International Journal of Pharmaceutical and Bio-Medical Science

ISSN(print): 2767-827X, ISSN(online): 2767-830X

Volume 06 Issue 03 March 2026

Page No : 893-903

DOI: https://doi.org/10.47191/ijpbms/v6-i3-17, Impact Factor: 8.428

Infusion of Desmodium Velutinum Improves Glycemia Reactivity and Lipid Profile in Diabetic Obese Rats MACAPOS 2

Clémence MVONGO[1*], Joseph NGAKOU MUKAM[2], Michel Archange FOKAM TAGNE[3], Adamou MFOPA[4], Sandrine NKOUBAT TCHOUNDJWEN[2], Paul Aimé NOUBISSI[5], René KAMGANG[2,4], Jean-Louis ESSAME OYONO[4]

[1] Department of Life Sciences, Higher Teacher Training College, University of Bertoua, Cameroon

[2] Animal Physiology Laboratory, Faculty of Science, University of Yaoundé I, Cameroon

[3] Department of Biological Science, Faculty of Science, University of Ngaoundéré, Cameroon.

[4] Laboratory of Human Metabolism and Non-Communicable Diseases, Institute of Medical Research and Medicinal Plants Studies (IMPM), Yaoundé, Cameroon.

[5] Department of Animal Biology and Conservation, Faculty of Science, University of Buea, Cameroon.

ABSTRACT

Desmodium velutinum is empirically used by the population of Cameroon eastern region in the treatment of various diseases including obesity and diabetes. The objective of this study was to evaluate the effects of aqueous extract of Desmodium velutinum on type 2 diabetes MACAPOS 2 rat model. Six to eight weeks old male Wistar rats were subjected to a high fat diet for 16 weeks, after which, a low dose of streptozotocin (25 mg/Kg b.w) was injected to all rat that presented. Seven days after streptozotocin administration, 25 rats with blood sugar levels ≥126 mg/dL were selected as diabetic and used to next works. These animals were divided into groups of five rats each, receiving (esophageal gavage) a daily treatment of aqueous extract of D. velutinum at doses of 50, 100, or 200 mg/kg b.w, or metformin (reference drug) at 70 mg/kg b.w, or distilled water at 10 mL/kg b.w (diabetic control group: DC) during 28 days. These animals were treated in comparison to a normal control group which received the normal diet and distilled water (10 mL/kg b.w).Water and food consumption were assessed every two days, fasting blood sugar and body weight were assessed every seven days. Glucose tolerance and insulin sensitivity were evaluated at the end of the treatment. The animals were sacrificed under ketamine and diazepam anaesthesia (50 mg/Kg and 10 mg/Kg b.w respectively) after 12 hours of fasting. Carcasses, fat tissue (subcutaneous, visceral, and peritesticular) were collected and weighted. The collected blood was centrifuged and the serum obtained was used to determine serum lipid parameters (triglycerides, total cholesterol, and HDL-cholesterol). LDL-cholesterol was calculated. At the end of the treatment, diabetic control animals presented hyperglycaemia, sugar intolerance, insulin resistance associated with tissue fat (visceral, subcutaneous, and peritesticular) increased, dyslipidaemia, compared to the normal control group. Aqueous extract of D. velutinum like metformin, has reduced fasting blood sugar levels (-36.38% DV200; -38.17%Met) and improved both insulin sensitivity and glucose tolerance. The infusion of D. velutinum significatively ($p < 0.01$) reduced tissue fat and serum lipids (triglycerides, total cholesterol, and LDL-cholesterol), and increased HDL-cholesterol. D. velutinum have reduced fasting glycemia and fat tissue, improve insulin sensitivity lipid profile, which would justify its empirical use in the treatment of type 2 diabetes and obesity.

ARTICLE DETAILS

Published On:
30 March 2026

KEYWORDS: Desmodium velutinum, diabetes, insulin sensitivity, lipids parameters, MACAPOS2 high-fat diet

Available on:
https://ijpbms.com/

1. INTRODUCTION

Type 2 diabetes mellitus, which accounts for 90% to 95% of all diabetic patients, is a metabolic disorder characterized by a chronic hyperglycemia, polyuria, polyphagia, polydipsia due to alterations in carbohydrate, fat and protein metabolism, associated with insufficient action of insulin (ADA, 2024; WHO, 2019) In addition to impaired insulin secretion and insulin resistance, this metabolic disorder is caused by a combination of genetic and environmental factors such as obesity, sedentary lifestyle, physical inactivity, and stress (Kaku, 2010). It was estimated 588 million people living with diabetes worldwide in 2024, with a global prevalence of 11.1% and the developing countries are the most affected (IDF, 2025). The management of diabetes is based on dietary hygiene measures associated with the oral anti diabetic drugs as well as insulin administration (Zhao et al., 2020). Unfortunately, these synthesised antidiabetic drugs have revealed various adverse side effects such as hypoglycemia, gastro-intestinal disorders, headache and others. In finding new therapies against diabetes mellitus, medicinal plants appear as a potential source of new and effective molecules. Desmodium velutinum is a commun plant empirically used in the treatment of various diseases such as diabetes, obesity and diarrhoea. Thus, the objective of the present work was to evaluate the activities of Desmodium velutinum aqueous extract on anthropometric parameters, glycemic reactivity and lipid profile in MACAPOS 2 diabetic obese rats.

2. MATERIALS AND METHODS

Plant extract

The whole plants of Desmodium velutinum were collected in Diang locality, Lom and Djerem Division (Eastern Region of Cameroon), during the month of May 2022. The plant was authenticated at the National Herbarium of Yaounde (Cameroon) in comparison to the material of R. Letouzey n° 5785 with the voucher specimen n° 7065 SRF/Cam. Plants were dried in the open air, away from the sun and at room temperature. After drying, the plants were ground and the obtained powder was used for the preparation of aqueous extract. Three hundred grams (300 g) of D. velutinum powder were introduced in 3 L of boiled water and let it cool for 5 hours. Then, the mixture was filtered using Wattman paper n°1. The filtrate obtained dehydrated to yield 31.5 g of dry dark aqueous extract.

Phytochemical Analysis

Qualitative phytochemical screening was performed using standard assays found in the literature.

Determination of the total polyphenols

The total phenolic content was evaluated following the method described by Singleton and Rossi (1965) with slight modification. A volume of 0.1 mL of extract (4 mg/mL) was mixed with 0.75 mL of Folin-ciocalteu reagent (10-fold diluted) and kept at room temperature for 5 min. Then, 0.75 mL of sodium carbonate (6%, w/v) was added. The mixture was homogenized and incubated at 25°C witting 90 min in darkness. The absorbance read at 725 nm in Spectrophotometer (Biobase; 2015 version). Gallic acid (0-1000 µg/mL) was used as standard. The total polyphenol was calculated from the standard curve. The results were expressed as micrograms of gallic acid equivalent per gram of dry matter (µg GAE/g DM). Each test was performed in triplicate.

Determination of the total flavonoids

According to the method described by Aiyegoro and Okoh (2010), the total flavonoid content was of the extracts was evaluated as follows. An aliquot of 0.5 mL of extract (4 mg/ mL) was introduced into a tube containing 1.5 mL of methanol, then, 0.1 mL of aluminum chloride (AlCl3, 10% w/v), 1 mL of potassium acetate (CH3COOK, 1 M) and 2.8 mL of distilled water were added. The mixture was homogenized, incubated at 25±1°C for 30 min and the absorbance was read at 415 nm against blank. Quercetin (ranging from 0 to 1000 µg/mL) was used as standard. The total flavonoids content was calculated from the standard curve and expressed as microgram of quercetin equivalent per gram of dry matter (µg QE/g DM). Each test was performed in triplicate.

Determination of the total tannins

The tannins content was determined using the method described by Bainbridge and collaborators (1998). A volume of 1 mL of the aqueous extract (4 mg/mL) was added into 5 mL of working solution (50 g of vanillin + 4 mL of HCl 1N in 100 mL of distilled water), the mixture was incubated at 30°C for 20 min. The absorbance was read at 500 nm against the blank. Tannic acid (0-1000 µg/mL) was used as standard and the tannins content was calculated using the standard curve. The results were expressed as microgram of Tannic acid equivalent per gram of dry matter (µg TAE/g DM). Each test was performed in triplicate.

Determination of the total alkaloids

Quantification of alkaloids was performed according to the following method (Singh et al., 2024) with slight modifications. Extracts (100 mg) were dissolved in 10 mL of ethanol (80%, v/v), then homogenized and centrifuged at 5000 rpm for 10 min. One mL of the supernatant was added with 1 mL of acidified FeCl3 solution (0.025 M; 0.5 M HCl) and 1 mL of an ethanolic solution of 1,10 phenanthroline (0.05M). The mixture was homogenized and incubated for 30 min at 100°C in a water bath (Fisher Scientific, USA). The absorbance was read at 510 nm against the blank. Quinine (10 µg/mL) was used as standard and the alkaloid content was expressed as microgram of quinine equivalent per gram of dry matter (µg QiE/g DM). Each test was performed in triplicate.

Determination of total saponins

The Vanillin-Sulfuric acid method was used to determine saponin content (Hiai et al., 1976). Two hundred (200 µL) of extract, 200 µL of vanillin (dissolving in 80% ethanol (V/V), 2000 µL of 72% sulfuric acid solution were added and mixed in a test tube. The mixture was homogenized and placed in a water bath at 60 C for 10 minutes. The absorbance was read at 535 nm against a blank. A saponin standard was used at various concentrations (0–1 mg/mL) to establish the calibration curve. The results were expressed as micrograms of saponin equivalent per gram of dry matter (µg SaE/g DM). A total of three replicates were performed.

Animals of experiment

Male albino Wistar rats, used for the experiment, were raised in the animal house of the Laboratory of Human Metabolism and Non-Communicable Diseases of the Institute of Medical Research and Medicinal Plants Studies (IMPM), Yaounde, Cameroon, under natural conditions of light and temperature, with free access to water and standard normal diet (Kamgang et al., 2005; Ngakou et al., 2023). In vivo experiments were conducted following the institutional committee of the Cameroonian Ministry of Scientific Research and Innovation guidelines and regulations adopted from the European Union on Animal Care (CEE Council 86/609) (Smith et al., 2007) and were approved by the University of Buea Institutional Animal Care and Use Committee (UB-IACUC), authorization number: 14/2022. The ARRIVE (Animal Research Reporting of In Vivo Experiments) guidelines were also observed.

Type 2 Diabetes induction

Six to eight weeks old male albinos Wistar rats were randomly divided into two groups: the normal group (ND subjected to the standard diet) and the high-fat diet group (HFD receiving a high-fat diet) according to Kamgang and collaborators in 2005. After six weeks of HFD, rats received a unique intravenous dose of streptozotocin (25 mg/kg bw i.v. Sigma Aldrich, 18883-66-4). One week after streptozotocin administration, the animals with fasting glycemia ≥ 126 mg/dL were considered as diabetic.

Experimental design and assessment of Desmodium velutinum aqueouss extract on diabetic rats

Diabetics rats were divided into five (5) groups of five animals each and treated once daily by oral gavage during 4 weeks as follow. The normal control group (NC) and the diabetic control group (DC) received distilled water (10 mL/kg bw); the positive control group (Met) received a reference drug, Metfomin at 70 mg/kg bw; and three other groups received, aqueous extract of Desmodium velutinum at 50 (DV50), 100 (DV100) and 200 (DV200) mg/kg bw respectively. During the treatment, the weight variation, water and food intakes, and fasting blood glucose levels were recorded every week. At end of treatment, all animals were subjected to glucose and insulin tolerance tests after 12 hours of fasting. Following these tests, the rats were sacrificed under anesthesia (diazepam, 10 mg/kg bw and ketamine, 50 mg/kg bw). Blood was collected in dried tubes, centrifuged and the serum obtained was used to determine the seric lipid profile. White adipose tissues (visceral, subcutaneous, perirenal, and peritesticular fats) and carcass were also collected and weight.

Glycemia reactivity

Oral glucose tolerance test

The Oral Glucose Tolerance Test (OGTT) was performed at the end of treatment according to Ngakou et al (2023). After 12 hrs of fasting, animals received per os 2.5 g/kg bw of D-Glucose, Central Drug House. Prior to glucose administration, using test strips ACCU-Chek Active and a glucometer of the same brand, glycemia was evaluated, and then at 30, 60, and 120 min after oral glucose administration.

Insulin tolerance test

The insulin tolerance test (ITT) was evaluated as described by Mvongo and collaborators (2014) with slight modifications. Following a 12 h fasting period, blood glucose was recorded before subcutaneous administration of insulin (Actrapid Human HM, 2 UI/kg b.w.). Then blood glucose level was measured at 15, 30, and 60 min after insulin administration.

Lipid profile

Total cholesterol (TC), HDL-Cholesterol (HDL-C) and Triglycerides (TG) were assayed in the serum through colorimetric methods with commercially available test kits according to the manufacturer's recommendations (Lab Kit brand). LDL-C (Low-density lipoprotein-cholesterol) was calculated using the following formula:

$$\text{LDL-C} = \text{TC} - (\text{HDL-C} + \frac{TG}{5})$$

Atherogenic index (AI) was calculated following the formula: AI = TC- (HDL-C/TC) (Wakayashi and Kobaba, 2002).

Statistical analysis

The results were expressed as Mean ± Standard Error of Mean (SEM). The statistical analyses were performed by one-way analysis of variance (ANOVA) associated with Tukey's test followed by the Dunnett test. GraphPad Prism 8.0.1 were used for analyses. The difference between and within various groups was significant at $P<0.05$.

3. RESULTS

Qualitative phytochemical screening

The quantitative phytochemical analysis of D. velutinim aqueous extract revealed the presence of different classes of chemical compounds such as phenols, tannins, anthraquinones, saponins, flavonoids, anthocyanidins, coumarins, triterpenes, alkaloids, and polysaccharides.

Total polyphenol, flavonoid, tannin and alkaloid contents

Quantitative analyses of Desmodium velutinum aqueous extract showed a higher concentration in Polyphenols, saponins follows by flavonoids and alkaloids. The tannins were present in trace amounts (Table 1).

Table 1 : Bioactif compound content of the aqueous extract of Desmodium velutinum

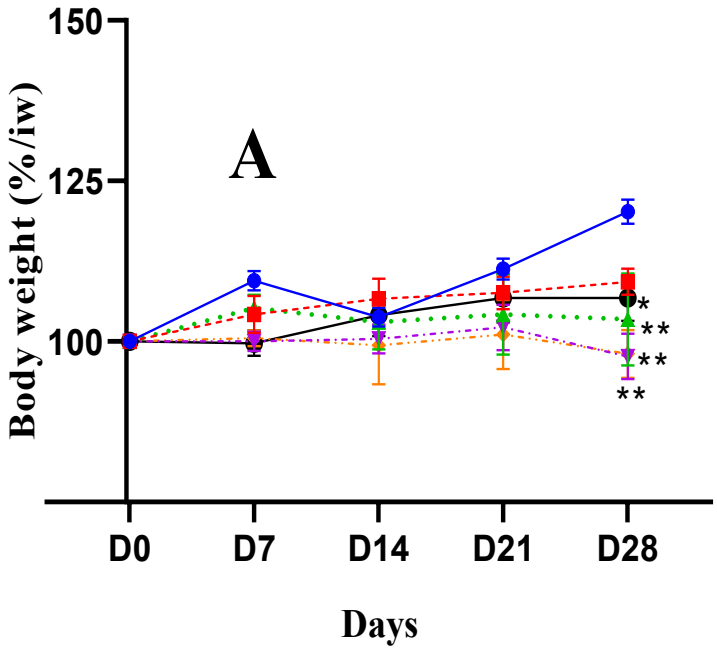
Compound	Polyphenols (in µg GAE/g DM)	Flavonoids (in µg QE/g DM)	Tannins (in µg TAE/g DM)	Alkaloids (in µg QiE/g DM)	Saponins (in µg SaE/g DM)
DV	942.95 ± 11.68	242.67 ± 12.42	0.5 ± 0.00	130.59 ± 7.65	608.33 ± 40.28

µg: Microgram; GA**E:** Gallic Acid Equivalent; Q**E:** Quercetin Equivalent; **TAE**: Tannic Acid Equivalent; **EQi:** Quinine Equivalent; **SaE:** Saponins Equivalent; **g:** Gram; **DM:** Dry Matter; DV : Desmodium velutinum. n = 3.

Effects of Desmodium velutinum aqueous extract on body weight gain, food and water intake

During the treatment, body weight gain of diabetic control rats (DC) remained low compared to normal control rats (NC). Plant extract at the doses used, apparently decreased the body weight gain compared to DC. Metformin on the other hand had no effect on body weight gain (Fig. 1A).

During the treatment, food intake of diabetic control rats (DC) was similar to normal control rats (NC). Desmodium velutinum aqueous extract apparently decreased food intake from day 7 to day 14 with de dose of 200 mg/kg bw, and at the end of treatment with the dose of 50 mg/kg bw (Fig. 1B). Water intake of DC increased from day 21 to the end of treatment compared to NC. From the first week of treatment, D. velutinum aqueous extract led to the decrease of water intake which became significant (P<0,05) with the dose of 100 mg/kg bw (-37,41%) at the end of treatment (Fig. 1C).



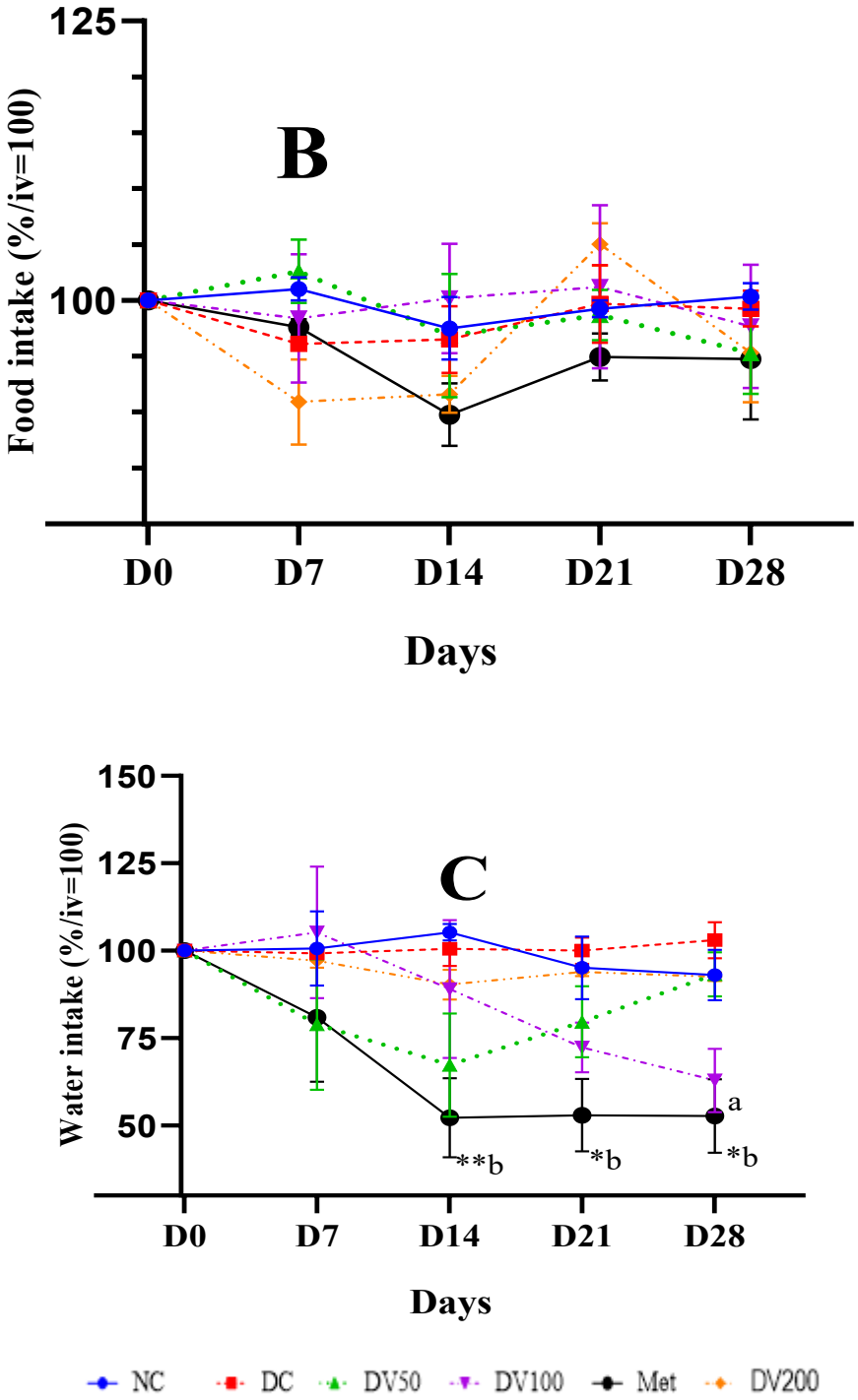


Figure 1 : Body weight gain (A) food (B) and water (C) intake (expressed as % of initial values) of rats during 28 days once daily treatment with 50,100, and 200 mg/kg b.w. D.veletinum aqueous extract (DV50, DV100, DV200) or Metformin70mg/kg b.w. (Met). NC: normal control rats; DC: Diabetic control rats. Significant difference: $^{*}P<0.05, ^{**}P<0.01$ compared to NC; $^{a}P<0.05, ^{b}P<0.01$ compared to DC. n = 5.

Effects of Desmodium velutinum aqueous extract on white adipose tissues and carcass

After 28 days of treatment, visceral, subcutaneous and peritesticular white adipose tissues significantly ($p<0.01$) increased: +55.43%, +54.87%, and +41.10% respectively, when carcass weight significantly ($P<0.05$) decreased: -6.86% in diabetic control rats (DC) compared to normal control rats (NC). However, the infusion of Desmodium velutinum at different doses led to a significant decrease ($P<0.01$) in visceral fat, with the best activity at 100 mg/kg bw (-56.06%). As well as metformin, D. velutinum aqueous extract significantly ($p<0.01$) reduced subcutaneous (-31.49% at 50 mg/kg bw) and peritesticular (Met: 39.13%; DV200: 28.45%) fats compared to DC, bringing those whites

adipose tissues back to the values close to NC. At different doses, plant extract apparently increased carcass weight at the end of treatment compared to DC (Table 2).

Table 2: Relative weight of visceral fat, subcutaneous fat, peritesticular fat and carcass in diabetic rats after 28 days of once daily treatment with 50,100, and 200 mg/kg b.w. D.velutinum infusion (DV50, DV100, DV200) or Metformin70 mg/kg b.w. (Met).

	Relative weight					
Group	**NC**	**DC**	**DV50**	**DV100**	**DV200**	**Met**
Visceral fat	2.14 ± 0.31	4.79 ± 0.20**	3.26 ± 0.10^{**b}	2.11 ± 0.14^{b}	3.54 ± 0.11^{**b}	3.39 ± 0.26^{**b}
Subcutaneous fat	1.397 ± 0.06	3.09 ± 0.27**	2.12 ± 0.25^{a}	2.83 ± 0.33**	2.63 ± 0.32**	1.78 ± 0.21^{b}
Peritesticular fat	1.498 ± 0.11	2.53 ± 0.18**	2.17 ± 0.17*	2.57 ± 0.09**	1.82 ± 0.14^{b}	1.54 ± 0.28^{b}
Carcass	74.59 ± 1.22	69.47 ± 1.24*	72.38 ± 0.70	71.00 ± 0.89	71.64 ± 0.75	73.83 ± 1.44

NC: normal control; DC: diabetic control rats. Significant difference: *P<0.05,**P< 0.01compared to NC; ^{a}P<0.05, ^{b}P<0.01 compared to DC. n = 5.

Glycemia reactivity

Fasting glycemia

During the 28 days of treatment, glycemia of diabetic control rats remained significantly (P<0.01; 56.85%) high compared to normal control group (NC). From the seven days of treatment, D. velutinum at the dose of 200 mg/kg bw as well as Metformin induced a progressive decrease of fasting glycemia which became significant (P<0.01) from day 21 to the end of treatment (Fig. 2).

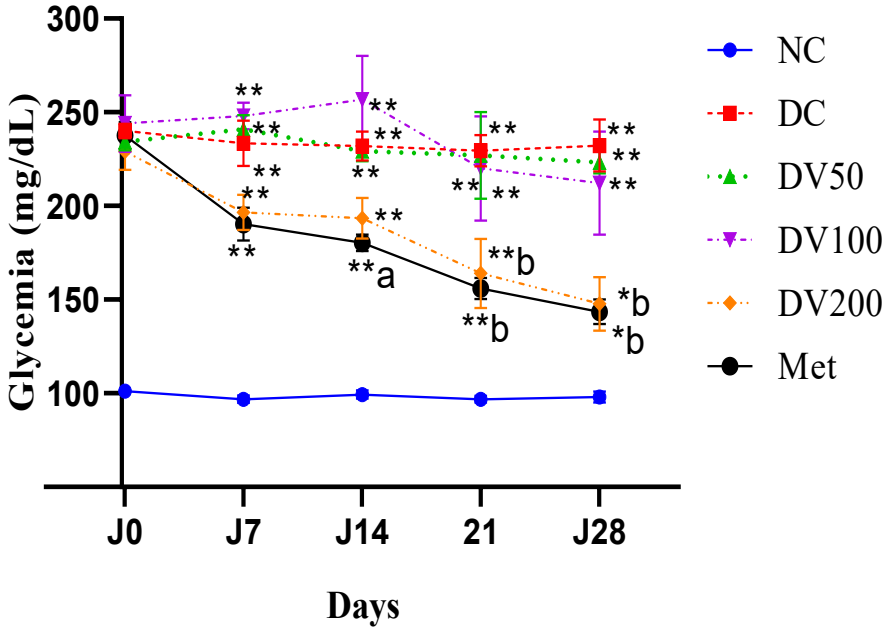


Figure 2: Fasting glycemia of diabetic rats after 28 days once daily treatment with 50,100, and 200 mg/kgb.w. D.veletinum infusion (DV50, DV100, DV200) or Metformin70mg/kg b.w.(Met). NC: normal control; DC: diabetic control rats. Significant difference: :*P< 0.05, **P< 0.01compared to NC; ^{a}P<0.05, ^{b}P<0.01 compared to DC. n = 5.

Glucose tolerance

Thirty minutes after oral glucose administration, glycemia increase in all groups of rat, with a significant increase in diabetic control rats (DC: +64.05%) compared to normal control rats (6.48%). In diabetic control group, blood glucose level remained elevated during the two hours of the test. Infusion of D. velutinum at doses 50 and 200 mg/kg bw clearly (P<0.01) prevented the rise in blood glucose level from the 30th minute onwards, bringing it back to normal 120 minutes after the oral glucose load compared to DC.

Metformin on the other hand did not bring back the blood glucose level to normal after 2 hours following the oral glucose load (Fig. 3).

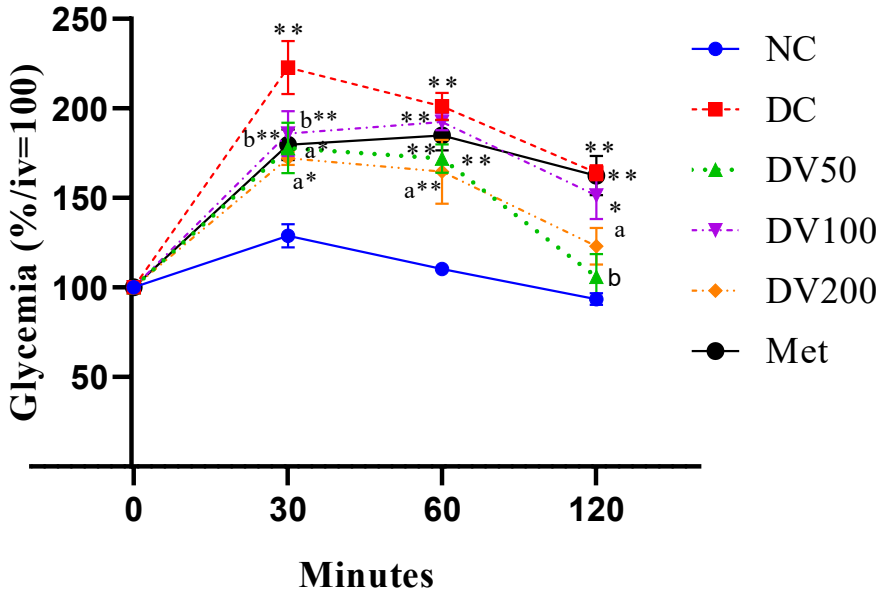


Figure 3: Glycemia variation during glucose tolerance test in diabetic rats after 28 days once daily treatment with 50,100, and 200 mg/kgb.w. D.veletinum infusion (DV50, DV100, DV200) or Metformin70mg/kg b.w.(Met). NC: normalcontrol; DC: Diabetic control rats. Significant difference: *P<0.05, **P< 0.01compared to NC; ^{a}P<0.05, ^{b}P<0.01 compared to DC. n = 5.

Peripheral insulin sensitivity

During the insulin tolerance test (ITT), glycemia of diabetic control rats (DC) remained significantly (P<0.01) high compared to normal control rats (NC). More than metformin, D. velutinum aqueous extract at a dose of 200 mg/kg bw remarkably decreased (p<0.01) blood glucose levels from the first 15 to the 60 minutes following insulin administration compared to DC. That decrease was similar to NC during the 60 minutes of ITT (-30.47%; -38.06%; and -60.96% at 15, 30, and 60 minutes compared to DC). Moreover, the decrease of glycemia with other plant extract doses and metformin was significant (p<0.01) from the 30th to the 60th minutes of ITT (Fig. 4).

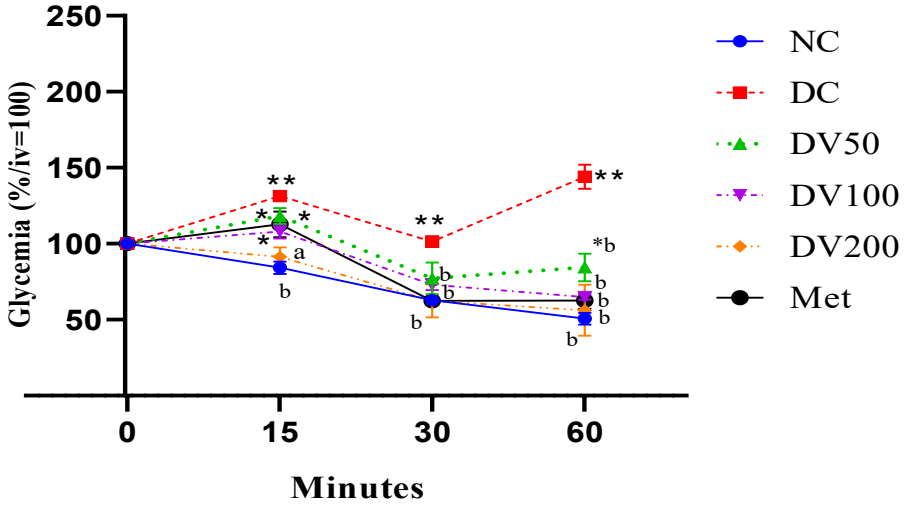


Figure 4: Glycemia variation during insulin tolerance test in diabetic rats after 28 days once daily treatment with 50,100, and 200 mg/kgb.w. D.veletinum infusion (DV50, DV100, DV200) or Metformin70mg/kg b.w.(Met). NC: normal control; DC: Diabetic control rats. Significant difference: *P< 0.05, **P< 0.01compared to NC; ^{a}P<0.05, ^{b}P<0.01 compared to DC. n = 5.

Lipemia and Aterogenic index

The seric levels of total cholesterol (TC), triglycerides (TG) and LDL-cholesterol (LDL) significantly ($p<0.01$) increased while the HDL cholesterol level remarkably ($p<0.01$) decreased in diabetic control rats (DC) compared to normal control rats (Fig. 5). After 28 days of treatment, D. velutinum infusion and metformin apparently reduced LDL level (-22.46% DV50; -20.10% DV100 ; -19.19% DV200 et -10.47% Met) and remarkably ($p<0.01$) decreased TG (-65.55% DV100 ; -55.99% DV200 and -47.46% Met) and TC (-30.51% DV200 and -19,33% Met) compared to DC (Fig. 5A, B, C). Furthermore, plant extract more than metformin, significantly ($p<0.01$) increased the seric levels of HDL (+38.13% DV100 ; +21.72% DV200 ; +26.18% Met) compared to DC (Fig. 5D). Compared to normal control, atherogenic index significantly ($p<0.01$) increased in diabetic control rats (489.47%). The treatment with infusion of D. velutinum (100 and 200 mg/kg bw) and metformin resulted in a remarkable ($p<0.01$) decrease of atherogenic index compared to DC (Fig. 5E).

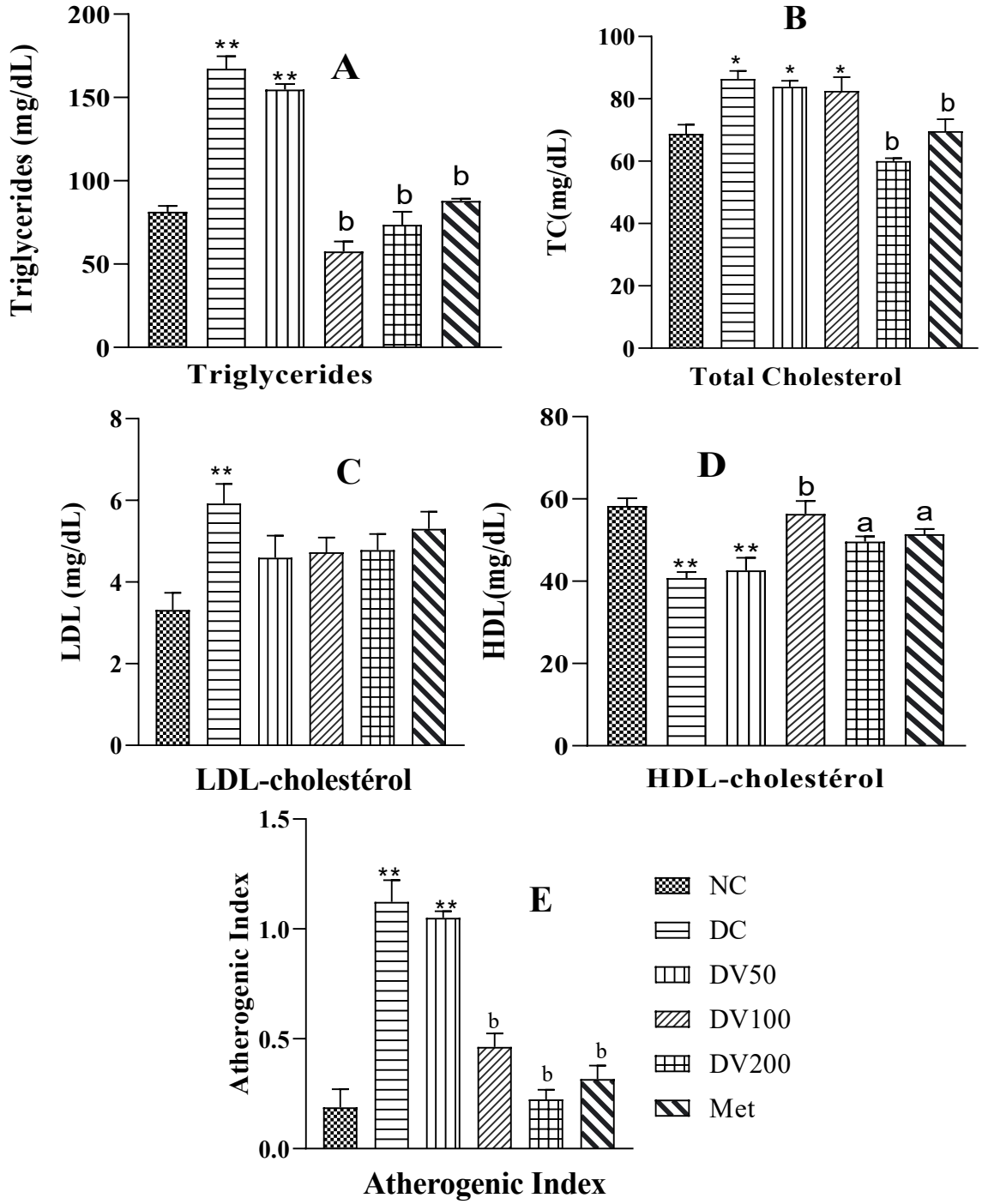


Figure 5: Triglycerides (A), total cholesterol (B), LDL-cholesterol (C), HDL-cholesterol (D) and Atherogenic index (E) in diabetic rats after 28 days once daily treatment with 50,100, and 200 mg/kgb.w. D.veletinum infusion (DV50, DV100, DV200) or Metformin70 mg/kg b.w.(Met). NC: normal control; DC: diabetic control rats, TC: total cholesterol. Significant difference: :*P< 0.05, **P< 0.01compared to NC; ^{a}P<0.05, ^{b}P<0.01 compared to DC. n = 5.

4. DISCUSSION

The present study aimed to evaluate the effects of D. velutinum on diabetic obese rat MACAPOS 2. The combination of MACAPOS 2 high fat diet and intravenous administration of low dose of streptozotocin induced type 2 diabetes in rats characterized by resistance to insulin, glucose intolerance and fasting hyperglycemia associated with dyslipidemia. The previous works showed that this hyperglycemia is due to high fat diet that induces a favorable condition for the development of type 2 diabetes (Ngakou et al., 2023). The phytochemical analysis revealed the presence of many groups of secondary metabolites such as polyphenols flavonoids, tannins, alkaloids and saponins. These compounds are known to have a good influence on metabolic parameters (Shehadeh et al., 2021).

The important fasting blood glucose reduction was observed after one week of treatment with D. velutinum aqueous extract at the dose of 200 mg/kg bw as well as with metformin. This result might be due to the important presence of polyphenols and saponins in this extract as revealed by the quantitative phytochemical analysis. These compounds are known to activate the synthesis and translocation of glucose transporter 4 (GLUT-4), potentiate insulin release, and increase the expression of skeletal muscle GLUT-4 (Shehadeh et al., 2021). The decrease of fasting glycemia by D. velutinum aqueous extract was associated with the improvement of glucose tolerance and peripheral insulin sensitivity. During the oral glucose and insulin tolerance tests, the best decrease of glycemia was observe with plant extract at the dose of 200 mg/kg bw. Considering the total polyphenols, flavonoids, saponins and alkaloids contents of D. velutinum aqueous extract, its beneficial effect on glycemic profile may be due to the isolate or combine effect of those bioactives secondary metabolites which are known for their antidiabetic properties (Shehadeh et al., 2021). Many medicinal plants have a beneficial action on insulin sensitivity through various cellular and metabolic targets. The principal sites targeted are the peripheral tissues (muscles and adipocytes) or the liver (Mohamed et al., 2014). The improvement of peripheral insulin sensitivity by D. velutinum extract was correlated with improvement in white adipose tissues and seric lipid profile. At the end of treatment, plant extract more than metformin, led to the remarkable decrease of Total cholesterol (TC), triglycerids (TG), LDL cholesterol (LDL) and white adipose tissues (visceral, subcutaneous, peritesticular fats) associated with the enhance in HDL cholesterol. The insulin sensitivity activity of this extract may therefore be due to the decrease of TG and white adipose tissue especially visceral fat. In fact, the increase of triglycerides will lead to an increase in the plasma level of NEFAs (non-esterified fatty acids) which have the capacity to induce insulin resistance (Mvongo et al., 2021). Visceral adipose tissue on the other hand is capable of secreting adipokines such as TNF- α (Tumor necrosing factor-α) and resistin which have the capacity to induce severe insulin resistance (Kolanowski, 2003). The beneficial effect of D. velutinum extract on seric and tissues lipid could be due to the combined effect of flavonoids and saponins which have lipid-lowering properties (Dimitry et al., 2022). Saponins reduce the intestinal absorption of cholesterol and have lipolytic activity (Alli, Adanlawo, 2013). In addition to their ability to reduce adipogenesis, flavonoids decrease fat storage and seric triglycerides level (Mvongo et al., 2021). Moreover, the decrease of seric levels of LDL, TC and TG associated with the increase of HDL resulted in a remarkable decrease of atherogenic index by plant extract after 28 days of treatment. This result suggests that D. velutinum extract may have protectives effect on heart and vessels. In fact, the alteration in lipid profile is known to increase the risk of coronary heart disease (Massing et al, 2001). The beneficial effect of plant extract on seric and tissue lipid profile may justify the decrease of body weight gain on diabetic rats treated with this extract.

During the treatment, D. velutinum aqueous extract slowed down the body weight gain in animals This result could be due to the decrease in white adipose tissues observed in those animals The decreased of fat tissues was associated with an increase of carcass weight, suggesting that D. velutinum aqueous extract may act in favor of the reconstitution of the lean mass at the cost of fat tissues. The decrease of body weight gain was also associated with a decrease of food intake. On the other hand, the decrease of water intake by plant extract and metformin may be due to the restoration of glucose homeostasis (Hyun-Jong et al., 2012).

CONCLUSION

This study indicated that Desmodium velutinum aqueous extract at the used doses, reduced fasting blood glucose level, improved insulin sensitivity, glucose tolerance, seric lipid profile and anthropometrics parameters in MACAPOS 2 induced type 2 diabetic rats. These results may justify the empirical use of this plant in the management of diabetes and obesity.

ACKNOWLEDGMENT

The authors sincerely acknowledge the Higher Teacher Training college, University of Bertoua, Cameroon, and the Laboratory of Human Metabolism and Non-Communicable Diseases, Institute of Medical Research and Medicinal Plants Studies (IMPM), Yaoundé, Cameroon for providing laboratory facilities for this study.

ABBREVIATIONS

MACAPOS: Maize, Cassava, Palm Oil, and Sugar
HFD: High Fat Diet
HDL: High-density lipoprotein
LDL: Low-density lipoprotein
DC: Diabetic control

NC: Normal Control
DV: Desmodium velutinum
Met: Metformin
ITT: Insulin Tolerance Test
OGTT: Oral Glucose Tolerance Test

REFERENCES

I. Abu, S., Hafizul, I., Ripon, C.S., Khaja, M.U., Amzad, H., Rashedur, R.M.H., Tanzila, A., Afrin, S. and Sadia, I. (2025). Phytochemicals from anti-diabetic medicinal plants: A comprehensive review of glycemic control mechanisms. World Journal of Advanced Research and Reviews. 26 (01): 3576-3590.

II. Aiyegoro, O.A., Okoh, A.I. (2010). Preliminary phytochemical screening and In vitro antioxidant activities of the aqueous extract of Helichrysum longifolium DC. BMC Complementary and Alternative Medicine. 10(21):1-8.

III. Alli, S.Y.R., Adanlawo, I.G. (2013). Tissue lipid profile of rats administered saponin extract from the root of bitter kola. Advances in Biochemestry. 1(1): 1-4.

IV. American Diabetes Association (ADA). (2024). Diagnosis and classification of diabetes: standards of care in diabetes-2024. Diabetes Care. 47(1):S20–S42.

V. Bainbridge, Z., Tomlins, K., Wellings, K., and Westby, A. (1996). Methods for assessing quality characteristics of non-grain starch staples. (Part 2. Field Methods.). Methods for assessing quality characteristics of non grain starch staples. Natural Resources Institute, Chatham, Kent. ISBN 0- 85954-400-1

VI. Dimitry, M.Y., Marie, T.B.A., Josiane; E., Emmanuel, P., Armand, A., Nicolas, N. (2022).Hypolipemic and antioxydant effects of vegetal milk produced with Mucuna Pruriens L. Seed in rats fed a high-fat diet Heliyon. 8(11):11835.

VII. Hiai, S., Oura, H., and Hakajima, T. (1976). Colour reaction of some sapogenins and saponins with vanillin and sulphuric acid. Planta Medica. 29: 116-122.

VIII. Hyun-Jong, S., Jae-Ha, K., Joo-Hark Y, et al. (2012). Polyuria with the Concurrent Manifestation ofCentral Diabetes Insipidus (CDI) & Type 2 Diabetes Mellitus (DM). Electrolyte Blood Press. 10: 26-30.

IX. Kaku, K. Pathophysiology of type 2 diabetes and its treatment policy. (2010). Journal of Japan Medical Association. 53(1):41-46.

X. Kamgang, R., Youmbi, R., Mengue, G.P., et al. (2005). Cameroon local-diet induced glucose intolerance and dyslipidemia in adult Wistar rats. Diabetes Res Clin Pract. 69: 224–230.

XI. Kolanowski, J. (2003). Rôle du tissue adipeux dans la physiologie de l'obésité et du diabète de type2. Louv Med 122: 223-231.

XII. Massing M.W., Sueta C.A., Chowdhury M.., Biggs D.P., Simpson R.J. Jr. (2001). Lipid management among coronary artery disease patients in diabetes mellitus or advanced age. American Journal of Cardiology. 87: 646-664.

XIII. Mohamed, E., Amina, B., Bachir, E.B., Lhoussain, H. and Naoufel, A. Z. (2014). Antidiabetic plants improving insulin sensitivity. Journal of Pharmacy and Pharmacology. PP18.

XIV. Mvongo, C., Mfopa, A., Kamgang, R., Essame Oyomo, J.L. (2021). Effect of of Crinum jagus extracts on lipids parameters and non alcoholic hepatic steatosis in MACAPOS 1 induced diabetes rats. European Journal of Pharmaceutical and Medical Research. 8(7):40-49.

XV. Ngakou Mukam, J., Mvongo, C., Mfopa, A., Kamgang Tchawou, A.G., Nkoubat Tchoundjwen, S., Fankem, G.O., Noubissi, P.A., Fokam Tagne, M.A., Kamgang, R., Essame Oyono, J.L. (2025). Kalanchoe crenata decoction and infusion improve insulin resistance and fasting glycemia of diabetic obese rats MACAPOS 2. Journal of Holistic Integrative Pharmacy. 6 (2025): 50–56.

XVI. Ngakou Mukam, J., Mvongo, C., Nkoubat, S., et al. (2023). Early-induced diabetic obese rat MACAPOS 2. BMC Endocr Disord. 23 (64):1–6.

XVII. Nkoubat Tchoundjwen Sandrine, Mvongo Clémence, Kamgang Tchawou Armel Georges, Mfopa Adamou, Ngakou Mukam Joseph, Noubissi Paul Aimé, Fankem Gaetan Olivier, Kamgang René, Essame Oyono Jean Louis. A Cameroon Western Regions high-fat diet (MACAPOS 2) induces visceral obesity in rat. Heliyon. 2025 ; 11(e41011) : 1-9.

XVIII. Sanchez-Moreno, C., Larrauri J.A., Saura, C.F. (1998). A procedure to measure the antiradical efficiency of polyphenols. J Sci Foods Agri. 76 (2):270-276.

XIX. Shehadeh, M.B., Suaifan, G., Abu-Odeh, A.M. (2021). Plants secondary metabolites as blood glucose-lowering molecules. Molecules. 26 (4333):1–46.

XX. Singh, DK., Srivastava, B., Sahu, A. (2004). Spectrophotometric Determination rauwolfia alkaloids: Estimation of of Reserpine in Pharmaceuticals. Analytical Sciences. 20 (3): 571-3.

XXI. Singleton, V., Rossi, J. (1965). Colorimetry of total phenolics with phosphomolydic-phospho tungstic

acid reagents. American Journal of Enology and Viticulture. 16:144 158.

XXII. Smith, J., van den Broek, F., Martorel, J., et al. (2007). FELASA working grp, and principles and practice in ethical review of animal experiments across europe: summary of the report of a felasa working group on ethical evaluation of animal experiments. Laboratory Animals. 41: 143–160.

XXIII. Wakayashi, I., Kobaba, W.R. (2002). Effet de l'âge sur le rapport entre le boire et les facteurs athérosclérotiques. Gerontology. 48: 151-156.

XXIV. World Health Organization (WHO). (2019). Classification of Diabetes Mellitus. Geneva: World Health Organization.

XXV. Zhao, R., Lu, Z., Yang, J., et al. (2020). Drug delivery system in the treatment of diabetes mellitus. Frontiers in Bioengeneering and Biotechnology. 8(880):1–16.