activity against lipid peroxidation of plant extracts is measured by the inhibition of peroxidation of linoleic acid using the ferric thiocyanate method, as described in **[13, 14]**.

In protected bottle foil, separately dissolving 4 mg of *Wakouba* in 4 mL of 99.5 % ethanol. For those compartments are added 4.1 mL of 2.5 % ethanol linoleic acid (99.5 %), 8.0 mL of phosphate buffer (20 mM) pH 7, 0) and 3.9 mL of distilled water to a final volume of 20 mL. Vitamin C (reference compound), prepared under the same conditions is used as a positive control. The bottles containing mixtures were incubated in water bath at 45 °C. During incubation, every 24 h, 0.1 mL of the mixture is collected into test tubes. To this amount are successively added 9.7 mL of ethanol (75 %), 0.1 mL of ammonium thiocyanate (30 % in distilled water) and 0.1 mL of iron II chloride ($FeCl_2$) to 20 mM in 3.5 % HCl. After 3 minutes of incubation

at room temperature, the absorbance of the resultant red coloration is measured in a spectrophotometer at 500 nm. The assays are performed for 7 days until the absorbance of the control reaches its maximum value. The percentage of inhibition of lipid peroxidation is then calculated using the following equation:

Inhibition (%) = (1 − (OD sample / OD negative control)) × 100

4.2.2 DETERMINATION OF THIOBARBITURIC ACID-REACTING SUBSTANCES (TBARS)

The method of **[15]** using an induction of lipid peroxidation by ascorbic acid/iron sulfate (Fenton reaction) has been adapted for this test. To a sample of plant extract (600 µL, 500 g/mL) was added Tris-HCl buffer (300 µL, pH 7.5, 20 mM), 20 mM linoleic acid (500 µL) and ferric sulphate (100 µL, 4 mM). Peroxidation begins after addition of 5 mM ascorbic acid (100 µL). Each reaction mixture obtained is incubated in a water bath at 37 ºC for 60 min. After this step, TCA (2 mL, 10%) are added to all tubes. Then, to an aliquot (1 mL) collected in each of reaction mixtures prepared previously was added TBA (1 mL, 1%). The new reaction mixtures obtained were placed in a boiling water bath at 95 ºC for 20 min. Gallic acid and distilled water respectively were used as reference molecule and negative control. The absorbance was read in a spectrophotometer at 532 nm and percentage inhibition of linoleic acid is determined by the following equation:

Inhibition (%) = (1 − (OD sample / OD negative control)) × 100

4.3 ASSAY OF SOME ENZYMES OF ANTIRADICAL SYSTEM

This study aims to determine the activity of superoxide dismutase (SOD) and catalase in the aorta and the heart of rabbits made hypertensive by adrenaline and processed by 'Wakouba'.

4.3.1 EXPERIMENTAL INDUCTION OF HYPERTENSION BY ADRENALINE IN RABBITS.

Twenty four (24) rabbits of the species *Oryctolagus cuniculus* of both sexes, aged 8 weeks with an average weight of 1 ± 2.2 to 1.5 ± 3.01 kg were used. These animals were brought from a poultry farm in Bingerville (South-east of Abidjan/Côte d'Ivoire), were acclimated for three weeks at the Animal unit of the National Agricultural Research Centre (NARC), IRO LA ME station then divided into 6 lots of 4 rabbits (Lot1to 6) . Lot 1 or witness lot received throughout the duration of the experiment distilled water; Lot 2-6 or experimental lots were intravenously injected with an insulin syringe, adrenaline dosed at 1 mg/mL to cause elevated blood pressure or hypertension, which was later stabilized after 10 days of treatment.

4.3.2 TREATMENT OF HYPERTENSIVE ANIMALS BY WAKOUBA AND THE TENORDATE

Ten days after induction of hypertension in animals, they were treated with *Wakouba*, a salt extract of *Elaeis guineensis* and Tenordate a reference antihypertensive sold in the market. Each lot was treated as follows:

LOT 1: Witness + distilled water / LOT 2: Witness treated with adrenaline (Adr)

LOT 3: Treated with Adr + Tenordate (Atenolol + Nifedipine) (10 mg/kg bw)

LOT 4: Treated with Adr + *Wakouba* (950 mg/kg bw)

LOT 5: Treated with Adr + Tenordate (20 mg/kg bw)

LOT 6: Treated with Adr + *Wakouba* (2500 mg / kg bw)

After this treatment, the blood pressure of the animals was measured. They were subsequently sacrificed to take the heart, and the aorta. Five mg (5 mg) of each member are ground in a glass potter Elvejem containing a solution of Mac Even. After centrifugation at 3000 rev / min for 5 min from the ground material, the activity of superoxide dismutase (SOD) and the catalase were measured.

4.3.3 DETERMINATION OF ACTIVITY OF THE SOD

The SOD activity was assayed by the test Nitro Blue tetrazonium. Indeed, the tetrazonium nitro blue (NBT) is reduced by NADPH in the presence of superoxide anion ($O_2 \bullet^-$) and gives a dark violet chromophore **[16].** Whereas the SOD eliminates superoxide anion (O_2^-), the intensity of the coloration of the purple chromophore is proportional to the activity of SOD in the medium. However, the activity of superoxide dismutase was measured in response. Five (5) µL of the enzyme source (organ homogenate) were added to 2 mL of the reaction mixture (sodium cyanide 2.10^{-5} M; NBT solution 1 76.10^{-4} M, EDTA 6 6.10^{-3}

M; Riboflavin 2.10^{-6} M; 10^{-2} M methionine and 3 mg of NADPH), and the mixture was irradiated with a 15 Watt lamp for 10 minutes. Absorbance was measured at 560 nm and the values were expressed as UI.mg-1 proteins.

4.3.4 DETERMINATION OF THE ACTIVITY OF THE CATALASE

Catalase was assayed in homogenates of various organs by the spectrophotometric method by **[17]**. Indeed, catalases are responsible for the breakdown of H_2O_2 to H_2O and O_2. This assay is therefore to measure the decrease in absorbance due to the disappearance of the hydrogen peroxide substrate for the enzyme. This reduction of hydrogen peroxide proportional to the activity of catalase is determined as following:

In a measurement vessel made of quartz, containing a substrate solution consisted of 1 mL of phosphate buffer (KH2PO4, 0.1 M, pH 7.4), 0.950 mL of H_2O_2 (0.019 M), 0.025 mL of the enzyme source is added (homogenate of organs). The reaction was monitored by recording the absorbance at 560 nm every minute for two minutes. The enzymatic activity is expressed in micromol H_2O_2 / mg prot.

5 TREATMENT OF RESULTS

All values presented are (mean ± SEM), with n representing the number of different separate experiments. Statistical significance of the values was analyzed using an analysis of variance (ANOVA) followed by multiple comparison tests by Tukey -Kramer. P values less than 0.05 were considered significant.

6 RESULTS

6.1 DOSAGES OF CONSTITUENTS WAKOUBA

The results of the assay of constituents 'Wakouba' are reported in Table I: The electrolytes of 'Wakouba' has reported that this salt contains: 230.887mg/g K^+ or 65.989% of the total ion content; 19.640 mg/g Mg^{2+} is 10.964%; 31.857mg/g Na^+ or 18.186%; 39.281mg/g or Ca^{2+}; 20.228%.

6.2 COMPARATIVE EFFECTS OF *WAKOUBA* AND VITAMIN C (VIT C) ON SOME OXIDATIVE STRESS PARAMETERS

6.2.1 ANTI-RADICAL ACTIVITY OF *WAKOUBA* BY THE DPPH METHOD

Antiradical activities of *Wakouba* and Vitamin C assessed by the DPPH method are represented by Figures 1 and 2 which show an increase in the DPPH discoloration as a function of increasing concentrations used. Concentrations of *Wakouba* vary from 140.62 µg / mL to 10,000 mcg/mL. Beyond 10000 mcg/mL, the anti-radical activity is stabilized and tends towards 100% discoloration. Figures 1 and 2 are allowed to determine the IC_{50} of vitamin C and *Wakouba*. IC_{50} Vit C is equal to 1.7 mcg/mL and the IC_{50} of *Wakouba* is of 911.11 mg/mL.

6.2.2 ANTIRADICAL ACTIVITY OF *WAKOUBA* BY INHIBITION OF LIPID PEROXIDATION

6.2.2.1 INHIBITION OF LIPID PEROXIDATION BY THE FTC

The variation of inhibition of the lipid peroxidation rate *Wakouba* compared with that of vitamin C and assessed by the FTC method is presented in Figure 3.

This figure shows that as to increase as the days, the inhibition rate of lipid peroxidation also increases. The percentages of inhibition are respectively: 0.067%; 0.10%; 0.18%; 0.23%; 0.37%; 0.44%; 0.75%; 1.080%. This high inhibition versus time changing substantially in the same direction as that exerted by the Vit C (reference molecule).

6.2.2.2 INHIBITION OF LIPID PEROXIDATION BY TBARS

Inhibition of lipid peroxidation exerted by 'Wakouba in the comparison with that of vitamin C (Vit C) reference molecule by the TBARS method showed that, 'Wakouba' exerts 78.3% inhibition and Vit C exerts 81.00% inhibition of lipid peroxidation. These results were used to plot the histogram of Figure 4.

6.3 INFLUENCE OF 'WAKOUBA' ON THE ACTIVITY OF SUPEROXIDE DISMUTASE (SOD) IN HYPERTENSIVE RABBITS

Figures 5 and 6 show the effect of *Wakouba* on the activity of superoxide dismutase (SOD) in hypertensive rabbits.

The activity of the SOD expressed in U/ng/prot was 1.68 ± 0.2 in the aorta, and 2.57 ± 0.11 in the heart, rabbits in the control group (T). In rabbits treated with adrenaline, these rates increase significantly in the aorta and the heart to the respective percentages of 27.97%; 22.56% compared to batch T. The treatment of hypertensive rabbits 'Wakouba' dose 950mg/ kg bw decreases the activity of the SOD to normalization. SOD decreases in the aorta by 20% and in the heart of 18.09% compared to batch MT. The W2500 dose reduces the activity of SOD of the aorta and the heart to the respective percentages of 24.18%; 18.41%. The ténordate, a reference antihypertensive has no significant effect on the activity of SOD in the organs. After seven days of treatment of hypertensive animals 'Wakouba', the SOD activity of the aorta and heart rabbits patient untreated lot (MNT) significantly increase the respective percentages of 112.50%; 66.63% compared to Lot T and 66.04% and 35.85% from the batch MT.

6.4 INFLUENCE OF *WAKOUBA* ON THE CATALASE ACTIVITY IN HYPERTENSIVE RABBITS.

The figures 7 and 8 show the effect of Wakouba on the catalase activity in hypertensive rabbits.

The rate of catalase expressed in mmol/decomposed H_2O_2 / min / mg protein in the aorta and the heart were respectively 2.55 ± 0.54; 2.38 ± 0.20 in the control group (T). Epinephrine injected into normotensive rabbits causes a significant increase in catalase activity passes to 4.20 ± 0.12 in the aorta and 3.67 ± 0.20 in the heart either percentage increases 64.70% and 54.20% from the batch T. Treatment with Wakouba to hypertensive animals reduces the rate of catalase to normalization. *Wakouba* dose 950 mg/kg bw decreases the catalase activity in the aorta of 31.90%, and in the heart of 25.06% compared to the batch MT. The W2500 dose reduces the activity of catalase in the aorta, the heart to the respective percentages of 45.23%; 28.06%.

6.5 EFFECT WAKOUBA ON AORTIC CONCENTRATION OF NITROGEN MONOXIDE (NO) IN HYPERTENSIVE RABBITS

The figure 9 shows the variation of the aortic nitric oxide concentration of normal rabbits (group T), hypertension (MT batch and lot MNT) and rabbits treated with 'Wakouba' 950 and 2500 mg / kg bw and the ténordate 10 and 20 mg / kg bw.

In the batch T, aortic concentration of NO is 32 molar (M). This value of the NO concentration drops significantly when going from healthy animals (group T) in hypertensive animals. The aortic concentration of NO in the range from 0.32M to 0.15M lot T and 0.11M in lot of sick animals hypertensive (MT batch and lot MNT) or 53.12%; and 65.62% decrease compared to the control. Treatment of sick animals with 'Wakouba' and ténordate significantly increases this concentration. The percentage increases are respectively 86% with W (950) and 106 with 67% W (2500). Treatment of animals by the ténordate increases the NO 46.66% for TEN (10) and 80% for TWENTY (20). NO in the aorta of the rats in batch MNT after 7 days of treatment increases significantly by 65.62% compared to the batch and T 26.70**%**.

7 DISCUSSION

This study of Wakouba's effects on reducing the DPPH radical one hand and inhibition of lipid peroxidation (TBARS and FTC) on the other hand showed that:

* *Wakouba* very slightly reduces the DPPH radical with an IC_{50} equal to 911.11 µg/mL compared to vitamin C which gave an IC_{50} equal to 1.68 mcg/mL,
* *Wakouba* inhibits lipid peroxidation compared to vitamin C, a reference molecule.

Wakouba is the code name of a palm oil extract salt or *Alaeis guineensis* (Jacq). It is a salt that is rich in mineral elements that do not have the ability to reduce DPPH radical as lacking the proton H^+ to yield the radical DPPH to reduce. This would explain the low capacity of Wakouba to reduce the DPPH radical.

Lipid peroxidation is the oxidation of polyunsaturated fatty acids in the free fatty acids by free radicals or enzymes in the body. Cell membranes and LDL ("low density lipoproteins") rich in polyunsaturated fatty acids are the main targets of lipid peroxidation **[18].** The free fatty acids thus generated can impair vasodilatation and stimulate oxidative stress **[18].** Lipid oxidation by free radicals generates lipid peroxides which are themselves highly reactive and able to generate other free radicals which become very high in the body. In addition, LDL oxidation is a process that develops atherosclerosis which is also the cause of high blood pressure. In the present study, Wakouba inhibits lipid peroxidation by both the FTC method as

TBARS. This inhibition was comparable to that of vitamin C reference molecule. Wakouba is a natural substance of vegetable origin which then exert its antihypertensive effect in part by the inhibition of lipid peroxidation. Indeed, Wakouba, inhibiting lipid peroxidation mainly LDL, prevents oxidation of the latter and prevents the development of arteriosclerosis and protects against hypertension. In addition, Wakouba which inhibits lipid peroxidation and LDL oxidation therefore, also prevents their accumulation and deposition in the intima in the form of foam cells, preventing consequently the occurrence of hypertension.

Superoxide dismutase and catalase are present two enzymes in the aorta, heart, liver and kidney where they act as enzymatic antioxidants. The results of our study show that the activity of these two enzymes significantly increased in blood pressure in the organs of hypertensive rabbits. Indeed, hypertension caused reduced endothélium-dependent relaxations aorta encouraging an increase in peripheral vascular resistance **[19].** This endothelial dysfunction associated with oxidative stress generates a strong overproduction in aortic and mesenteric vessels of superoxide anions **[20, 21]** that increase the enzymatic activity of SOD and the catalase in different organs of hypertensive rabbits. Indeed, superoxide dismutases (SOD) which are enzymes of the antioxidant defense system ensures dismutation of the superoxide anion to hydrogen peroxide (H_2O_2), and Catalase defuses the oxidative potential of hydrogen peroxide (H_2O_2) by its transformation into H_2O and O_2 **[22]**. The treatment of hypertensive animals with different doses of Wakouba and Tenordate show a significant decrease until the normalization of the activity of SOD and catalase in the aorta and heart. This action of Wakouba would be attributed to its major component which is potassium. The latter would capture the superoxide anion to eliminate as potassium superoxide (KO_2), because according to **[23]** and **[24],** antioxidants would be able to simply recover the superoxide anion, thereby increasing the availability of functional NO, a vasodilator synthesized in endothelial cells. The bioavailability of NO was observed in the aorta of hypertensive treated rabbits Wakouba. Moreover, the decrease in the concentration of superoxide anion in the organs of rabbits treated with Wakouba compared to rabbits treated exclusively Adrenaline was observed by a decrease in the activity of SOD and catalase in the aorta and the heart. Through these results, we can say that the antihypertensive effect of Wakouba would also be due to its anti-radical effect. This gives a particular interest in its use as an antihypertensive in the traditional environment.

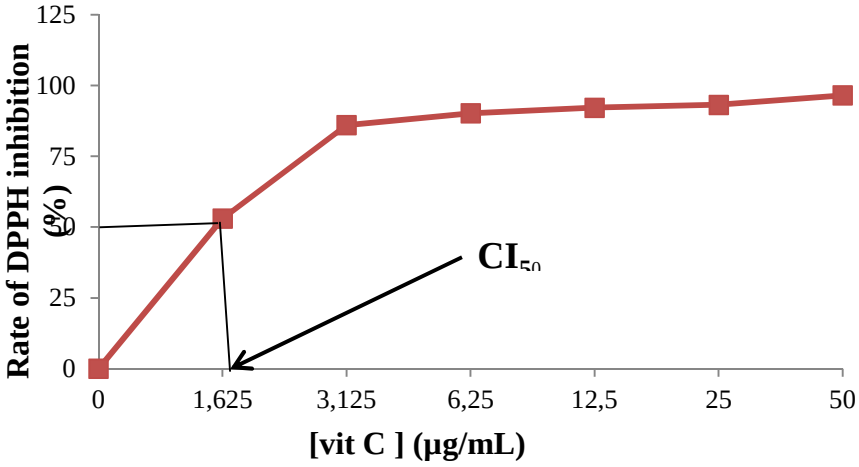

Figure 1: Effect of vitamin C (VITC) on the discoloration of DPPH

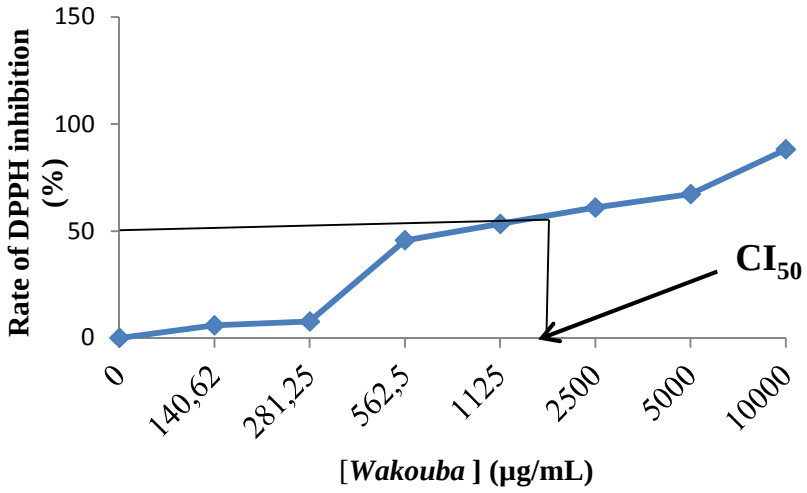

Figure 2: Effect of Wkouba on the discoloration of DPPH

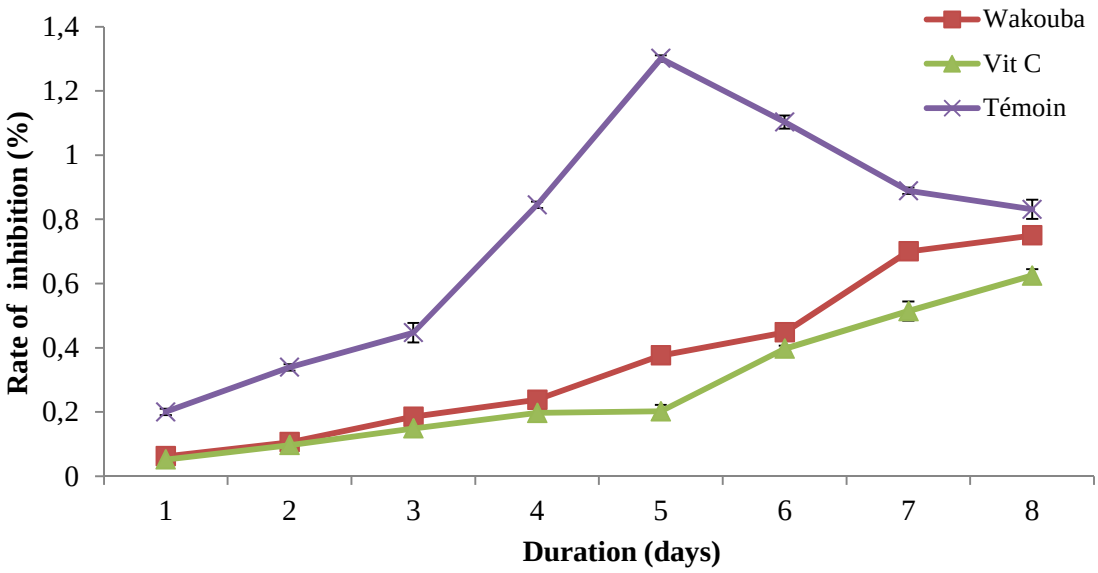

Figure 3: Effect of Wakouba on the inhibition of lipid peroxidation by the method of FTC

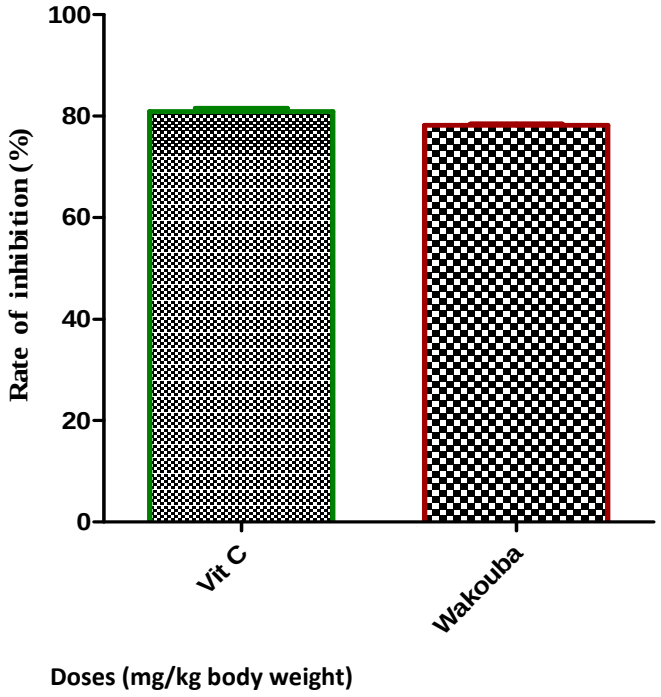

Figure 4: Effect of Wakouba on the inhibition of lipid peroxidation by the method of TBARS

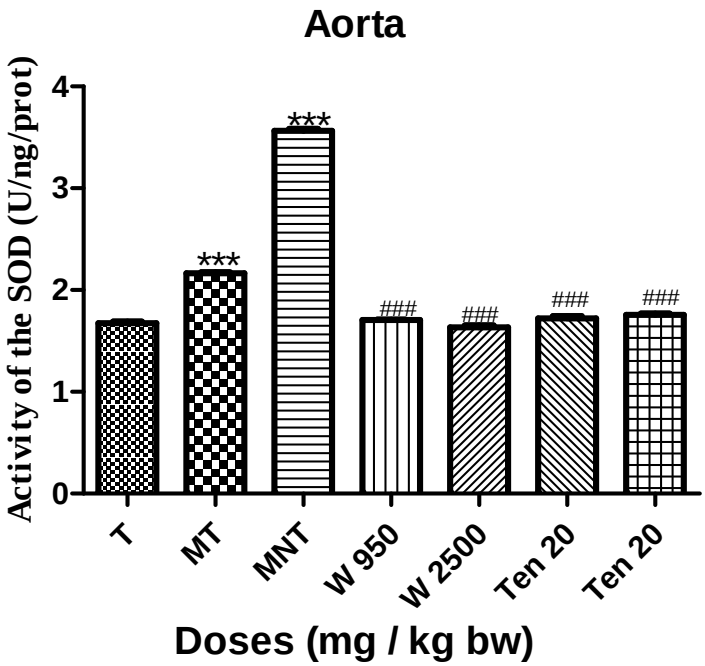

Figure 5: Effect of Wakouba on the catalase activity in the aorta of hypertensive rabbit

*Each bar represents the mean ± SEM. ***, Significantly different from the control batch normotensive at p <0.001; ###, Significant difference compared with control patients batches (MT) and untreated (MNT) at p <0.001. T, lot normotensive control; MNT, untreated patient lot; W950, group treated with 'Wakouba' dose 950mg / kg.pc; W2500, group treated with 'Wakouba' dose 2500mg / kg.pc; Ten10, batch treated with Ténordate dose 10mg / kg.pc; Ten20, batch treated with Ténordate dose 20mg / kg.pc*

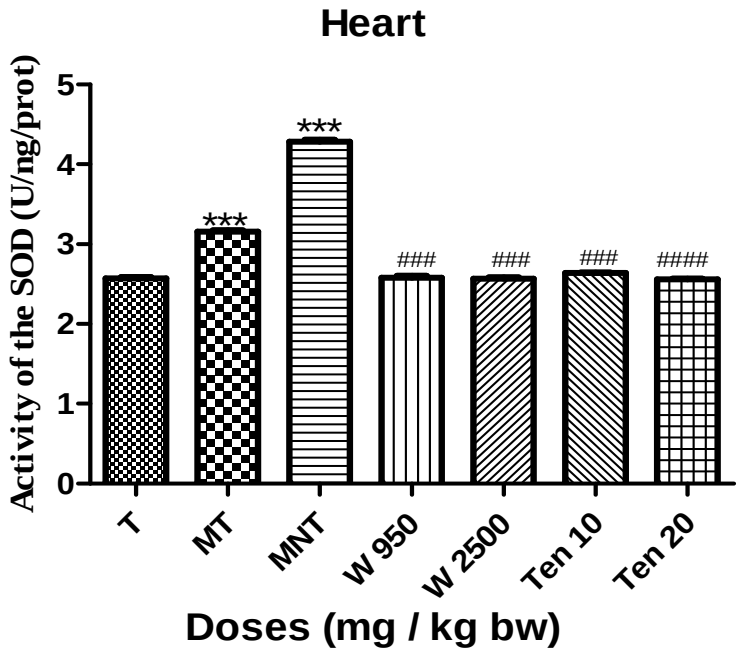

Figure 6: Effect of Wakouba on the activity of superoxide dismutase (SOD) in the heart of hypertensive rabbits

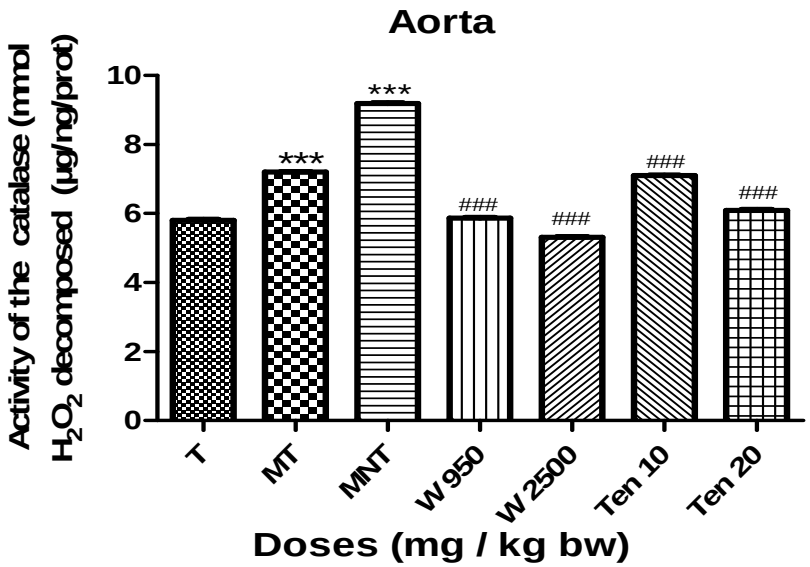

Figure 7: Effect of Wakouba on the catalase activity in the aorta of hypertensive rabbits

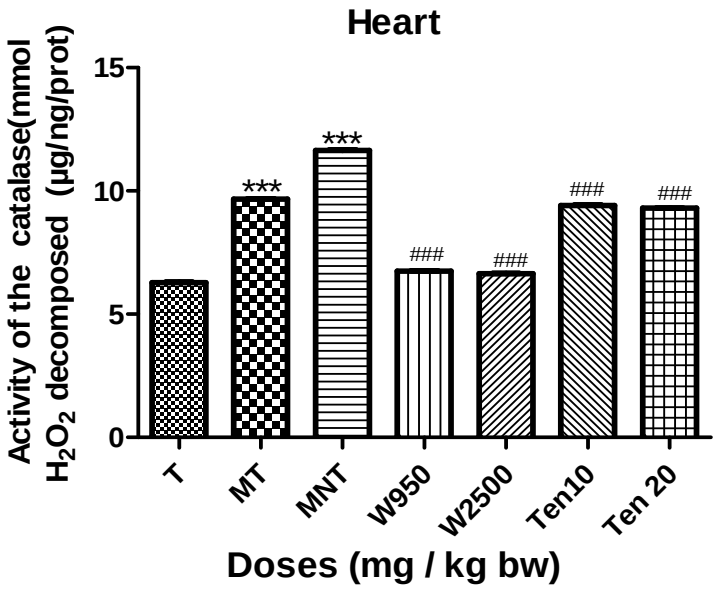

Figure 8: Effect of Wakouba on the catalase activity in the aorta of hypertensive rabbits

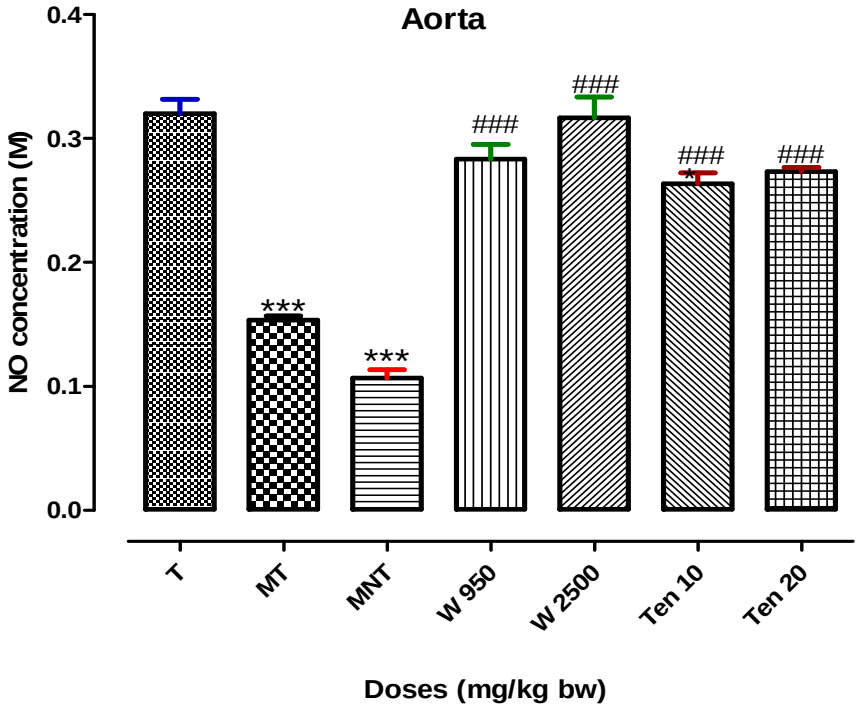

Figure 9: Effect of Wakouba on the concentration of nitrogen monoxide (NO) in hypertensive rabbits

*Each bar represents the mean ± SEM. ***, Significantly different from the control batch normotensive at p <0.001; ###, Significant difference compared with control patients batches (MT) and untreated (MNT) at p <0.001. T, lot normotensive control; MNT, untreated patient lot; W950, group treated with 'Wakouba' dose 950mg / kg.pc; W2500, group treated with 'Wakouba' dose 2500mg / kg.pc; Ten10, batch treated with Ténordate dose 10mg / kg.pc; Ten20, batch treated with Ténordate dose 20mg / kg.bw*

Tableau I: Minerals constituants of Wakouba

Mineral elements	Reference samples (g)	Percentage in content (%)
K^+	226,887 ± 2.57	60,442
Na^+	39,281 ± 1.24	17,119
Ca^{2+}	30,610 ± 1,62	16,780
Mg^2	19.640 ± 1.38	3,472
Cl^-	5.125 ± 0.92	1,791
I^{2-}	2.245 ± 0.98	0,396

Values are determined as a percentage of the total content of ions assayed. Potassium ion (K^+); calcium (Ca^{2+}); Sodium ion (Na^+); Magnesium ion (Mg^{2+}); Chloride ion (Cl^-); iodide ion (I^{2+})

8 CONCLUSION

At the end of this study, we consider that the research of the anti-radical mechanism of the antihypertensive effect of Wakouba extract from palm oil revealed the low capacity of Wakouba to reduce the DPPH radical. Wakouba inhibits lipid peroxidation by both the FTC method as TBARS. This inhibition was comparable to that of vitamin C reference molecule. Wakouba which inhibits lipid peroxidation and LDL oxidation therefore, also prevents their accumulation and deposition in the intima in the form of foam cells, preventing consequently the occurrence of hypertension. The treatment of hypertensive animals with different doses of Wakouba shows a significant decrease until the normalization of the activity of SOD and catalase in the aorta and heart. This action of Wakouba would be attributed to its major component which is potassium. Through these results, we can say that the antihypertensive effect of Wakouba would also be due to its anti-radical effect. This gives a particular interest in its use as an antihypertensive in the traditional environment.

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DECLARATION OF INTEREST

The authors have no conflict interest. The authors alone are responsible for the content and writing of the paper.

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