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# Antihyperglycemic and Antioxidant Properties of *Jatropha curcas* and *Jatropha gossypifolia* (Linn) Extracts

**Albert Manggading Hutapea[1], Qori Fadillah[2*]**

## ABSTRACT

The World Health Organization recommends the use of traditional medicines, including herbs, to maintain public health and prevent and treat diseases, especially chronic diseases, degenerative diseases, and cancer. Traditional medicine has relatively fewer side effects than modern pharmaceutical medicine. There have been many studies that explore secondary metabolites in plants. Among them, several plant species have been found to have antidiabetic properties. One of these plants is *Jatropha curcas* (Linn). Scientifically, it is known to exhibit antihyperglycemic and antioxidant activity. Phytochemical screening shows that the leaves of this plant species contain alkaloids, steroids, triterpenoids, flavonoids, and tannins, which are potentially antihyperglycemic, antioxidant, anti-cancer, and anti-inflammatory agents.

**Keywords:** *Jatropha curcas* (Linn), antihyperglycemic, antioxidant.

Diabetes mellitus is a metabolic disease that ranks third in the world after cancer and cardiovascular disease. In Southeast Asia, the number of diabetics has reached as many as 159 million in 2017 and is expected to increase. Indonesia is one of the top ten countries with a high number of diagnosed diabetes sufferers aged 20-79 years old.[1]

This disease is generally divided into two types, namely, type 1 diabetes mellitus (T1DM) and type 2 diabetes mellitus (T2DM). The most common type found in society, about 80% of 90% of all cases of diabetes mellitus, is T2DM, characterized mainly by chronic hyperglycemia, insulin resistance, and relative insulin deficiency.[2]

Treatment of diabetes mellitus is a lifelong endeavor. Treatment of diabetes mellitus, such as insulin and oral antihyperglycemic drugs, is relatively expensive, and their use for a long time may cause unwanted side effects. Therefore, looking for effective drugs with low prices and relatively low side effects is necessary. Efforts to find alternative herbal medicines as a substitute for chemical drugs are continuously being made.[3]

The World Health Organization recommends using traditional medicines, including herbs, to maintain public health and prevent and treat diseases, especially chronic diseases, degenerative diseases, and cancer. Traditional medicine has relatively fewer side effects than modern medicine.[3]

There have been many studies to explore secondary metabolites in plants. Among them, several plant species have been found to have antidiabetic properties which can lower blood sugar levels, and one of these plants is *Jatropha curcas* (Linn). Scientifically, it has antihyperglycemic activity and antioxidants.[4] Phytochemical examination reported by Nursahfitri, Amalia, & Fadillah (2020) [5] showed that the leaves of this plant contain alkaloids, steroids, triterpenoids, flavonoids, tannins, which according to Warsinah, Baroroh, & Sunarto, (2017) [6], these ingredients have the potential as antihyperglycemic, antioxidant, anticancer, and anti-inflammatory.

Based on the increasing number of people with diabetes mellitus in the world and in Indonesia, many studies regarding the benefits and effectiveness of the *Jatropha curcas* (Linn), we would like to

* Penulis Korespondensi: qorifadillah@unprimdn.ac.id
[1] Faculty of Science, Universitas Advent Indonesia – Bandung, Jawa Barat, Indonesia.
[2] Faculty of Medicine, Universitas Prima Indonesia- Medan, Sumatera Utara, Indonesia

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collect several review articles that prioritize the effectiveness of antihyperglycemic and antioxidant because these effects can improve and prevent the worsening of diabetes mellitus. damage in patients with diabetes mellitus

## METHOD

This literature review searched for reports of studies using quasi-experimental and randomized controlled trial designs. These research designs are the best methods for answering clinical questions in the field. The type of study reviewed is all types of research using *Jatropha curcas* (Linn) leaves. The inclusion criteria included interventions to reduce blood glucose levels and its effectiveness as an antioxidant agent in human and animal models, without limiting the number of articles to be reviewed. The exclusion criteria are the interventions using extracts other than the leaves, interventions not on human and animal models, and interventions other than to reduce blood glucose levels. The search was done on the databases Science Direct, Medline, and Google scholar using the following key terms: *Jatropha curcas* (Linn), *Jatropha curcas* (Linn), and antihyperglycemic antioxidant agents. The articles found were read carefully to see whether they met the inclusion criteria to be used in this literature review. The search is limited to papers published from 2017 to 2021, with full text in pdf format.

Articles that fall under the inclusion criteria were analyzed, and the conclusion was extracted and synthesized.

The following is the types of information gathered from the study: the title of the study, the name of the researcher, the year of publication, the method, the number of samples from the intervention group and the control group, the cytotoxic substances used, the results and conclusions of the research along with its significance value.and the steps to find the articles with predefined keywords in journal directories. However, the article is matched with the topic, the keyword of the problem, its similarity, the inequality of the article, view of the author, comparison with other research sources as well as summaries.

## RESULTS

To find articles, the author does a keyword search that has been compiled. After selecting based on inclusion and exclusion criteria, 22 articles were obtained. These are analyzed. Figure 1 summarizes a list of articles extracted in diagrammatic form.

Using the keywords that had been predetermined, the Indonesian scientific journal database came up with nine research articles, but none was suitable for analysis. On Google Scholar, using the exact keywords produced 1.950 articles that matched the inclusion criteria. However, only 15 articles are suitable for analysis. We found 271 articles with predetermined keywords in the directory of open-access journals. However, no articles were suitable for analysis at JSTOR. Twenty-two articles matched keywords, but there were no articles suitable for analysis. The sage journal found seven articles that matched the keywords, but none were suitable for analysis.

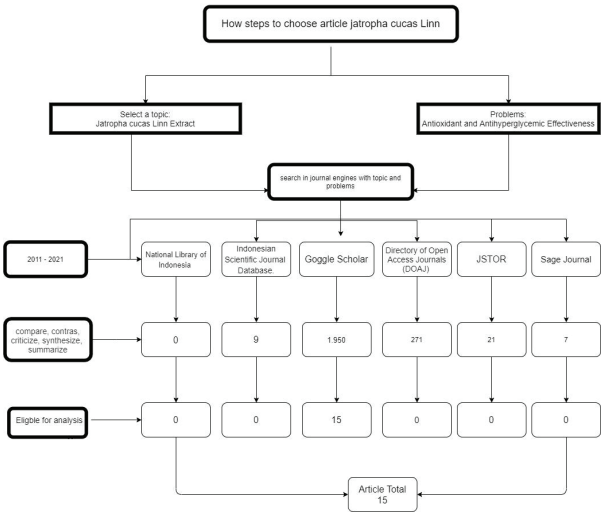


Figure 1. steps to choose article jatropha cucas Linn

The following are the results of the extraction of eligible literature reviews for analysis:

Table 2. Data Extraction of Research Results

| No. | Study | Place of Research | Number of Samples | Group | | Research Method/ Measuring Instrument | Outcome |
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| | | | | Intervention | Control | | |
| 1 | Antihyperglycemic Property ethanol extract of *Jatropha curcas* L. Leaf among White Male *Rattus norvegicus* Rats [7] | Faculty of Mathematics and Natural Sciences, Sam Ratulangi University. | 15 | Treatment with 125, 250, and 375 mg/kg BW doses. | The positive control group was given metformin. | The reading of the blood sugar concentration used a glucometer in units of mg/dL. | The dose of 375 mg/ kg BW significantly lowered postprandial hyperglycemia |
| 2 | Study of Antioxidant and Antimicrobial Activity Fractions and Extracts from Leaves and Twigs of *Jatropha curcas L*. and its utilization in hygiene personal products [8] | Surfactant and Bioenergy Research Center, Bogor Agricultural Institute | 4 | Antioxidant concentrations of 4, 6, 8, 10, 12, 16, and 20 g/mL were utilized in the study were tested against *Candida albicans, Microsporum gypseum, and Pseudomonas aeruginosa* at concentrations of 1, 2, and 3 percent. | The antioxidant activity of soxhlet crude extract, ethyl acetate fraction, ethanol-water fraction, and maceration crude extract was determined using the DPPH method and their antimicrobial activity using the well diffusion method. | The antioxidant activity of the samples was measured using the DPPH compound and compared to that of Vitamin C as a control group. The antibacterial activity of samples against the bacteria was investigated using the agar diffusion method, in which the widths of clear zones surrounding introduced substances on agar plates were used to determine antimicrobial activity. | Only at a concentration of 3% did the ethyl acetate fraction show inhibitory activity against *Microsporum gypseum*, with inhibitory zones of 14 mm, and soap with ethyl acetate fraction added at a concentration of 8% produced soap with antioxidant activity of 66.15 percent and foam stability of 83.23 percent. |
| 3 | Detection of Hypoglycemic and Antidiabetic Fraction in Ethanol Extract of *Jatropha curcas* Aerial Parts in Alloxan-induced Diabetic Rats [9] | Pharmacognosy Department, Faculty of Pharmacy, King Saud University, Riyadh, Saudi Arabia | 30 | After 24 hours of fasting, each chloroform, ethanol, and hexane extract or fraction was dissolved in 0.5 ml tween 80, and a dose of 400 mg/kg weight was given orally as an intervention. Blood samples were obtained before treatment and after 2 hours of therapy. | Normal saline was given to one group, tween 80 (solvent) to the second, and a standard hypoglycemic drug, daonil® (glibenclamide) at a dose of 1 mg/kg to the third. | Blood samples were taken for the three extracts of *Jatropha curcas* L, and glucose levels were measured using a reflotron® device. | At a 400 mg/kg dose, the ethanol and chloroform extracts of *Jatropha curcas* aerial portions had strong hypoglycemic and antidiabetic effects. |
| 4 | Effects of Aqueous Root Extract of *Jatropha curcas* on Hyperglycemic and Hematological Indices in Alloxan-induced Diabetic Rats [10] | University of Ilorin, Ilorin, Nigeria | 13 | *Jatropha curcas* aqueous root extract (250 and 450 mg/kg/ day) was given orally to alloxan-induced diabetic rats for 15 days. | Glucophage (14.2 mg/kg/day) in an aqueous solution was given orally to Alloxan-induced diabetic rats for 15 days. | Hemoglobin (Hgb), red blood cell (RBC) count, white blood cell (WBC) count, packed cell volume (PCV), percentage lymphocytes (LYM), and neutrophils (NEUT) levels were all measured and evaluated. | This study revealed that an aqueous root extract of *Jatropha curcas* had hypoglycemic properties and improved anemia in alloxan-induced diabetic rats. |
| 5 | Attenuation of Some Metabolic Deterioration Induced by Diabetes Mellitus Using Different *Jatropha curcas* [11] | Plant Biochemistry Department, National Research Centre (NRC), El Bohouth St., Dokki, Giza, Egypt | 70 | For 30 days, STZ-induced diabetic rats were given oral treatments of 250 mg/ kg BW petroleum ether, ethyl acetate, and consecutive methanolic extracts of *Jatropha curcas* leaves, as well as 10 mg/kg BW glibenclamide. | Rats that were healthy and rats that were given the extract at a dose of 45 mg/kg BW). | In rat blood serum, levels of creatinine, urea, and inflammatory biomarkers such as C-reactive protein (CRP), tumor necrosis factor-alpha (TNF-), and interleukin-10 (IL-10) were assessed. | The extracts of *Jatropha curcas* leaves (successive extracts and crude methanolic extract) were found to have antidiabetic and anti-inflammatory properties as well as a reduction in renal dysfunction. |

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| 6 | Combinatorial Effects of Aqueous Root Extract of *Jatropha curcas* and *Jatropha Gossypiifolia* in Alloxan-Induced Diabetic Rats. [12] | Faculty of Life Science University of Ilorin, Nigeria | 6 | Aqueous extracts of *Jatropha curcas, Jatropha gossypiifolia*, and mixture roots (250 mg/kg/rat/day) were administered to diabetic rats for 15 days. | Glucophage (14.2 mg/kg/rat/d) in an aqueous solution was given orally to diabetic rats for 15 days. | The levels of cholesterol, triglycerides, HDL, and LDL, alanine transaminase, aspartate transaminase, and alkaline phosphatase, were measured spectrophotometrically in both serum and tissues. | According to this study, the combined extract of the two plants, *Jatropha curcas* and *Jatropha gossypiifolia*, is more efficient for treating diabetes mellitus. |
| 7 | A Comparative Study of the Antioxidant and Proteolytic Activities of Methanol Extracts of *Jatropha gossypifolia* and *Jatropha curcas* Leaves [13] | Department of Experimental Pharmacology and Toxicology, Faculty of Pharmaceutical Sciences, University of Port Harcourt, Rivers State, Nigeria | 2 | Methanolic extracts of *Jatropha gossypifolia* and *Jatropha curcas*. | In the DPPH experiment for antioxidant activity, ascorbic acid was utilized as a positive control. | TLC was used to determine the presence of antioxidant components in extracts of *Jatropha gossypifolia* and *Jatropha curcas*. | In addition to having significant proteolytic activities, the extracts *Jatropha gossypifolia* and *Jatropha curcas* could be a possible source of natural antioxidants. |
| 8 | Determination of Polyphenolic Contents and Antioxidant Potential of Leaf Extracts from *Jatropha curcas* (Linn) [14] | Department Pure and Industrial Chemistry, Faculty of Physical Science, Bayero University, Kano | 2 | Ethyl acetate extract and ethanol extract of the leaves of *Jatropha curcas* | The control groups in this assay were standard butylated hydroxyl toluene (BHT) and ascorbic acid. | Assay for proanthocyanidin content. A spectrophotometer was used to test the absorbance at 600 nm. The reaction mixture's absorbance indicates that the plant extract's power has been significantly reduced. | Compared to the conventional BHT and AA, the ethanol extracts had higher antioxidant activity than the ethyl acetate extracts, demonstrating that phenolic content and antioxidant power are related. |
| 9 | Antidiabetic Activity of Leaves of *Jatropha curcas L.* (Euphorbiaceae) in Alloxan Induced Diabetes Rats [15] | Department of Pharmacy CEC School of Pharmacy | 30 | Diabetic rats were treated with JCH 250 mg/kg BW in Group IV, while diabetic rats were treated with *Jatropha curcas* with a dose of 250 mg/kg BW in Group V. | Group I (the control group) received 0.5 mL saline, Group II (untreated diabetic rats), and Group III (tolbutamide 80 mg/kg BW diabetic rats). | Serum glucose and lipid profiles were examined (total cholesterol, triglycerides, HDL cholesterol, and LDL cholesterol). | JCH extract has a possible antidiabetic and antihyperlipidemic action, which is bioactivity that is important in diabetes mellitus complication treatment. |
| 10 | Antidiabetic Activities of the Leaf and Bark Extracts of *Jatropha curcas* on Alloxan-Induced Diabetic Albino Rats [16] | Department of Biochemistry of Kaduna State University, Kaduna – Nigeria. | 21 | • JCB is the name of the group. Alloxan-induced diabetic rats were given 1000, 2000, and 4000 mg of *Jatropha curcas* bark extract.<br>• Group: JCL Alloxan-induced diabetic rats were given 1000, 2000, and 4000 mg of *Jatropha curcas* leaves extract. | • CNI rats that were neither induced nor given any treatment.<br>• CNT rats that were not treated but were induced (negative control).<br>• CSD rats were induced and treated with Metcon 500-SR, a standard medication (positive control) | A glucometer was used to measure the blood glucose level of fasting alloxan-treated rats. | Methanolic extracts of *Jatropha curcas* leaves (JCL group) and bark (JCB group) elicited substantial antidiabetic effects. |
| **11** | Evaluation of antidiabetic and related actions of some Indian medicinal plants in diabetic rats [17] | CEC School of Pharmacy, Lal Khadan, Masturi Road, Bilaspur (C.G.) India | 65 | Diabetic rats induced by alloxan: 1. given tolbutamide in saline at an oral dose of 80 mg/kg body weight; 2. given chloroform extracts of *Acacia arabica* bark, *Benincasa hispida* fruit, *Tinospora cordifolia* stem, *Ocimum sanctum* aerial part, and *Jatropha curca* leaves at doses of 250 and 500 mg kg BW, respectively. | Group 1 received 0.5 mL saline, while group 2 were diabetic rats who had not been treated. | Biochemical markers such as serum glucose (GOD-POD technique), cholesterol (CHOD-PAP method), triglycerides (GPO-Triender method), HDL, and LDL were estimated using serum samples from all of the experimental rats. | Compared to untreated diabetic rats, chronic therapy with CEAA, CEBH, CETC, CEOS, and CEJC significantly reduced high serum glucose levels and caused cholesterol, triglyceride, HDL, and LDL values to revert to normal. |

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| **12** | Antidiabetic and Antioxidative Properties *of Jatropha curcas* Extracts in Streptozotocin-induced Diabetic Rats [18] | Department of Medical Biochemistry, Cross River University of Technology, Okuku Campus | 54 | Groups II-VI were given streptozotocin 50 mg/kg to develop diabetes, whereas groups III-VI were given leaf, stem bark, root extracts, and glibenclamide (a standard medication). | Group I: Normal control (NC) animals were given only a regular diet and water.<br>Group II: Diabetic control (DC) mice were given STZ to develop diabetes and were left untreated. | The blood glucose levels were measured using the One Touch ACCU-CHECK advantage glucometer. | The ethanol-methanol extracts of *Jatropha curcas* leaf, stem bark, and root employed in this study had a robust antihyperglycemic effect, with blood glucose levels returning to normal within two weeks of dosing. |
| **13** | Evaluation of Antidiabetic and the Effect of Methanolic Leaf Extract of *Jatropha curcas* on Some Biochemical Parameters in Alloxan-induced Diabetic Male Albino Rats [19] | Department of Science Laboratory Technology (Biochemistry Unit), School of Technology, Lagos State Polytechnic, Ikorodu, Lagos, Nigeria | 25 | Alloxan-induced diabetic rats were treated with leaf extract of *Jatropha curcas* at doses of 150 and 250 mg/Kg BW, respectively. Group D- Diabetic+150mg/Kg B.WT of *Jatropha curcas* Group 4, Alloxan-induced diabetic rats were treated with leaf extract of *Jatropha curcas* at doses of 150 and 250 mg/Kg BW. | Group I, control group: normal (non-diabetic rats )<br>Group II, negative control group (diabetic without treatment)<br>Group III, positive control (diabetic rats treated with glibenclamide) | Accu-chek Active Glucometer was used to monitor blood sugar levels. BC-3200 Auto Hematology was used to determine the hematological parameters total RBC, HGB concentration, WBC cell count, and platelet count. Using Randox kits, the researchers tested the analyzer, lipid profiles, total protein, total bilirubin, and liver biomarker enzymes. | These findings reveal that *Jatropha curcas* methanolic leaf extracts are not hepatotoxic, may prevent alloxan-induced liver damage, and have antihyperglycemic and hypolipidemic characteristics. |
| **14** | Antihyperglycemic and antihyperlipidemic activity of *Jatropha gossypifolia* methanolic extract in streptozotocin-nicotinamide induced diabetic rats [20] | Department of Biotechnology, School of Bioengineering, SRM University, Kattankulathur, Kancheepuram, Tamil Nadu, India. | 45 | Diabetic rats were given 50 and 100 mg/kg BW of a methanolic extract of *Jatropha gossypifolia*. | Streptozotocin-nicotinamide-induced diabetic rats treated with metformin (500 mg/kg BW); control rats fed 0.5 percent CMC, methanolic extract (ME) (100 mg/kg BW). | Glutamate oxaloacetate transaminase (GOT) and glutamate pyruvate transaminase (GPT) enzymes were tested, and liver glycogen level was estimated spectrophotometrically. | The results show that methanolic extract has an antihyperglycemic and antihyperlipidemic effect in diabetic rats generated by streptozotocin-nicotinamide. |
| **15** | Pharmacological evaluation of *Jatropha curcas* L. leaves for antidiabetic activity in alloxan-induced diabetic rats [21] | Govind Ballabh Pant University of Agriculture and Technology, Pantnagar, Uttarakhand 263 145 India | 30 | The Alloxan-induced diabetic rats were given 200 (group IV) and 400 mg/kg BW (group V) of hydroethanolic extract of *Jatropha curcas* leaves, respectively. | Group I, an uninduced and untreated diabetic healthy control group. Group II, Nnegative control rats (uninduced and untreated); Group III. Alloxan-induced diabetic rats treated with metformin (300 mg/kg BW). | Standard diagnostic kits and aspartate aminotransferase, alanine aminotransferase, and alkaline phosphatase were used to estimate biochemical parameters such as total proteins, albumin, globulin, total cholesterol, glucose, creatinine, and urea. | In comparison to the Alloxan-induced diabetic group, Metformin plus *Jatropha curcas* extract treatment dramatically lowered blood glucose levels and other biochemical indicators. |

## DISCCUSION

The determination of strict criteria on keywords, inclusion criteria, and exclusion criteria greatly affects the number of articles obtained. The time frame was determined to range from 2017 to 2020. After seeing that the number of articles obtained is limited, some articles that are not related but still contain one of the inclusion criteria were kept, totaling 15 articles.

The number of articles related to the title of this review literature may be small. However, the article can show the research methods carried out in the studies. Thus, future studies may use the same methods.

The studies conducted in the selected articles vary in terms of the solvents used for the extraction process of different plant parts. The plant *Jatropha curcas* was extracted with different solvents such as water by Pingkan, Aladodo, water and ethanol by Patil, Singh, ethanol by Pingkan, Setyaningsih,

ethanol, and ethyl acetate by Ibrahim ethanol and methanol by Asuk, methanol by Amidi, Aina Johnson, Isaac, successive hexane, chloroform, and ethanol by Farag, successive petroleum ether, ethyl acetate, and methanol by Ali, and chloroform by Patil.

The plant's parts that were extracted for the study especially were its leaves by Ali, Amidi, Asuk, Ibrahim, Isaac, Johnson, Patil, Pingkan, Setyaningsih, Singh, followed by other parts, i.e., root by Aladodo, Asuk, bark by Aina Asuk, and combined aerial parts by Farag.

Beside its antihyperglycemic and antidiabetic properties in diabetogenic-induced rats by Aina, Aladodo, Ali, Asuk, Farag, Isaac, Johnson, Patil, Pingkan, Singh, and antioxidant properties by Amidi, Ibrahim, other effects were also reported such as antihyperlipidemic by Patil, Johnson, Isaac, Singh, and antimicrobial effect by Setyaningsih.

In terms of antihyperglycemic qualities, Aladodo found that a blend of *Jatropha curcas* and Jatropha gossypiifolia roots has a higher potential for effective antidiabetic activity than different plant extracts and may be safe to eat. Several elements determine the effectiveness of this Jatropha leaf extract, one of which is the dose utilized in the study. According to several research studies, the higher the extract dose used, the more beneficial it will be.

Patil, et al. tested several herbal plants, including the *Jatropha curcas* plant, on diabetic rats induced by alloxan and found that doses of 250 mg and 500 mg significantly reduced glucose levels on days 7 and 14. Based on this research, we predicted that *Jatropha curcas* (Linn) material would have the same antihyperglycemic effectiveness.

In a 2015 study done by AA Asuk et al., it was discovered that jatropha extract (leaves, bark, and roots) had both antihyperglycemic and antioxidant activity by observing a decrease in blood glucose levels toward normal on days 11 and 15 and an increase in liver tissue enzyme responses (superoxide dismutase (SOD) and catalase (CAT)) and an improvement in liver tissue damaged by diabetes.

M Johnson et al. investigated and observed the effects of a methanol extract of Jatropha leaves on Alloxan-induced albino rats. The phytochemical content of J. curcas extract contains secondary metabolites such as tannins, saponins, flavonoids, and other compounds that have been shown to have antihyperglycemic and antioxidant properties. In rats, blood sugar levels, aspartate aminotransferase (AST), alkaline phosphatase (ALP), and plasma ALP all decreased significantly at doses of 150 mg and 250 mg, indicating that J. curcas extract has the potential to be antidiabetic and hepatoprotective [19]

Issac observed the antihyperglycemic and antihyperlipidemic activities of the methanolic extract of *Jatropha gossypifolia* at doses of 50 mg and 100 mg/kg BW. There was a significant decrease in liver function parameters in streptozotocin-induced diabetic rats. These parameters include GOT and GPT and the increased glycogen content of the liver. Triglycerides (TG), total cholesterol (TC), high-density lipoproteins (HDL), low-density lipoproteins (LDL), very-low-density lipoprotein (VLDL), and alkaline phosphatase (ALP) are all near-normal values, as well as aspartate aminotransferase (AST). According to these findings, the methanolic extract *Jatropha gossypifolia* has a hepatoprotective (antioxidant) impact in preventing diabetic complications.[20]

In diabetic rats caused by alloxan, extract of *Jatropha curcas* at a dose of 400 mg/kg on day 14, the results revealed a significant decrease in blood sugar levels, as well as a decrease in the lipid peroxidation product Malondialdehyde (LPO) in Red Blood Cells (RBC), Kidneys, and liver. After various studies above, this reveals the efficiency of antihyperglycemic and antioxidant capabilities of *Jatropha curcas* extract. [20]

## CONCLUSION

According to the findings of this literature study, *Jatropha curcas* (Linn) has been found to have antihyperglycemic and antioxidant properties in various studies. *Jatropha curcas* (Linn) leaf is easy to locate, use, and afford when utilized for further research. It is feasible to identify little adverse effects in humans. It is hoped that this material will aid in the development of herbal therapy.

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