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Evaluation of the Hypoglycemic and Antihyperglycemic Effect of Persea *Americana* (Lauraceae) Leaves in Wistar Strain Rats (*Rattus norvegicus*)

ABALE Louise Christelle Akouasso[1*], ROBET Emilie Jocelyne[1], DJALEO Ouraga Rodolphe[2], Ouattara-Soro Fatou Scherazade[2]

[1]Faculty of Science and Technology, Alassane Ouattara University, Bouaké, Ivory Coast
[2]Faculty of Bioscience, Felix Houphouët Boigny University, Ivory Coast, Ivory Coast

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***Corresponding author:** ABALE Louise Christelle Akouasso
Faculty of Science and Technology, Alassane Ouattara University, Bouaké, Ivory Coast

Abstract | **Original Research Article**

Persea americana is a plant used in traditional medicine for the treatment of diabetes mellitus, which is a real public health problem. This study aims to investigate the hypoglycemic and antihyperglycemic activity of the aqueous extract of *Persea americana* leaves in Wistar strain rats (*Rattus norvegicus*). The hypoglycemic and antihyperglycemic properties of the aqueous extract were studied respectively through the hypoglycemic activity test in normoglycemic rats and rats subjected to oral glucose tolerance. Data analysis showed that P. *americana leaves* do not possess hypoglycemic properties compared to glibenclamide, which significantly reduces blood glucose. On the other hand, this extract showed antihyperglycemic properties with a dose-dependent effect. It induced a strong reduction in blood glucose comparable to that caused by glibenclamide at 120 minutes of the experiment. These remained stable and were comparable to those of normoglycemic groups at 180 minutes of the study. The antihyperglycemic activity was highly significant with doses of 200 and 600 mg/kg BW. The initial blood glucose levels at doses of 200 and 600 mg/kg BW decreased from 1.72±0.13 g/l to 0.64±0.04 g/l and from 1.70±0.88 g/l to 0.592±0.00 g/l, respectively, compared to the control groups. These values were comparable to those of s rats.

Keywords: *Persea americana* Mill., glycemia, antihyperglycemic and rat.

INTRODUCTION

Diabetes mellitus is one of the diseases causing high mortality in the world (WHO, 2025). Ranked eighth among the ten most deadly conditions, it caused the death of 3.4 million people in 2024 (IDF, 2025). It is indeed a metabolic disorder characterized by chronic hyperglycemia. (Goldenberg and Punthakee, 2013). This anomaly is due to a lack of insulin production (type 1) and an insufficiency or poor use of this hormone by the body (type 2) (Ghourri *et al.,* 2013). In developing countries, diabetes is gaining more and more ground. In addition, the autoimmune aspect, changes in food systems in favor of ultra-processed foods and poor lifestyles are the main reasons for the increase in its prevalence (Duquen *et al.,* 2025, Séré *et al.,* 2021). In 2022, 24 million adults suffered from diabetes in Africa and forecasts by 2045 estimate the number of people affected by this disease at 55 million, an increase of 129% (WHO, 2025). In Côte d'Ivoire, the International Diabetes Federation (IDF) counts 14,140,900 people aged between 20 and 79 living with diabetes, or 44.3% of the population in 2024. This represents an additional expense for the Ivorian government of $342.1 or 19,641,402 CFA francs per person in medical care (IFD, 2025). As a result, diabetes mellitus is a major public health problem (Kroa *And al.,* 2016). Faced with this situation, sustainable and accessible solutions must be considered in order to reduce these expenses. Currently, the therapeutic management of diabetes is based on strict diets and the administration of hypoglycemic sulfonamides, biguanides, alpha-glucosidase inhibitors, glinides and thiazolidinediones and insulin which are expensive or even inaccessible to the population (Konda *et al.,* 2011; Singh and Singh, 2012). In the long term, these substances develop adverse effects such as digestive disorders that can cause other pathologies (Sakouhi *et al.,* 2023). Populations then resort to ancient therapeutic practices based on the use of medicinal plants. In Africa, and in Ivory Coast in particular, several medicinal plants have been identified and are used for the treatment of diabetes. This is the case of Persea americana from the Lauraceae family (Lima *and al.* 2012) known by the vernacular name of avocado tree. It

is a plant of Mexican and American origin whose fruits are appreciated for their nutritional and cosmetic properties (Bossou *et al.,* 2024). These plants are also used for their anticonvulsant effects (Ojewole and Amabeoku, 2006) and antidiabetics (Lima *and al.* 2012). The use of this plant as a remedy for diabetes requires understanding its mechanism of action. Therefore, it would be more advantageous to direct scientific research in this direction in order to enhance and optimize its use. This study aims to evaluate the hypo- and anti-hyperglycemic effect of Persea Americana leaves in rats (*Rattus Norvegicus).*

MATERIALS AND METHODS

Material

Plant material

The plant material consists mainly of fresh leaves of *Persea americana* (lauraceae). The identification was made at the National Center of Floristry (CNF) of the Félix Houphouët-Boigny University (Abidjan, Ivory Coast), under the number LICJ008974. They were washed in tap water and then dried away from light for three weeks at room temperature.

Animal material

Male albino rats of Wistar strain, weighing between 200 and 250 g, were selected for this study. These rats were raised under adequate ventilation and at room temperature. They had free access to water and food consisting of dry bread and pellets.

Technical equipment

The technical equipment used consisted of an electric mixer, pieces of white cloth, hydrophilic cotton, a MEMMERT laboratory oven (Germany), a precision balance and a VX1 mechanical stirrer (Germany). Blood glucose was measured using an on-call plus test strip glucometer.

Chemical equipment

The chemical material used for this experimental study is the aqueous extract (ETA) of *Persea americana Persea A*, pure anhydrous glucose for the induction of hyperglycemia by oral route and glibenclamide of the Sandoz brand.

Study method

Preparation of aqueous extract of *Persea americana leaves*

The dried leaves of *Persea americana* were ground and the resulting powder was used to prepare the aqueous extract. This extract was made following the method of Yapo *and al.,* 2016. For this purpose, 50 g of this powder was added to 1 liter of distilled water and mixed for three minutes at room temperature three times in a row at five-minute intervals. The homogenate obtained was filtered twice through white cloth, then five times through hydrophilic cotton. The filtrate obtained was evaporated in a MEMMERT oven at a temperature of 50° ± 2C.

Preparation of experimental solutions

Three solutions of aqueous extract of *Persea americana* were prepared, the first at a dose of 100 mg/kg of body weight (BW), the second at 200 mg/kg and the third at 600 mg/kg of BW. A solution of glibenclamide was prepared at 10 mg/kg of BW and another consisting of distilled water at 10 ml/kg BW.

Study of the antihyperglycemic effect of the aqueous extract of *Persea americana leaves* in normoglycemic rats

For this study, 25 rats were used. They were divided into five groups of five rats.

1. Lot 1 is the negative control (NC) receiving only distilled water (10 ml/kg BW)
2. Batch 2 is the reference control (RC) to which glibenclamide (10 mg/kg BW) was administered
3. Batch 3: rats treated with *Pa ETA* at a dose of 100 mg/kg of PC;
4. Batch 4: rats were treated with *Pa ETA* at a dose of 200 mg/kg of PC;
5. Batch 5: rats were treated with the ETA of *Pa* at a dose of 600 mg/kg of PC.

Before treatment at T0 (initial time), blood glucose levels were measured in each group. After treatment of the animals, blood glucose levels were measured every 30 minutes for 150 minutes and calculated using the following formula:

$$R\,(\%) = \frac{GT0 - GT5}{GT0} \times 100$$

R (%): percentage reduction in blood glucose at T5 (T0 + 150 min).
GT0 initial blood glucose at T0;
GT5 blood sugar at T5.

Dose-response effect of total aqueous extract of *Persea americana leaves* on blood glucose levels in rats subjected to the glucose tolerance test

For this study, 30 rats were divided into 6 groups of six rats. Hyperglycemia was induced in groups 2, 3, 4, 5 and 6 of these animals by oral administration of glucose at a dose of 4 g/kg of body weight.

1. Batch 1 (TN) received only distilled water (10 ml/kg BW).
2. Lot 2 positive controls (PC) received 4 g/kg BW of glucose, and distilled water (10 ml/kg BW) after 30 minutes;
3. Batch 3 (TR) received g/kg BW of glucose, then glibenclamide (10 mg/kg BW) after 30 minutes;
4. Batch 4 received 4 g/kg of glucose PC, and the ETA *of P. americana* at a dose of 100 mg/kg of PC after 30 minutes;

5. Batch 5 received 4 g/kg of glucose PC, and the ETA *of P. americana* at a dose of 200 mg/kg of PC after 30 minutes;
6. Batch 6 Rats receiving 4 g/kg of glucose PC, then at the dose 600 mg/kg of P. *americana ETA PC* 30 minutes later;

Blood glucose levels of rats in each group were measured just before administration of glucose or distilled water and after treatment with different doses of P. *americana ETA* or glibenclamide, at 30-minute intervals, for 3 hours.

The percentage reduction of induced hyperglycemia at T6 (T0 + 180 min) is calculated according to the following formula:

$$\mathbf{R\ (\%) = \frac{GT0 - GT6}{GT0} \times 100}$$

R (%): percentage reduction in hyperglycemia at T6 (T0 + 180 min).
GT0 initial blood sugar;
GT6 blood sugar at T6.

❖ Blood glucose measurement in pretreated rats

Sampling was identical to that of the post-treated rats. However, in this series of experiments, the different batches of rats received the same solutions before induction of hyperglycemia 30 minutes later. Hyperglycemia was induced by oral administration of 4 g/kg BW of glucose. The blood glucose levels of the rats in each batch were measured just before and after the treatments at 30-minute intervals, for 180 min.

The percentage of induction of provoked hyperglycemia is calculated according to the following formula:

$$\mathbf{I\ (\%) = \frac{GT2 - GT1}{GT1} \times 100}$$

I (%): percentage of induction of hyperglycemia at T2 (T0 + 60 min),
GT1: blood glucose at T1 (T0 + 30 min);
GT2: blood sugar at T2.

Statistical analysis of the results

Statistical processing of the results was performed using Graph Pad Uninst_Prism7 software. The results were given as the mean followed by the standard error of the mean (mean ± SEM). The one- way ANOVA test was used for multiple comparisons and determining significance levels. Differences are considered statistically significant at the 0.05 level ($p < 0.05$). This software is also used to obtain the graphs.

RESULTS

Study of the antihyperglycemic effect of the aqueous extract of *Persea americana leaves* in normoglycemic rats. The results of the variation in blood glucose levels of rats treated during this study are shown in Figure 1. The blood glucose levels of rats in batch 1 (TN) receiving only distilled water did not change over time (150 minutes). The values were equal to (0.71± 0.01 g/l). The blood glucose levels of rats treated with Persea ETA certainly decreased, particularly at the dose of 600 mg/kg of PC k at the end of treatment, however this change was not significant compared to the blood glucose levels of control rats. In addition, the measured blood glucose levels of rats in batch 2 (TR) receiving glibenclamide at 10 mg/kg of PC decreased significantly ($p<0.05$) compared to that of control rats (TN). The initial blood glucose value was 0.76 ± 0.089 g/l increased to 0.74± 0.07g/l and 0.55± 0.02g/l after 60 minutes and 90 minutes respectively. This blood sugar level decreased significantly ($p<0.001$) between the 120th and 150th minutes compared to the control group. Its value increased to (0.46± 0.03g/l).

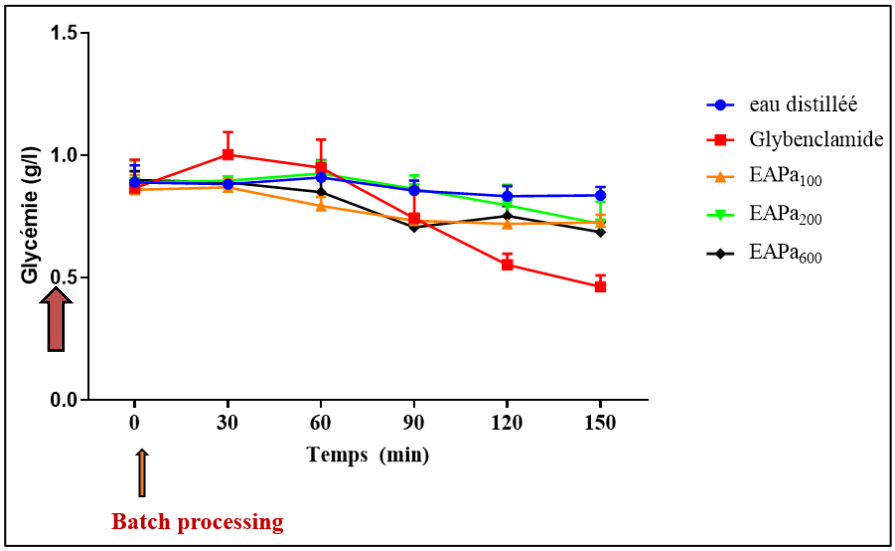

Figure 1 Glibenclamide treatment or *P. americana* or distilled water

Variation in blood glucose levels in normoglycemic rats after treatment with different doses of P. *americana ETA* (Pa) or glibenclamide *(Mean ± SEM, n = 5) SEM: Standard error of the mean*

Effects of PA ETA on blood glucose of post-treated hyperglycemic rats

Glucose administration at the beginning of the experiment (T0) in groups 2, 3, 4, 5, 6 caused hyperglycemia in rats after 30 minutes. This reached a peak of 1.81± 0.87 g/l and was highly higher ($p<0.001$) than those of group 1 (TN). At this same time, the administration of the treatment solutions in each group induced a considerable decrease in blood glucose in all rats treated with glibenclamide, ETA *Persea A* and distilled water. Moreover, this decrease was significant ($p<0.001$) in rats treated with glibenclamide and ETA Persea compared to that of group 2 (TP) treated with distilled water from the 60th ^{minute} and throughout the entire handling time (Figure 2).

Regarding the ETA of Persea A, the dose of 100 mg/kg resulted in a significant decrease in blood glucose ranging from 1.70±0.13g/l to 0.88±0.04g/l. With the dose of 200 mg/kg BW, blood glucose was from 1.72±0.13 0 to 0.64±0.04 g/l and from 1.70±0.88 g/l to 0.592±0.00 with the dose of 6.00 mg/kg/BW. Of all these doses, those of 200 and 600 allowed to observe better results after 150 minutes. At these doses, blood glucose was comparable to that of rats of batch 1 (negative controls)

As for glibenclamide (reference substance), its administration after 30 min resulted in a reduction in blood glucose levels from 1.61±0.06 g/l to 0.53±0.01 g/l at the 180th minute. This value was below that of rats (negative controls).

In the control rats treated with distilled water, blood glucose remained practically high throughout the experiment, falling from 1.77 ± 0.06 at the 30th minute to 1.37 g/l at the 180th minute.

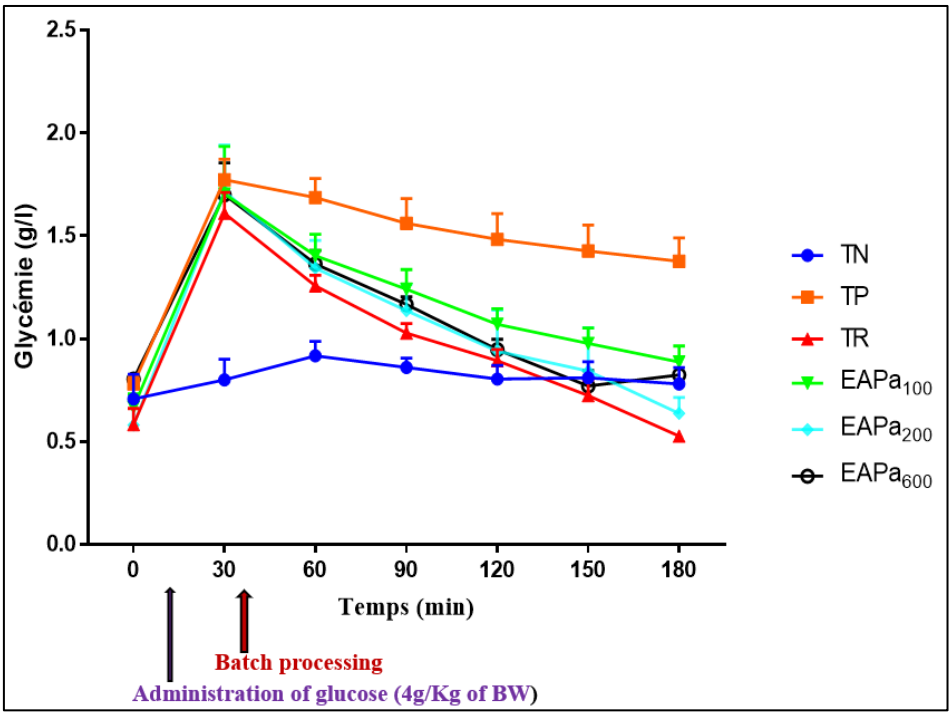

Figure 5: Time course of blood glucose in hyperglycemic rats post-treated with different doses of *p americana* (Pa) ETA or glibenclamide

(Mean ± SEM, n = 5) SEM: Standard Error of the Mean

***P. americana* ETA on blood glucose levels in pretreated hyperglycemic rats**

The results of blood sugar levels in rats pretreated with the products (glibenclamide, extract of the *P. americana*) and untreated control rats are shown in Figure 3. After 30 minutes of treatment of batches 2, 3, 4, 5, 6, the administration of 4 g/kg of glucose PC induced an increase in blood glucose levels in all rats. Blood glucose levels increased to reach their peaks at the 60th minute. It was also observed during this study that hyperglycemia in positive controls remained significantly higher than that of rats pretreated with glibenclamide and with the different doses of *Persea americana extract* (100, 200, 600 mg/kg of PC). The peak of hyperglycemia was around 1.72±0.04 g/L at the 60th minute. This value remained almost the same throughout the treatment. In rats pretreated with glibenclamide, the maximum blood glucose value was equal to 1.22±0.02 after 60 minutes. It significantly decreased (0.001) compared to that of the batches treated with distilled water and was lower than that of rats in batch 1 that were not made hyperglycemic. Similarly, in

the batches receiving ETA of Perséa A at doses of 100, 200, 600 mg/kg of BW, the peak of hyperglycemia was respectively equal to 1.42±0.03; 1.35±0.03; 1.28±0.15 g/l. These values significantly decreased compared to the blood sugar measured in rats of batch 2 (TP) to be comparable to that of batch 1, moreover these results are very appreciable with the dose of 600 mg/kg of PC at 180 minutes of the study.

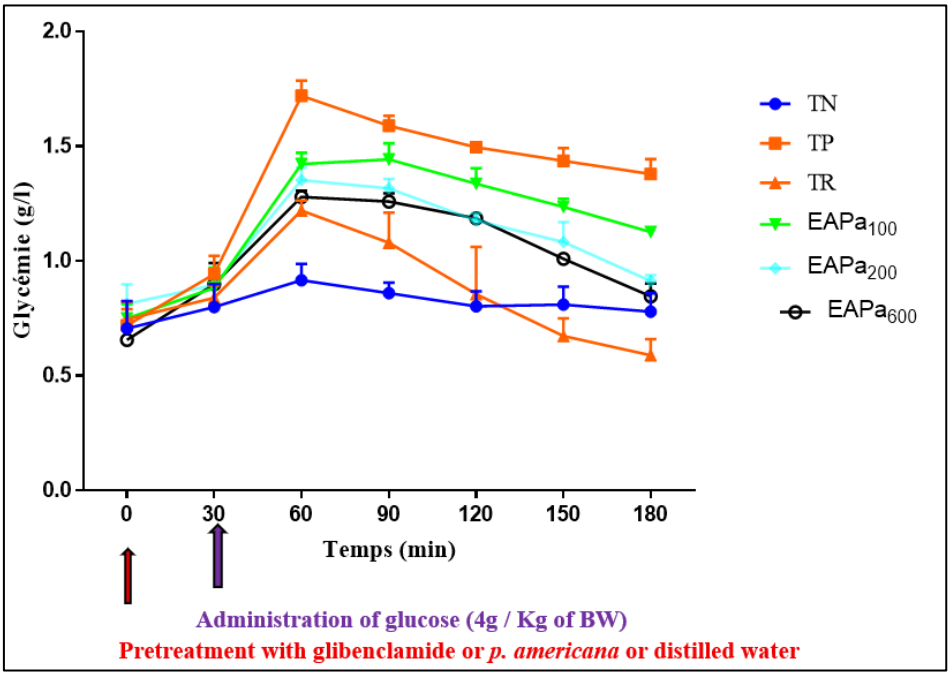

Figure 6: Time course of blood glucose in hyperglycemic rats pretreated with EAPa or glibenclamide
(Mean ± SEM, n = 5) SEM: Standard Error of the Mean

DISCUSSION

Persea A 's ETA *on* the blood sugar of normoglycemic rats did not have hypoglycemic effects like glibenclamide which is known for its modulating effect on the entry of glucose into cells (Ndombe, 2025). These results do not corroborate the assertions of Jouzier & Berké (2012) about this plant. They indeed proposed this plant for its hypoglycemic effect for the prevention and treatment of Diabetes. In this study the doses proposed would be the cause of this result. N'Doua et al, 2015 during a study similar to this one had observed a hypoglycemic effect of the 70% ethanolic extract of rauwolfia vomitoria afzel roots comparable to that of glibenclamide. This extract was effective at a dose of 1000 mg/kg of PC while the lowest dose of the extract (500 mg/kg of PC) although having led to a reduction in blood sugar was far comparable to that of the reference molecule. Furthermore, the result obtained reassures regarding the administration of this plant in a subject with normal blood sugar. Indeed, hypoglycemic substances such as Glibenclamide are contraindicated in non-diabetic people (Dridi *et al.,* 2021). They would induce in these people a factitious hypoglycemia which could cause the occurrence of even more serious pathologies (Yassine *et al.,* 2015).

The results obtained from the effect of Persea A on rats made hyperglycemic are very convincing. The antihyperglycemic effect observed in the presence of this extract confirms the results of Lima *et al.,* in 2012 and Agunloye *et al.,* 2025. These researchers have in fact evaluated the effect of this plant on diabetic rats. In this study, the administration of Persea A before or after the induction of hyperglycemia had effects comparable to glibenclamide. Moreover, the best results were obtained at the dose of 600 mg / kg of PC. This result highlights the dose-dependent nature of this plant defined by Didierjean -Jouveau, (2018). In addition, the blood glucose values of the rats at the end of treatment with Persea A were comparable to those of the normoglycemic batch 1 rats. Therefore, this plant would not have had a hypoglycemic effect because the blood sugar obtained with glibenclamide was significantly lower than that of the rats in batch 1 at the end of the study. Therefore, Persea would act as a blood sugar regulator. According to Gaspard *et al.,* 2016, there would be a functional analogy between certain plants and hormones, alluding to the notion of phytohormone. In this study, Persa A would have had a similar or modulating effect of insulin on blood sugar. This hypothesis is confirmed by the work of Ojo, *et al.,* carried out in 2022. This extract indeed contributes to better use of insulin and also participates in the regulation of glycolipid metabolism. These authors also attribute to this plant an ability to inhibit the death of beta cells which would be a boon for patients suffering from type 1 diabetes. In addition, the anti-hyperglycemic effect of Persea A. would come from its content of flavonoids and alkaloid bossu *et al.,* 2024. Flavonoids are bioactive compounds of plants (Moran, 2014). They have the

ability to modulate insulin sensitivity, Persea A. could be used in prevention of Diabetes (Ricciardolo , 2023).

CONCLUSION

Evaluation of the effects of the aqueous extract of Persea Americana leaves on blood sugar levels showed that it does not have a hypoglycemic effect like glibenclamide. Rather, it has a dose-dependent antihyperglycemic effect aimed at bringing blood sugar levels back to normal. It is therefore a blood sugar regulator that could be recommended for both insulin-dependent and type 2 diabetics.

BIBLIOGRAPHICAL REFERENCES

- Agunloye MO, Owu1 DU, Onaadepo O, Ugwu1 FN, Jjesero1 E, Ssali1 ED, Fasogbon IV (2025) systematic review Avocado (Persea americana) in diabetes management: a systematic review of preclinical evidence and its translational potential F1000Research 2025, 14:404Page 1 of 15
- Bossou AF ADohoué, Adoko S. Dieudonné, Avlessi Félicien and Sohounhloue KC D ,2024); botanical aspects, nutritional and chemical profiles, biological properties and cosmetic uses of persea americana mill; International. Journal. Advanced. Research. 12(02)p 134-143
- Didierjean-Jouveau , C. (2018). Dose-dependent. Breastfeeding from A to Z (pp. 53a-54). érès. https://shs.cairn.info/l-allaitement-de-aaz--9782749261652-page-53a?lang=fr .
- Dridi M., Htira Y., Hakiri G, Haj Ali Z., Ben Memi F., 2021: Factitious hypoglycemia with glibenclamide: about a case, Annales d'Endocrinologie, Volume 82, Issue 5, Page 493, ISSN 0003-4266, https://doi.org/10.1016/j.ando.2021.08.701.
- Duquen P., Fezeu L. K., Bourhis L., Yvroud P, Srour B., Kesse -Guyot E., Julia C, Baudry J., Cosson E., Tatulashvili S., Galan P., Hercberg S., Touvier M, Andreeva V. 2025 Risk factors of nutritional origin for type 2 diabetes – contribution of the French NutriNet -Santé cohort to scientific knowledge, Nutrition and dietetics notebook 60(03): Pages 164-175
- Gaspar T, Penel C. & Greppin H. 2016 Analogical approach and realities of phytohormones: delays and strategic errors? Bulletin of the Royal Society of Sciences of Liège, Vol. 85, pp. 190 - 208
- Ghourri M., Zidane L & Douira A., 2013. Use of medicinal plants in the treatment of diabetes in the Moroccan Sahara (Tan-Tan). Journal of Animal & Plant Sciences, 17 (1): 2388-2411.
- Goldenberg R. & Punthakee Z., 2013. Canadian Diabetes Association 2013 Clinical Practice Guidelines for the Prevention and Management of Diabetes in Canada: Definition, Classification, and Diagnosis of Diabetes, Prediabetes, and Metabolic Syndrome. Canadian Journal of Diabetes, 37 (5): 369–372.
- International Federation of Diabetes, 2025: World Diabetes Report 2000-2050, Brussels, Belgium
- Jouzier E & Berké B (2012) Diabetes and Philately II – Hypoglycemic Plants (*) Bull. Soc. Pharm. Bordeaux, 2012, 151(1-4), 141-170
- Konda K., Kabukura M., Mbembe B., Itufa Y., Mahuku K., Mafuta M & Mpoyi K., 2011. Medicinal plants from the Equateur province in DR Congo). Institute of Research in Health Sciences. Journal of Ethnopharmacology, 10 (2): 188-124.
- Kroa E., Doh SK, Soko YN, Yohou KS, Koulaï OJ, Gbogbo M & N'Guessan K., 2016. Effect of aqueous extract of Anthocleista stem bark djalonensis A. Chev. (Gentianaceae) on rabbit blood glucose. International Journal Biology, Chemistry Sciences, 10(2): 552-558.
- Lima CR, Vasconcelos CF, Costa-Silva JH, Maranhão CA, Costa J, Batista TM, Carneiro EM, Soares LA, Ferreira F, Wanderley AG. Anti-diabetic activity of extract from Persea americana Mill. leaf via the activation of protein kinase B (PKB/Akt) in streptozotocin-induced diabetic rats. J Ethnopharmacol. 2012 May 7;141(1):517-25. doi: 10.1016/j.jep.2012.03.026. Epub 2012 Mar 26. PMID: 22472105.
- Morand C, Interest of foods rich in flavonoids for maintaining cardio-metabolic health, Medicine of Metabolic Diseases, Volume 8, Issue 5, ,2014, Pages 477-482, ISSN 1957-2557,
- N' doua LA R, Abo K. JC, Aoussi Serge, Gbogbo M., Yapo A. P, Ehile E. (Hypoglycemic and antihyperglycemic effects of 70% ethanolic extract of rauwolfia vomitoria roots afzel (apocynaceae): European Scientific Journal February 2015 edition vol.11, No.6 ISSN: 1857 – 7881 (Print) e - ISSN 1857- 743
- Ndombe TR, Mutambel 'HD, Pati P, Ibebeke BSY, Idrissa AZ, Musuyu D, Divengi JP, Kimole N K, Ntenzolo Z Z 2025: Hypoglycemic Activity of Syzygium Guineense Aqueous Extract Subsp Guineense (Wild) DC in Alloxan-Induced Diabetic Mice International Journal of Progressive Sciences and Technologies: 49(1) pp. 383-390 ISSN: 2509-0119.
- Ojewole JA, Amabeoku GJ. Anticonvulsant effect of Persea americana Mill (Lauraceae) (Avocado) leaf aqueous extract in mice. Phytother Res. 2006 Aug;20(8):696-700. doi: 10.1002/ptr.1940. PMID: 16775810.
- Ojo, OA, Amanze , JC, Oni, AI *et al.,* Antidiabetic activity of avocado seeds (Persea americana Mill.) in diabetic rats via activation of PI3K/AKT signaling pathway. SciRep 12, 2919 (2022). https://doi.org/10.1038/s41598-022-07015-8
- WHO, 2025 African Region to lead in undiagnosed diabetes, WHO analysis finds
- WHO, 2025, Top 10 Causes of Death

- Ricciardolo L Mediterranean plants in the management of diabetes and its complications. Pharmaceutical Sciences. 2023. ffdumas-04244868f
- Sakouhi M., Matmour D, Belakhdar K., Kraroubi A., 2023; Cross-sectional Study on the Adverse Effects of Metformin Hydrochloride in 130 Type 2 Diabetic Patients Admitted to the Medical Center and the Diabetes House of Sidi Bel- Abbès , Annales Pharmaceutiques Françaises 81(4): Pages 684-695
- Séré L, Tiéno H, Yanogo D, Traoré S, Nagabila Y, Ouédraogo DD, Drabo YJ. Prevalence of Diabetes and Associated Cardiovascular Risk Factors in a Rural Population in Burkina Faso [Prevalence of Diabetes and Diabetes-Related Cardiovascular Risk Factors in a Rural Population in Burkina Faso]. Med Trop Sante Int. 2021 Feb 12;1(1): B1J8-7K63. French. doi :10.48327/B1J8-7K63. PMID: 35586634; PMCID: PMC9022753.
- Singh B & Singh BK, 2012. Ethnomedicinal use of Pteridophytes in reproductive health of tribal Université Officielle de Bukavu , 1(1): pp. 63-68.
- Yapo CVY, Konkani DG, Coulibaly K., Camara D & Zirihi GN, 2016. - Botanical study, evaluation of antifungal activity on in vitro growth of Candida albicans and toxicity on HFF cells of Mallotus leaves oppositifolius (Geiseler) Müller.Arg (Euphorbiaceae). Journal of Animal & Plant Sciences, 28 (1): 4330-4339.
- Yassine I., Lahlou A., Khaldouni I., Ajdi F., 2015: P231 Factitious hypoglycemia about four observations, Diabetes & Metabolism1Volume 41, Supplement 1, Pages A91-A92, ISSN 1262-3636