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Antidiabetic and antioxidant potential of total extract and supernatant fraction of the roots of *Anogeissus leiocarpus* in HFD-fed and Streptozocin -induced diabetic rats

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HFD+ STZ

Total extract
+
Supernatant
fraction

Outcome:

↓ Glucose level

↓ Triglycerids + ↓ cholesterol

β function improved

Oxidative stress alleviated:
↑ GSH, ↓MDA

Abstract:

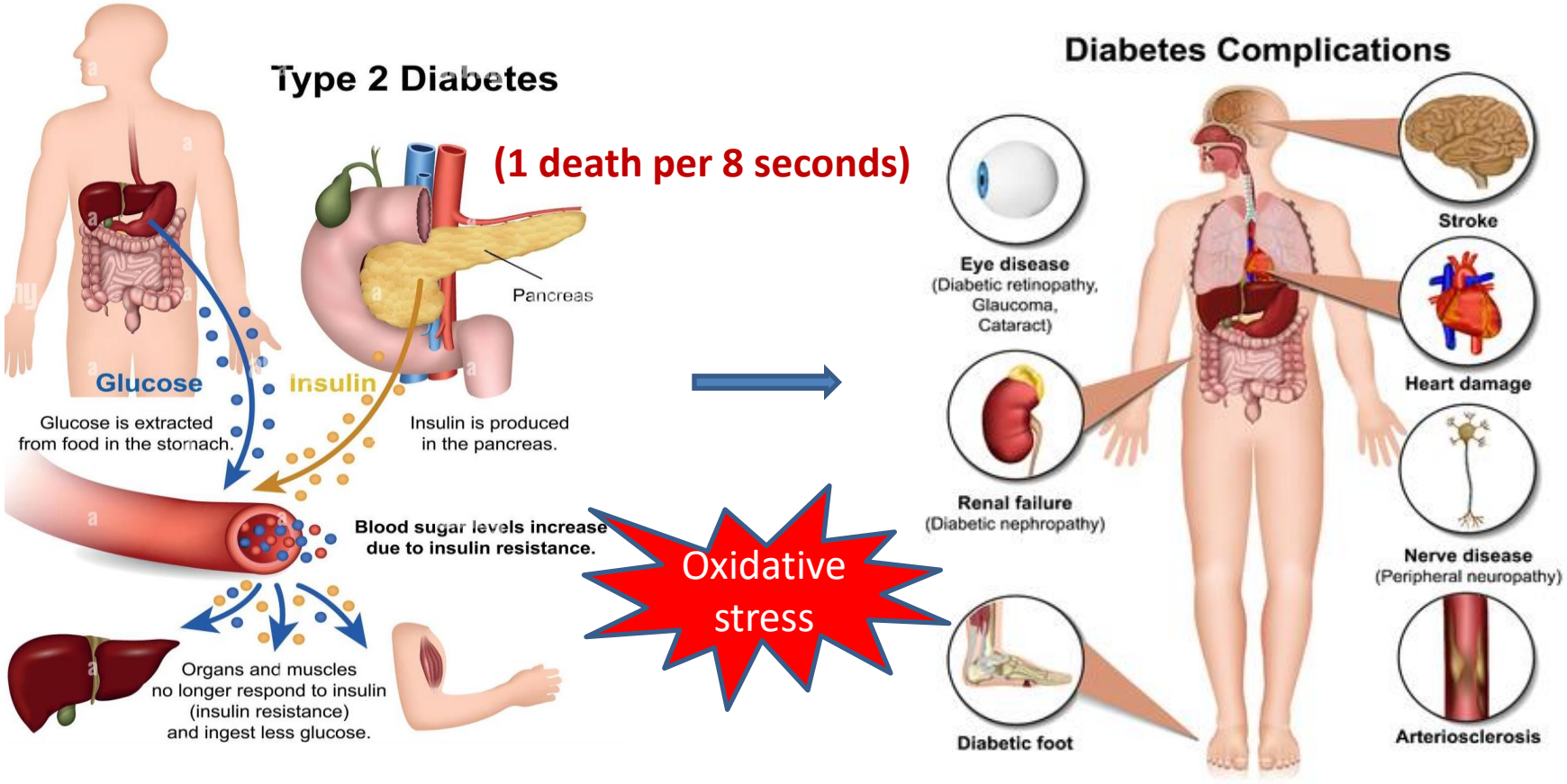
The aim of this study was to evaluate the antidiabetic properties of hydro alcoholic extract and supernatant fraction of the roots of *Anogeissus leiocarpus*, a plant used by traditional healers to treat *Diabetes mellitus*. *Diabetes mellitus* was induced by a single intraperitoneal administration of Streptozocin to *Sprague Dawley* rats under a fructose-enriched fat diet. Diabetic rats were treated with 500 mg/kg of total extract and 100 mg/kg of supernatant. The antidiabetic activity was assessed by measuring blood glucose level, lipid profile, insulin and biochemical parameters together with the antioxidant potential

The administration of total extract and supernatant exhibited significant decrease ($p < 0.01$) of the blood glucose level in the diabetic rats after 7 days of treatment compared to the diabetic rats. A significant reduction of cholesterol level (19.7%) and triglycerides level (56.7%) was observed in the treated diabetic rats. The levels of insulin did not differ across all the groups. However, compared to diabetic rats, HOMA-IR (Homeostasis Model Assessment for Insulin-resistance) and HOMA-β (Homeostasis Model Assessment for β cell function) showed a statistical decrease in insulin resistance and an increase in pancreatic β cell function in the treated diabetic rats. Moreover, total extract and supernatant significantly increased GSH level and decreased lipid peroxidation. In comparison, the supernatant fraction exerted stronger antidiabetic and antioxidant effects than the total extract.

Hence, the roots of *A. leiocarpus* are a potent antidiabetic agent that can be developed as an alternative medicine for diabetes and its complications.

Keywords: *Anogeissus leiocarpus*; *in vivo*; antidiabetic; HOMA- β ; HOMA -IR-; antioxidant

Introduction (1)



(Ighodaro et *al*., 2018), (IDF, 2021)

Introduction (2)

DT2 treatment

Adverse outcome

Less side effect

Low cost

Alternatives !

(Artasensi et *al*., 2020), (Salehi et *al*., 2019)

Introduction (3)

Antihyperglycemic *in vitro and in vivo*

Antihyperlipidemic *in vivo*

Roots of *A leiocarpus*

Kpodar et *al*.,2015

Total extract + Supernatant fraction

(Motto et al.,2020a and b; Motto et al.,2021)

Antioxydant *in vitro*

Non toxic

Can the total extract and supernatant fraction exert a antidiabetic property *in vivo*?

Introduction (4)
Aim

HFD+ STZ

Total extract +
Supernatant fraction

Oxidative stress: MDA+ GSH

Underlined mechanism

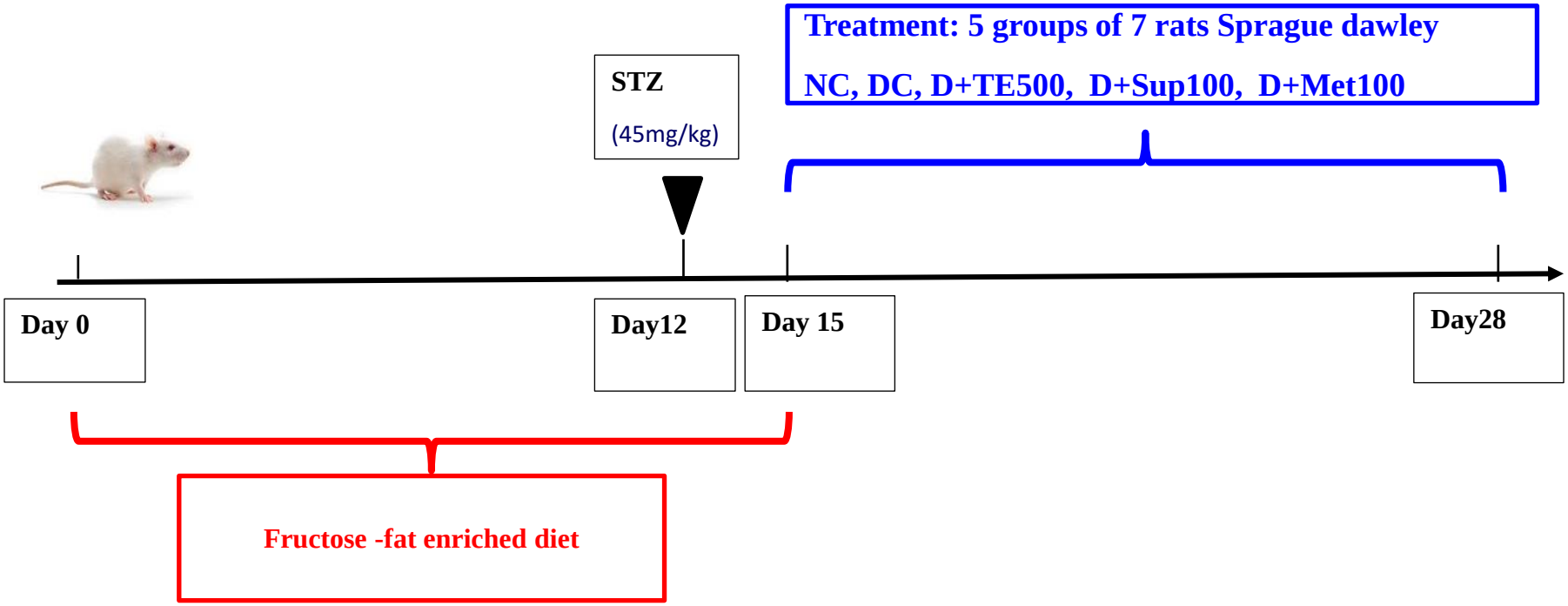
Glucose level and glucose intolerance

biochemical, Insulin, Homa IR, Homa β

Methods (1)

Extraction and fractionation : method of Motto et *al*., 2020

Antidiabetic activity of Total extract and supernatant fraction : method of Kadebe et *al*., 2016



Methods (2)

Antidiabetic activity of TE and supernatant fraction

D15: Diabetic rats confirmed with fasting blood glucose levels (> 200 mg/dl)

Parameters:

- ✓ **Feed consumption, and water intake (daily), blood glucose level (weekly) ,body weight (every 2 days),**
- ✓ **D28 :OGTT (oral glucose tolerance test) Biochemical, hematological parameters, Insulin** (Elisa), **malondialdehyde (MDA) and reduced glutathione (GSH)** (Kpemissi et *al*., 2020;Sedlak et Lindsay, 1968)

Results and discussion (1)

Effect of total extract and supernatant fraction on feed consumption and water intake

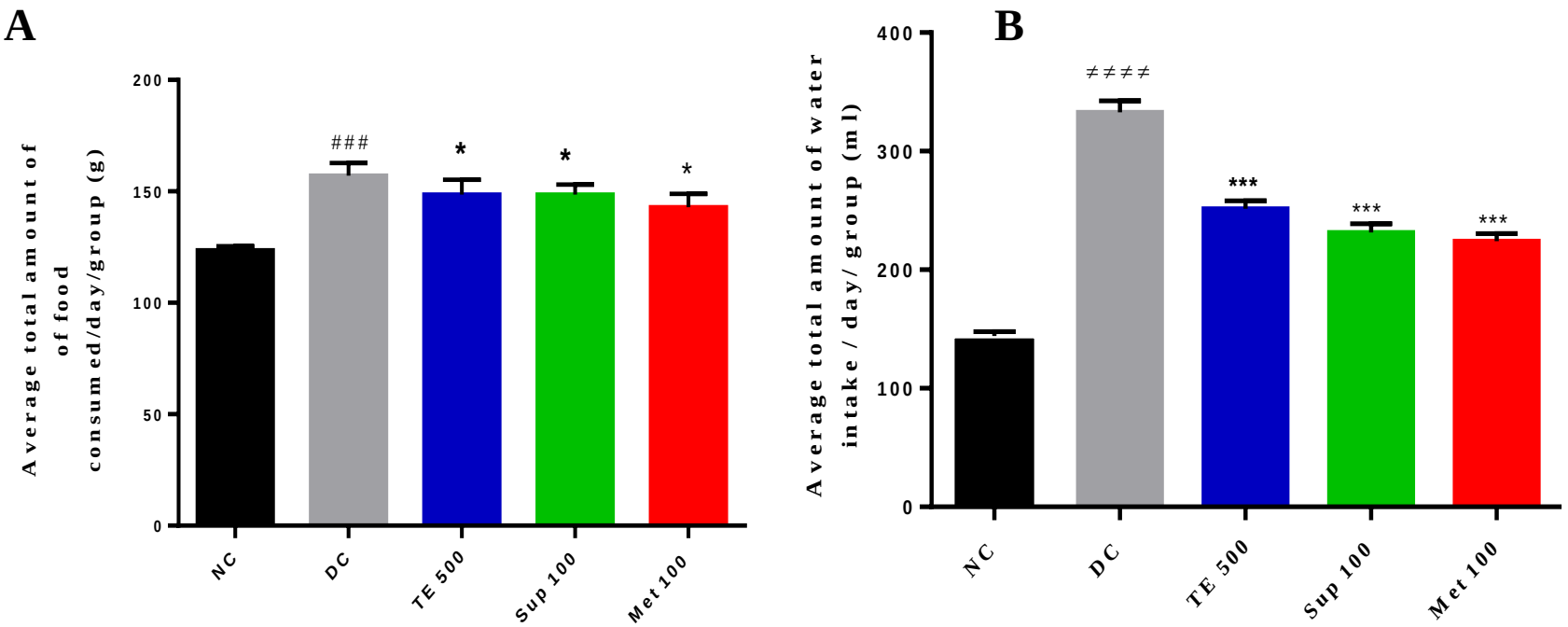


***Figure 1**: Effect of total extract and supernatant on food consumption (A) and water intake (B)*

Results and discussion (2)

Effect of total extract and supernatant fraction on blood glucose level and glucose intolerance

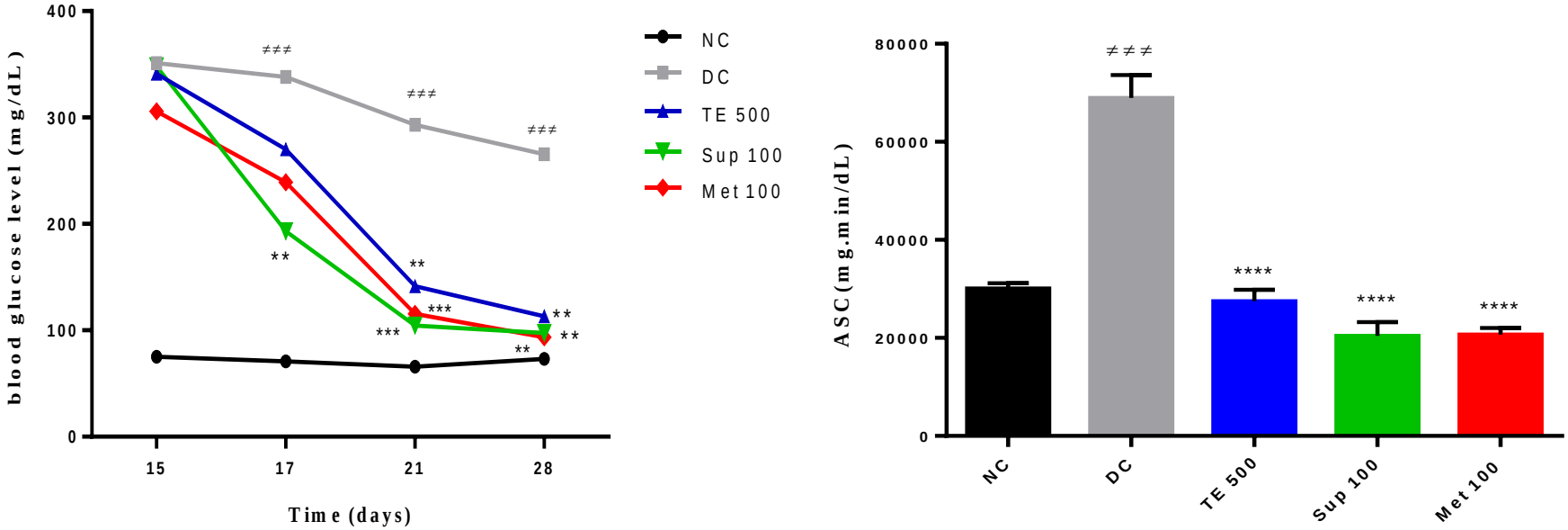


***Figure 2**: Effect of total extract and supernatant on basal glucose level (A) and the aera under curve of glucose tolerance (B)* Cheng et *al.*,2018 Matthews et *al.*,2021 2020

Results and discussion (3)

Effect of total extract and supernatant fraction on hematological parameters

Nusca et *al.*,2021

Table 1: ***Effect of total extract and supernatant on hematological parameters***

	NC	DC	TE 500	Sup 100	Met 100
WBC (10^3/µL)	8.50 ± 0.37	**4.96 ± 0.35$^{\neq\neq\neq}$**	6.30 ± 0.85	6.08 ± 0.46	6.90 ± 1.19
RBC (10^6/µL)	6.58 ± 0.39	5.89 ± 0.14	6.58 ± 0.17	**6.67 ± 0.11****	**6.57 ± 0.16***
Hb (g/dL)	13.98 ± 0.90	**12.24 ± 0.27$^{\neq}$**	13.92 ± 0.32	**13.80 ± 0.40***	**13.92 ± 0.28****
Ht (%)	33.76 ± 0.60	31.84 ± 1.09	32.04 ± 0.81	33.51 ± 0.57	34.05± 0.80
MCHC (g/dL)	35.16 ± 0.46	**39.08 ± 0.45$^{\neq}$**	35.00 ± 0.72	35.46 ± 0.24	35.66 ± 0.19
Plt (10^6/µL)	901.80±80.59	**468.60±93.90$^{\neq\neq\neq}$**	**615.40±37.56*****	**656.00±43.23*****	**695.60±78.18*****

Results and discussion (4)

Effect of total extract and supernatant fraction on lipid metabolism and kidney and liver functional markers (Motto et *al.*,2021) (Zhao.2016)

Table 2: Effect of total extract and supernatant on lipid, hepatic and renal parameters

	NC	DC	TE 500	Sup 100	Met 100
TG ($g.L^{-1}$)	0.39 ± 0.07	**0.97 ± 0.06** $^{\neq}$	0.62 ± 0.04	**0.42 ± 0.06** *	**0.61 ± 0.02** *
T-Chol ($g.L^{-1}$)	0.57 ± 0.01	**0.71 ± 0.04** $^{\#}$	**0.58 ± 0.03***	**0.57 ± 0.03***	**0.57 ± 0.01***
HDL-C ($g.L^{-1}$)	0.36 ± 0.02	0.36 ± 0.07	0.36 ± 0.04	0.44 ± 0.03	0.35 ± 0.02
LDL-C ($g.L^{-1}$)	0.12 ± 0.00	0.22 ± 0.02	0.13 ± 0.05	0.13 ± 0.02	0.11 ± 0.02

	NC	DC	TE 500	Sup 100	Met 100
AST (U/L)	129.61 ± 44.06	140.52 ± 31.79	126.92 ± 21.54	127.11 ± 30.46	116.94 ± 10.85
ALT (U/L)	97.44 ± 12.95	119.82± 17.71	117.83 ± 5.36	98.52 ± 16.48	102.11 ± 15.01
GGT (mg/dL)	4.53 ± 0.29	10.57 ± 1.13	6.31 ± 0.76	5.02 ± 1.55	5.51 ± 0.51*
CK (U/L)	793.73 ± 77.7	**1111.84 ± 87.96**$^{\neq\neq}$	**909.11±69****	**777.69 ± 76.01****	**736.68 ± 61.87****
UREA (g/L)	0.46 ± 0.03	1.09 ± 0.03$^{\neq\neq\neq}$	0.89 ± 0.12	0.65 ± 0.14	0.84 ± 0.05
CREAT (g/L)	7.67 ± 0.85	7.87 ± 0.48	7.57 ± 0.89	7.21 ± 0.21	7.42 ± 0.52

Results and discussion (5)

Effect of total extract and supernatant on serum insulin, insulin resistance, β-cell function and insulin sensitivity

Table 3: ***Effect of total extract and supernatant on insulin levels, insulin resistance and pancreatic functions***

	NC	DC	TE 500	Sup 100	Met 100
Insulin (µUI/mL)	19.90 ± 6.67	20.37 ± 6.6	21.20 ± 5.41	33.40 ± 18.11	14.05 ± 2.98
HOMA-IR	3.64 ± 1.24	16.19 ± 4.50	6.14 ± 1.94	8.23 ± 4.56	3.04 ± 0.5
HOMA-β	707.5 ±209.7	**37.32 ±12.15$^{####}$**	266.04 ± 38.46	**408.10 ± 168.11****	251.6 ± 93.6
QUICKI	0.31 ± 0.02	0.27 ± 0.01	0.30 ± 0.01	0.30 ± 0.01	0.33 ± 0.01

Significant Insulino resistance ➔ HOMA-IR > 3

Matthews et *al.*,2015

Results and discussion (6)

Effect of total extract and supernatant on hepatic MDA and GSH

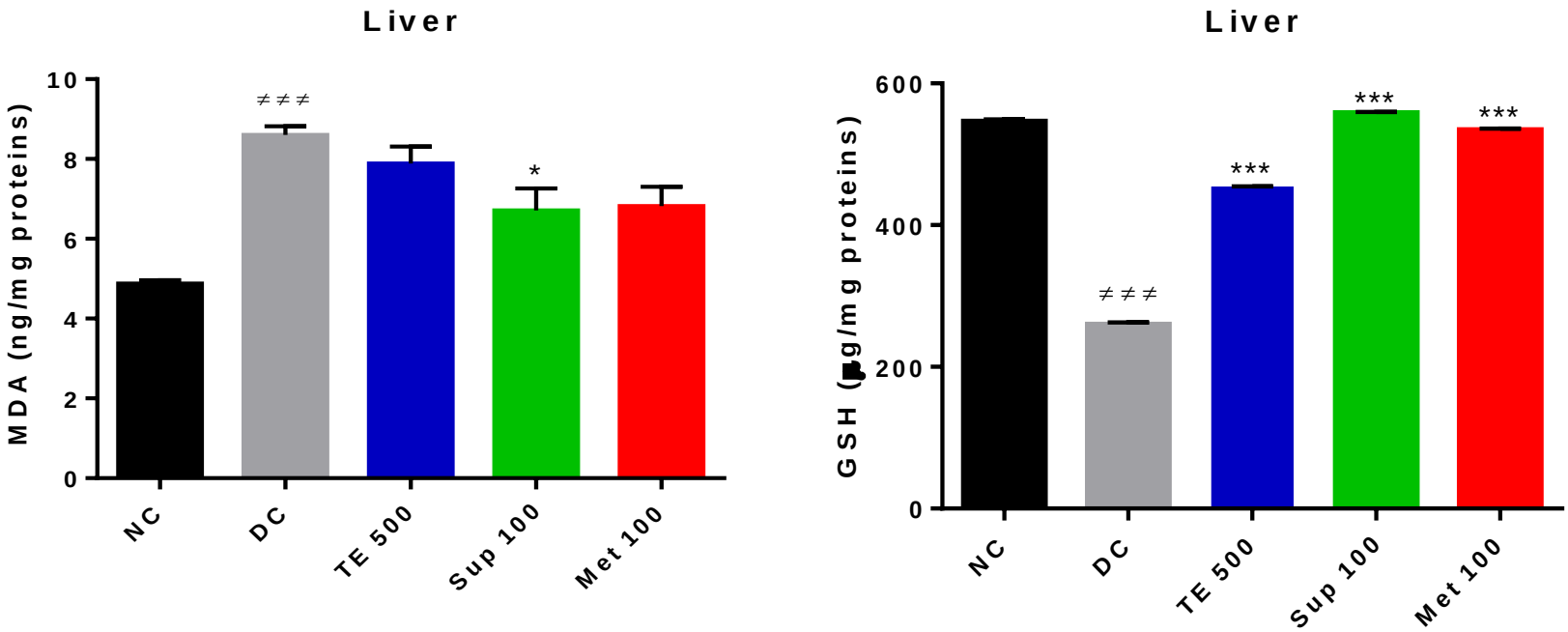


***Figure 3**: Effect of total extract and supernatant on hepatic malondialdehyde level and reduced glutathione concentration*

Asmat et *al*.,2016 Kadébé et *al*., 2016

Results and discussion (7)

Effect of total extract and supernatant on renal MDA and GSH

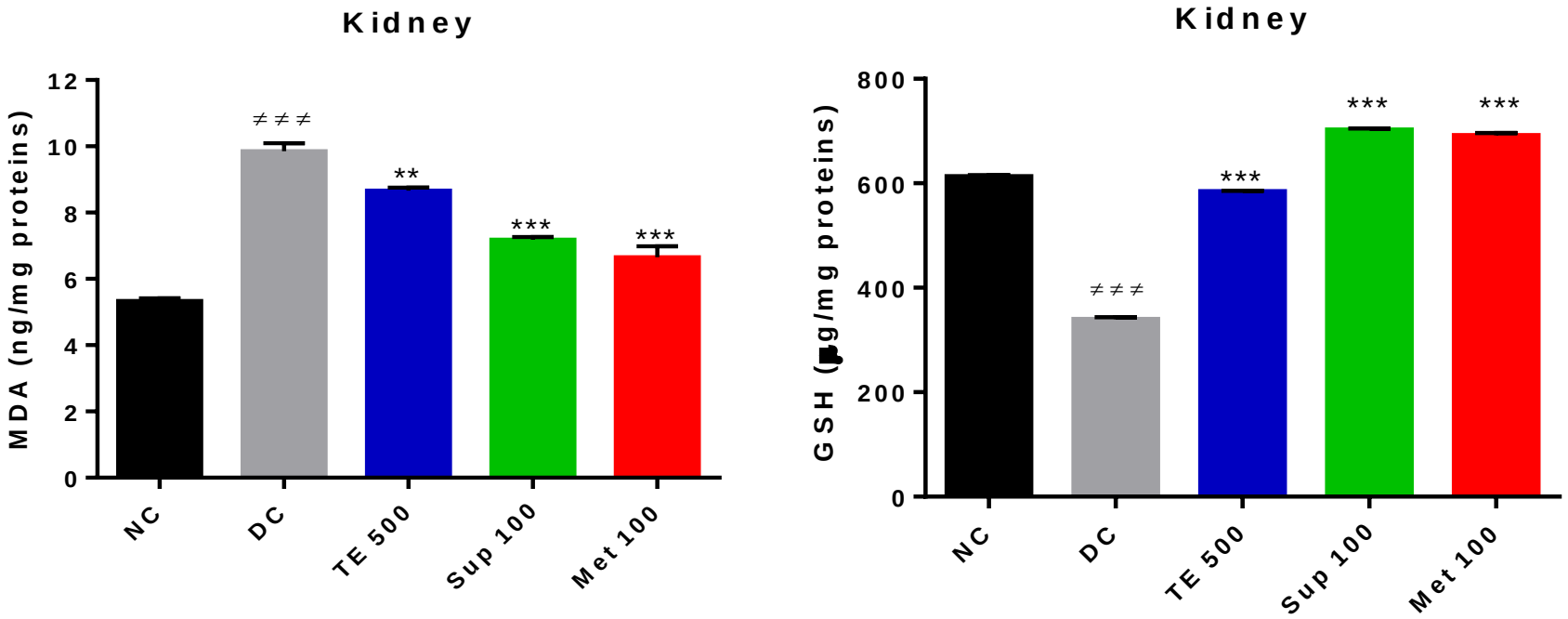


***Figure 4**: Effect of total extract and supernatant on renal malondialdehyde level and reduced glutathione concentration*

Bassalat et *al.*,2020

Conclusion

Total extract and supernatant fraction of roots of *A. leiocarpus* exerted a strong antidiabetic activity

- ✓ **by reducing hyperglycemia, glucose intolerance, and hyperlipidemia diabetic rats.**
- ✓ **by improving β-cell function and reducing oxidative stress**

These activities are related to the bioactive compounds present that may react alone or in synergy