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Research Article

PHYTOCHEMISTRY AND HYPOTENSIVE EFFECT OF JATROPHA CURCAS L (EUPHORBIACEAE) LEAVES AQUEOUS EXTRACT

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Abstract :

*High blood pressure (HBP) is the first risk factor for death in the world according to the World Health Organization (WHO). Several plant-based formula including *Jatropha curcas* leaves are proposed. This study aim at evaluating its hypotensive and antioxidant effects and to investigate the different chemical groups. In the study of hypotensive effects the invasive method was used. The DPPH method was used for the evaluation of antioxidant effects. JCLAE in cumulative doses decreased the mean arterial pressure of normotensive rats in a dose-dependent manner with a maximum effect of 69.12%. Administration of atropine prior to JCLAE resulted in a decrease in hypotension caused by the extract alone. The phytochemical study revealed the presence of Flavonoids, Tannins, Saponins and Terpenoids/steroids. Also, an antioxidant activity of 67.597 ± 1.833 was determined. The presence of all these chemical compounds could be at the origin of the hypotensive effects recorded. The study showed that JCLAE has a hypotensive property. This property justifies its use in traditional medicine as a hypotensive.*

Keywords : *Jatropha curcas, Hypotensive, antioxidant, phytochemical contents,*

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INTRODUCTION :

High blood pressure is one of the well-known cardiovascular diseases. It is a chronic disease defined by a blood pressure of 140/90 mmHg or higher. We have two groups of hypertension : essential hypertension without obvious cause which represents 90% of hypertension and secondary hypertension which has a real cause concerns 10% [1]. Many formula are proposed by traditional medicine. Several recipes have been the subject of scientific studies and their effectiveness has been demonstrated [2,3].

In Burkina Faso, *Jatropha curcas* falling leaves are used in traditional medicine for hypertension treatment [4]. The LD₅₀ of *Jatropha curcas* falling leaves total aqueous extract (JCLAE) is greater than 5000 mg/kg [5]. This formula has the particularity of using falling leaves that have exhausted their capacity to absorb CO₂, and its use cannot increase the current pressure on natural resources. This study aims to evaluate JCLAE hypotensive effect and chemical groups that could be responsible for this effect.

MATERIALS AND METHOD :

Plant material

Jatropha curcas leaves yellowing on the plant were collected at Kombissiri, a village situated at 45 km from Ouagadougou (Burkina Faso). This identification was carried out by the Plant Biology and Physiology Laboratory of the University Joseph KI-ZERBO. Those *Jatropha curcas* leaves were dried in shade for fourteen days and then ground using an electric grinder to obtain a powder which was sieved.

Leaves total aqueous extract preparation

150g vegetable powder was added and homogenized in 1500 mL of distilled water, and left to macerate with magnetic stirring for 24 h at room temperature. Then the macerate was filtered three times on hydrophilic cotton, then lyophilized and shielded from light in non-transparent flasks. The yield was 8.2%.

$$\text{Yield} = (\text{Mass of extract}/\text{mass of dry plant}) \times 100$$

Animal material

Male and female wistar rats weighing between 200 and 400 g were used in the in vivo study. These male and female rats were taken from UFR/SVT breeding farm at the University Joseph KI-ZERBO. The rats were raised in stable temperature rooms (24 ± 2 °C) where they had free access to water and granular.

Evaluation of the extract effects on blood pressure

This evaluation was carried out according to the method described by Gilani and Aftab [6] and taken up by Dabire et al. [7]. Rats were weighed and anaesthetised with 15% urethane intraperitoneally at a dose of 1.5 g/kg body weight. Once asleep, the rats were placed supine on a restraint device. After an incision of the skin just below the larynx and separation of the muscular planes in the medial zone, the trachea was freed and cannulated.

Next, the jugular vein just below the skin on the lateral side of the neck was released and tied. After a small incision in the jugular vein, a catheter connected to a syringe filled with heparinized physiological water is introduced in the opposite direction to the cephalic side. Two prepared knots are used to secure this catheter. Physiological heparin water from the syringe is injected so that the blood does not clot in the catheter.

Finally, the fairly deep carotid artery running parallel to the trachea on the opposite side of the jugular vein was also freed and tied off. After a small incision in the carotid artery, a catheter filled with heparinized physiological water and connected to a sensor was introduced in the heart direction and two prepared nodes were attached. Various tests were started after a 45-minute period of blood pressure stabilisation. Cumulative doses were administered through the jugular vein and these doses were 10⁻² to 10 mg/kg

Phytochemical studies

The phytochemical composition was determined by classical colorimetric tests.

The phenolic compound content (PCC) was estimated using the Folin-Ciocalteu method [8]. For this purpose, the calibration curve of the gallic acid used as a reference was established beforehand. $Y = 536,6x + 0,4239$, $R^2 = 0,9992$

The different extracts total flavonoid content (TFC) was evaluated by using the equation of the calibration curve of quercetin as reference [9]. $Y = 4,438x + 0,0518$, $R^2 = 0,9992$

The extract antioxidant content (AC) was estimated using the DPPH method. Trolox was used as reference substrate. For this purpose, the calibration curve of Trolox was established by measuring the DPPH● radical absorbance. $Y = -60,101x + 0,5548$, $R^2 = 0,9964$

Statistical analysis :

The data were presented as mean \pm standard error of the mean (SEM). The comparison between the control and the different doses was made by One Way ANOVA analysis of variance followed by the Dunnett test with the GraphPad software. The difference between the means was considered significant for $p < 0.05$.

RESULTS :

Jatropha curcas extract effects on blood pressure Increasing dose effects

Dose-escalation effects JCLAE given in cumulative doses of 10^{-1} to 10 mg/kg lowered mean arterial pressure by 2 mmHg to 63 mmHg, corresponding to 2.20 and 69.12%. This dose-dependent reduction was significant from 1 mg/kg dose onwards with an effective dose 50 (ED₅₀) of 0.60 mg/kg (Figure 1).

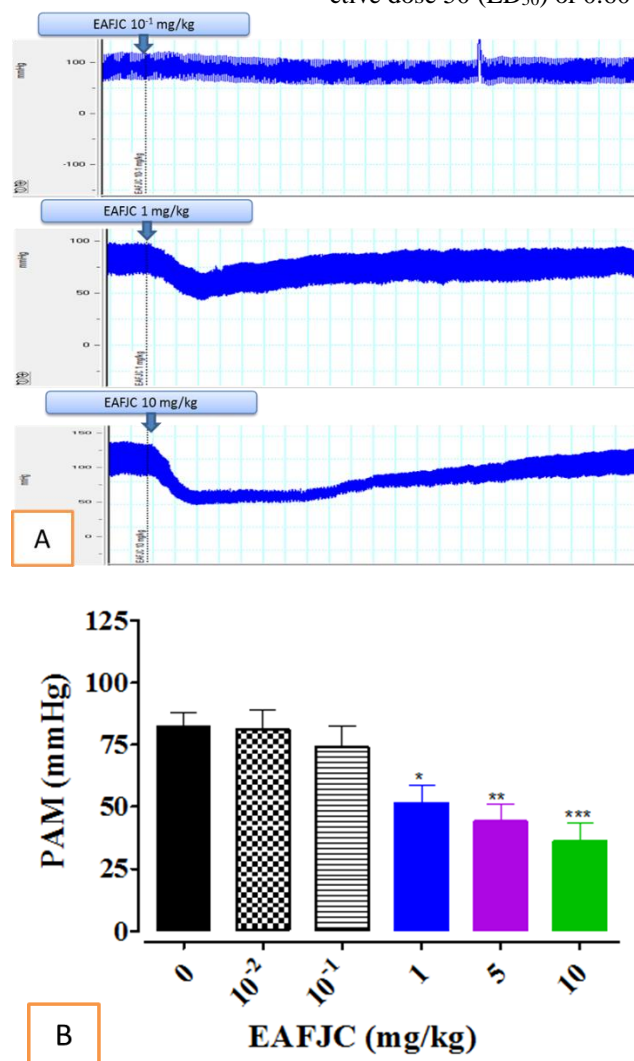


Figure 1 : *Jatropha curcas* leaves aqueous extract effects on blood pressure in normotensive rats. A: Sample record; B: Graphical representation ;

The histogram values express the dose-dependent decrease in mean arterial pressure compared to the control (Mean \pm SEM, significant difference * $P < 0.05$; ** $p < 0.01$ and *** $p < 0.001$ compared to mean arterial pressure without extract ; $n = 5$).

EAFJC : Extrait Aqueux des Fanes de *Jatropha curcas* or JCLAE

Jatropha curcas extract effects in atropine presence

Atropine administration (10^{-6} , 10^{-5} , 10^{-4} mg/kg) 5 minutes prior to JCLAE at a dose of 5 mg/kg results in a reduction in hypotension caused by the administered extract alone. Indeed, JCLAE alone causes a hypotension of $32.21 \pm 3.01\%$

and in atropine presence, hypotension is reduced to $30.38 \pm 3.07\%$; $27.16 \pm 1.37\%$; $19.07 \pm 2.93\%$ depending on the atropine dose. This inhibition of hypotension corresponds to 5.68%, 15.64% and 40.82% respectively (figure 2).

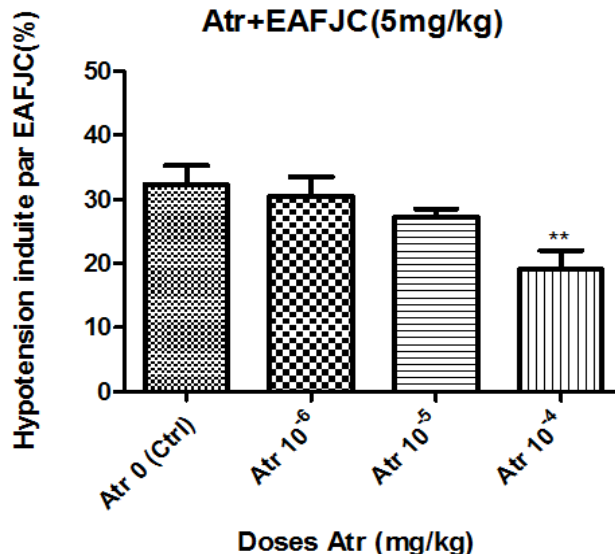


Figure 2 : *Jatropha curcas* leaves aqueous extract effects on blood pressure of normotensive rats in Atropine presence.

Values express percentage decrease in blood pressure compared to control (Mean \pm SEM, significant difference $**p < 0.01$ compared to effects of extract without atropine ; n = 5).

EAFJC : Extrait Aqueux des Fanes de *Jatropha curcas* or JCLAE

Phytochemical studies

The presence of flavonoids, tannins, saponins and terpenoids/steroids was demonstrated (Table 1).

Table 1 : Chemical groups researched in the extract

Chemical groups researched				
	Flavonoids	tannins	Saponins	Terpenoids/stéroïdes
Extract	+	+	+	+

(+) : test positif

The contents of phenolic compounds (PCC), total flavonoids (TFC) and antioxidants (AC) were determined (Table 2).

Table 2 : PC, TF and A contents. Values are given as the mean \pm standard deviation of three independent trials.

PC, TF and A contents	
PCC ($\mu\text{g EAG/g d'extract}$)	$56,188 \pm 3,120$
TFC ($\mu\text{g EQ/g d'extract}$)	$51,960 \pm 5,906$
AC ($\mu\text{g ET/g d'extract}$)	$67,597 \pm 1,833$

DISCUSSION:

The study of JCLAE effect on the blood pressure of normotensive rats showed that this extract induces a dose-dependent hypotension. In atropine presence, a competitive antagonist of muscarinic cholinergic receptors [10], the JCLAE hypotensive effect is reduced. Similar results were obtained on a plant of the same genus, *Jatropha gossypifolia* [11,12] and on plants of the same family, *Mareya micrantha* (Euphorbiaceae) ; *Excoecaria grahamii* (Euphorbiaceae) [13,7]. The hypotensive effect reduction in atropine presence attests to the presence of cholinomimetic substances in JCLAE. Cholinomimetic substances act on the cardiovascular system and lead to a decrease in blood pressure. The vessels respond by dilating to acetylcholine, which activates muscarinic receptors at endothelial level. This results in the production of a vasodilatory factor, nitric oxide (NO). This is effective in the local arteriolar microcirculation. In the heart, the cholinergic system induces a cardiomodulatory effect by increasing K⁺ (output) and decreasing Ca²⁺ (input) conductance. This results in a decrease in cardiac conductivity (negative dromotropic), contractility (negative inotropic) and beat frequency (negative chronotropic) with a decrease in cardiac output [14]. Phytochemical analysis of *Jatropha curcas* aqueous extract, revealed the presence of Flavonoids, Tannins, Saponins and Terpenoids/steroids. Previous results showed the presence of Flavonoids, Tannins in *Jatropha curcas* green leaves [15]. The presence of all these chemical compounds could be at the origin of different therapeutic virtues attributed to this medicinal plant. Indeed, saponosides are endowed with diuretic and vasodilator properties [16,17]. Diuretics help the kidneys to eliminate sodium and water, reducing the volume of fluid in the body and thus lowering blood pressure. Vasodilators are substances that increase the diameter of blood vessels by relaxing the muscles in their walls, thus lowering blood pressure [18].

This study revealed the presence of antioxidants in the extract and their content was determined. The extract antioxidant activity could be explained by the presence of polyphenolic substances such as tannins and flavonoids. Indeed, tannins are free radical scavengers. They inhibit angiotensin converting enzyme and peroxide ion formation [16]. Constituents with antioxidant activity prevent the deposit of fat in the arteries, which facilitates blood circulation.

CONCLUSION :

This study demonstrated JCLAE hypotensive properties. Indeed, the extract caused a reduced dose-

dependent hypotension in atropine presence. The study also revealed the presence of bioactive elements in JCLAE. In view of obtained results, we plan to further investigate this study by evaluating the vasodilatory effects and determining the extract action mechanisms on rat aorta.

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