

An Evaluation of Anti-Hypertensive Property of Hibiscus *sabdariffa*

Upendra Sharma.H.S.^{1*}, Vasundhara Raina², Gopal Arora³

¹Department of Life Sciences, School of Sciences, B-II, Jain (Deemed to be University), JC Road, Bangalore-560027.

²Department of Life Science, Faculty of Applied Science, Parul University, Vadodara, Gujarat, India

³Department of Chemistry, Sanskriti University, Mathura, Uttar Pradesh, India

*Corresponding author:

Upendra.sharma@jainuniversity.ac.in

Abstract

Hypertension is the primary worldwide cause of cardiovascular disease and early death. Because of the extensive use of anti-hypertensive treatments during the past 40 years, the mean blood pressure (BP) over the world has either decreased dramatically or remained constant. Contrastingly, hypertension has increased in prevalence, especially in low- and middle-income countries. There is evidence of decreasing the incidence rate of hypertension however, it has been noted that there are more and more side effects that are being discovered associated with high-cost chemical treatments. Therefore, Phyto-based traditional medicine is now being investigated for its safety and low-cost characteristics. One of the main phyto-based treatments for hypertension is Hibiscus sabdariffa, which has been used by different countries. However, a comprehensive approach for evaluating the efficacy of this plant, its extracts, and beverages is still lacking. Therefore, this study aims to provide a review and compilation of the clinical trials and animal studies documenting and evaluating the effectiveness of H. sabdariffa for the effective management of hypertension in individuals with low to severe hypertension issues. Thus, this study can pave the pathway for future research to focus on the limitations that are confronting harnessing the full potential of Hibiscus sabdariffa.

Keywords

Anti-hypertensive, Blood Pressure, Hibiscus sabdariffa, Hypertension, Sour Tea

Imprint

Upendra Sharma.H.S., Vasundhara Raina, Gopal Arora. An Evaluation of Anti-Hypertensive Property of Hibiscus sabdariffa. *Cardiometry*; Issue 24; November 2022; p. 291-297; DOI:

10.18137/cardiometry.2022.24.291297; Available from: <http://www.cardiometry.net/issues/no24-november-2022/evaluation-anti-hypertensive-property>

1. INTRODUCTION

The global public health problem of hypertension is important as several diseases, such as chronic kidney disease, ischemic heart, cerebrovascular disease, and others have been linked to hypertension. The worldwide rise in fatalities and disability-adjusted life years are also attributed to hypertension. Adult hypertension was present in 31.1% of the population, with countries that are still developing, bearing a major burden. Furthermore, hypertension affects 26.6% of Iran's population. It should be highlighted that managing hypertension individuals is a greater challenge for healthcare systems in the developing world due to inadequate treatment and misinformation [1], [2].

The accessibility and accuracy of blood Pressure information from demographic investigations throughout the world are crucial for the accurate calculation of worldwide BP values and the prevalence of hypertension. The accuracy of prevalence estimates can be influenced by a variety of variables, including the predictive value of populations which has been incorporated for the study (e.g., response rates and sampling techniques), BP measurement techniques (e.g., calibration of appropriate blood pressure cuff size, BP measuring devices, and preparation of participants), and a multitude of BP measurements [3], [4]. In many countries, blood pressure experiments based on population have not been carried out or Blood pressure pieces of information are not publicly available. Additionally, there are significant regional variations in the quantity of research and the caliber of the data that is accessible.

As a result, BP projections for certain nations are dependent solely on modeling from many pooling studies. This is especially evident in Sub-Saharan Africa, where BP data are scarce. To correctly quantify the global burden of hypertension, population-based studies with high-quality, that reliably measure blood pressure in all countries in the world, are necessary.

Although the rate of hypertension has already been widely recorded in many parts of the world, no data has been assembled on its prevalence and total burden globally. For logical planning of health care and as a primary source of information, precise estimations

of the prevalence of this condition across the globe are crucial. Assessment of the suffering caused by hypertension would enable adequate prioritization and funding of its prevention and management by international public health policymakers. As per the data of WHO, the prevalence of Hypertension has been estimated at 23% in Europe, 26% in Eastern Mediterranean, 25% in South East Asia, 19% in Western Pacific, 27% in Africa, and 18% in America as illustrated in Figure 1 below.

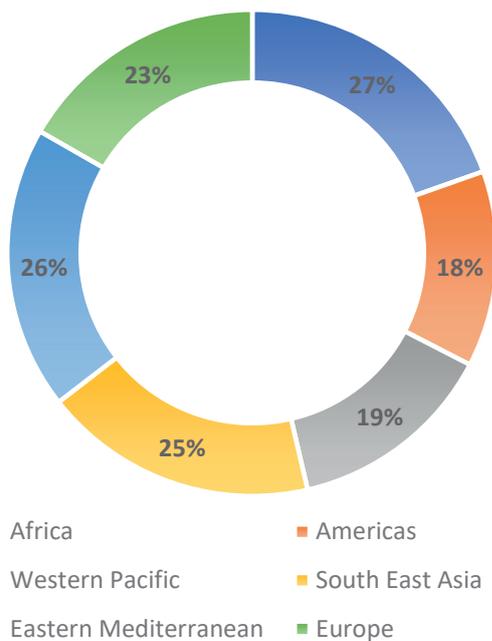


Figure 1: Illustrating the Prevalence of Hypertension by Countries by World Health Organization

Herbs including green and black tea, sour tea, Chinese herbal medicine, onion, garlic, and *Hibiscus sabdariffa* were suggested by tradition. Research has shown the therapeutic benefits of several of these treatments [5], [6]. The latter, which serves as our investigational agent, is a plant that includes minerals, fatty acids, flavonoids, vitamins, and proteins. According to studies, this plant possesses qualities that include antibacterial, anticancer, anti-oxidative, hepato- and nephroprotective, anti-diabetic, anti-cholesterol, diuretic, and anti-hypertensive. Despite the extensive use of this alternative medicine by individuals, there is little data and understanding regarding its effectiveness in treating a variety of diseases. Therefore, it would appear to be required to get more information about this plant and to carry out a study based on data and evidence. Hence, the present paper discusses the *H. sabdariffa* effectiveness for treating the issue of hypertension both in human as well as animal models [7], [8].

This paper comprises a total of five sections in which, the first section provides an overview of the topic and the face of the review study, followed by the second section involving the methodology of the review study. In the third section, the effectiveness of *H. sabdariffa* is discussed with

2. METHODOLOGY

The information of this review study is obtained from electronic database searches on Scopus, PubMed, Research gate, Google Scholar and Science Direct. To carry out the review combinations of keywords were used that are followed: *H. sabdariffa*, Hypertension, Blood Pressure, and others. Only studies involving human individuals and animal models studies are included with the exclusion of other documents. Records with languages other than English were also discarded. In addition to that initial screening of the abstract and title was also performed to get relevant records for the study. Figure 2 below provides the complete design of the methodology used to carry out the review study.

3. LITERATURE REVIEW

3.1. Hypertension and *H. sabdariffa*

One of the «silent killers» is hypertension. Although hypertension may not show any symptoms or warning indications, the majority of people with the condition are uninformed of the problem. Blood pressure must always be monitored frequently due to this reason. Early-morning nosebleeds, headaches, abnormal heart rates, changes in eyesight, and ears buzzing are just a few of the symptoms that might emerge. Vomiting, Nausea, Fatigue, dizziness, anxiety, chest discomfort, and stiff muscles are all symptoms of severe hypertension.

Table 1
Enlisting the Different Categories of Blood Pressure (Systolic and Diastolic Pressure).

Blood Pressure Category	Systolic	Diastolic
Normal	< 120	< 80
Elevated	120-129	< 80
High Blood Pressure (Hypertension) Stage 1	130-139	80-89
High Blood Pressure (Hypertension) Stage 2	140 or > 140	90 or > 90
Hypertensive Crisis	> 180	> 120

Hibiscus sabdariffa is one of the mostly employed traditional medicine to treat hypertension. In English,

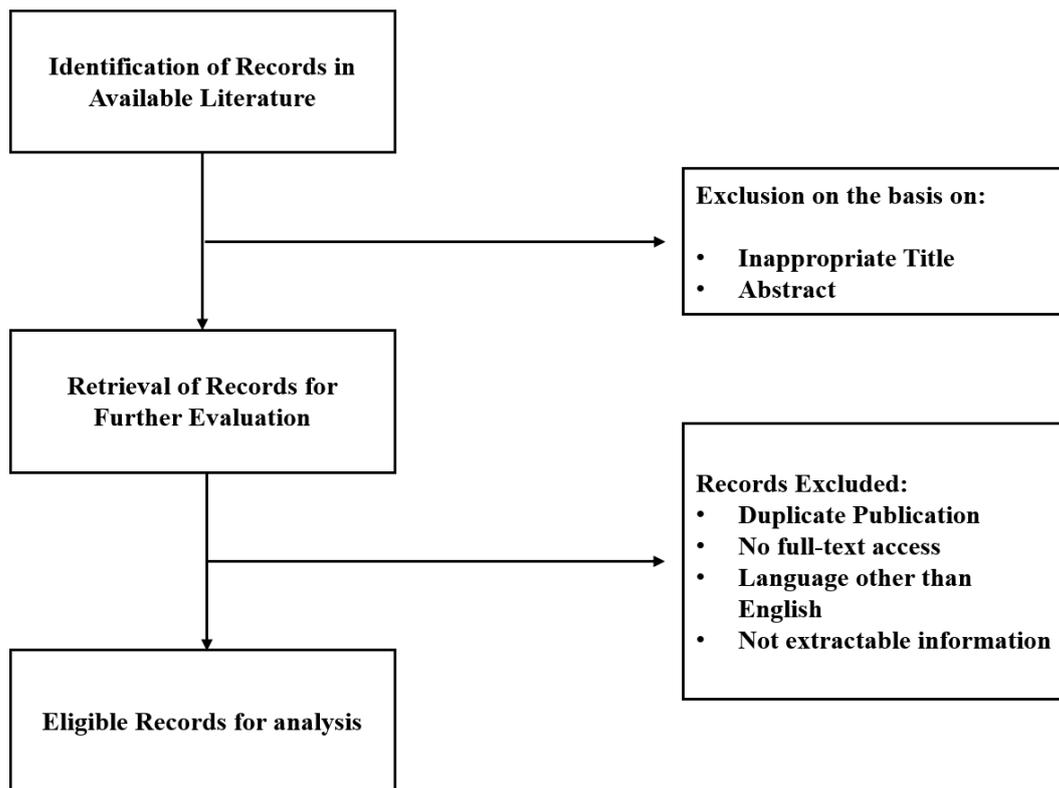


Figure 2: Illustrating the Methodology Used to Carry Out the Present Review Study.

«roselle» or «red sorrel», and «Arabic», «karkadeh», *Hibiscus sabdariffa* L. is the plant that falls in the family “Malvaceae” and is frequently grown in West and Central Africa, Southeast Asia, and other regions. The plant is an erect annual herb belonging to the Malvaceae family, and Ross has detailed its botanical characteristics. Globally, people are drinking the cup-shaped, thick, crimson, and meaty calyces of flowers both cold and hot (sour tea). Below is the pictorial representation of the flower *Hibiscus sabdariffa* in Figure 3 and its major constituents in Figure 4.

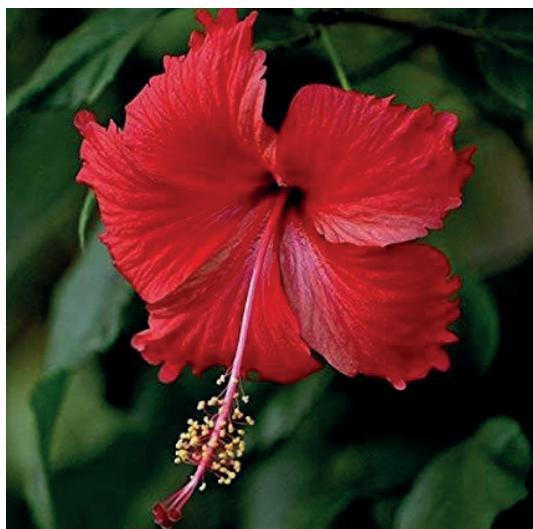


Figure 3: A Pictorial Representation of *Hibiscus sabdariffa* flower.

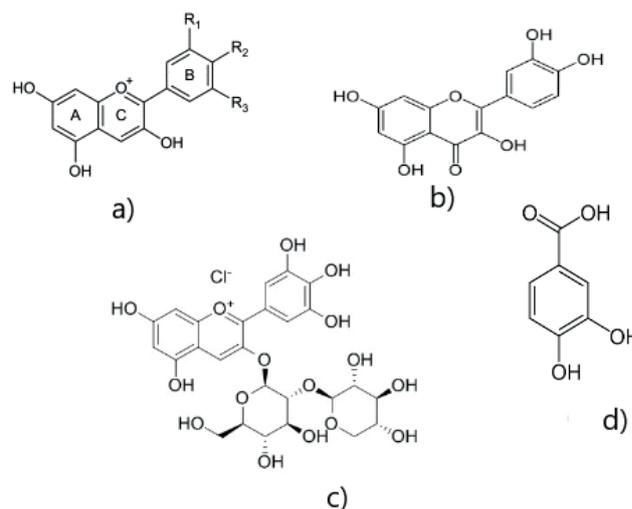


Figure 4: Illustrating the Major Chemical Compounds Present in *Hibiscus sabdariffa*.

3.2. Human Studies

As the pharmacological properties of “*Hibiscus sabdariffa*” are now being investigated increasingly, clinical trials are also being conducted to assess and validate the claims of its therapeutic efficacy.

Khosravi *et al.* in a clinical trial evaluated the anti-hypertensive efficacy of “black tea (BT)” infusion with “sour tea (ST; *Hibiscus sabdariffa*)”. The patients were divided into BT and ST groups randomly and instructed to consume BT and ST infusions twice daily

for one month which was then evaluated at a period of 15-day difference. The results of their study revealed a considerable decrease in the mean systolic pressure followed by 1 month of administration. This implies that ST infusion intake has a favorable influence on the blood pressure of patients having type II diabetes who have moderate hypertension levels [9].

Another recent clinical trial conducted by McKay *et al.* involved a total of sixty-five pre-hypertensive and adults aged 30 to 70 years having mild hypertension who were not consuming treatments to lower the blood pressure were given either i) 3× 240 mL servings of “hibiscus tea” or a “placebo” every day for six weeks. At baseline and every week, the measurement of blood pressure was performed using a standard technique. The results of their study revealed that hibiscus tea reduced systolic blood pressure at six weeks [10].

Herrera-Arellano *et al.* investigated individuals of the 25-61 years of age group with both sex males as well as females daily treated for 28 days with 10 mg of Lisinopril, dried extracts of “*H. sabdariffa calyxes (HsHMP)*”, 250mg of total anthocyanins. The results of their study demonstrated that there was 100% of safety and tolerability in the experimental group with therapeutic efficacy of 65.12% as the BP reduced from 146 to 129 mm Hg [11].

Serban *et al.* conducted a thorough literature search and analysis of the relevant RCTs to determine whether *H. sabdariffa* could have anti-hypertensive properties. *H. sabdariffa* supplement showed a substantial reduction in both SBP, as revealed by the fixed-effect meta-regression [12].

Majid Jalalyazdi examined the anti-hypertensive effects of “sour tea”, on hypertension in stage one. Hypertension of stage I in the participant subjects was confirmed by a cardiology expert. The participants were separated into a total of two groups. For one month, the case group was given two standard cups each morning and the other one is given a placebo. Both groups saw a substantial drop in systolic blood pressure, while the case group experienced a considerably greater mean drop in both SBP and DBP [13].

3.3. Animal Models

Onyenekwe *et al.* evaluated the LD50 of the extracts from roselle calyx and its effects on hypertension. They found that over 5000 mg kg-1 was LD50. The study revealed that in spontaneously normotensive and hypertensive Wistar-Kyoto rats, the infusion was

shown to considerably ($p < 0.05$) reduce both SBP and DBP at evaluated dosages of 500 and the second 1000 mg/kg-1 body weight. They also found that weight was favorably connected with the drop in blood pressure for both groups [14].

Ugwu *et al.* hypothesized that anthocyanins might reduce salt-induced hypertension in rats by inhibiting renin-angiotensin-aldosterone system components (RAAS). The rats were given 8% sodium chloride in their diet for a total of 6 weeks to develop hypertension. The results of their study revealed that anthocyanins lowered heart rate and blood pressure in hypertensive. The drop in blood pressure caused by anthocyanins was related to a decrease in plasma aldosterone and serum ACE in hypertensive rats [15].

4. DISCUSSION

At least 45% of deaths from cardiovascular disease and 51% of deaths from stroke are caused by hypertension. The concern of renal failure, stroke, heart disease, early mortality, and disability is increased in part by hypertension. Long-term untreated hypertension can result in significant problems, most of which will require expensive interventions to be resolved and managed. These treatments, which are expensive for both individuals and governments, reportedly include carotid artery surgery, cardiac bypass surgery, and dialysis.

A range of drug routines have also been proven to show positive effects in reducing blood pressure, however, the negative consequences of long-term use of such drugs are apparent. Scientists have been focusing on examining the effects of various herbal compounds and products on treating hypertension, as per a current trend in the utilization of traditional and herbal treatments. According to recent studies reviewed, hibiscus (*H. sabdariffa*) tea can decrease blood pressure just as effectively as some common anti-hypertensive treatments. The basic mechanism of action of *H. sabdariffa* is provided in Figure 5 below.

According to the results of the current clinical investigation, sour tea can reduce blood pressure in hypertension patients. After a month, the blood pressure in the control case also dropped, which may have been a result of non-medical recommendations including losing weight, following the DASH diet, boosting potassium and decreasing salt intake, as well as engaging in aerobic activity. The primary disadvantage to the concept of using *H. sabdariffa* as an agent to lower blood

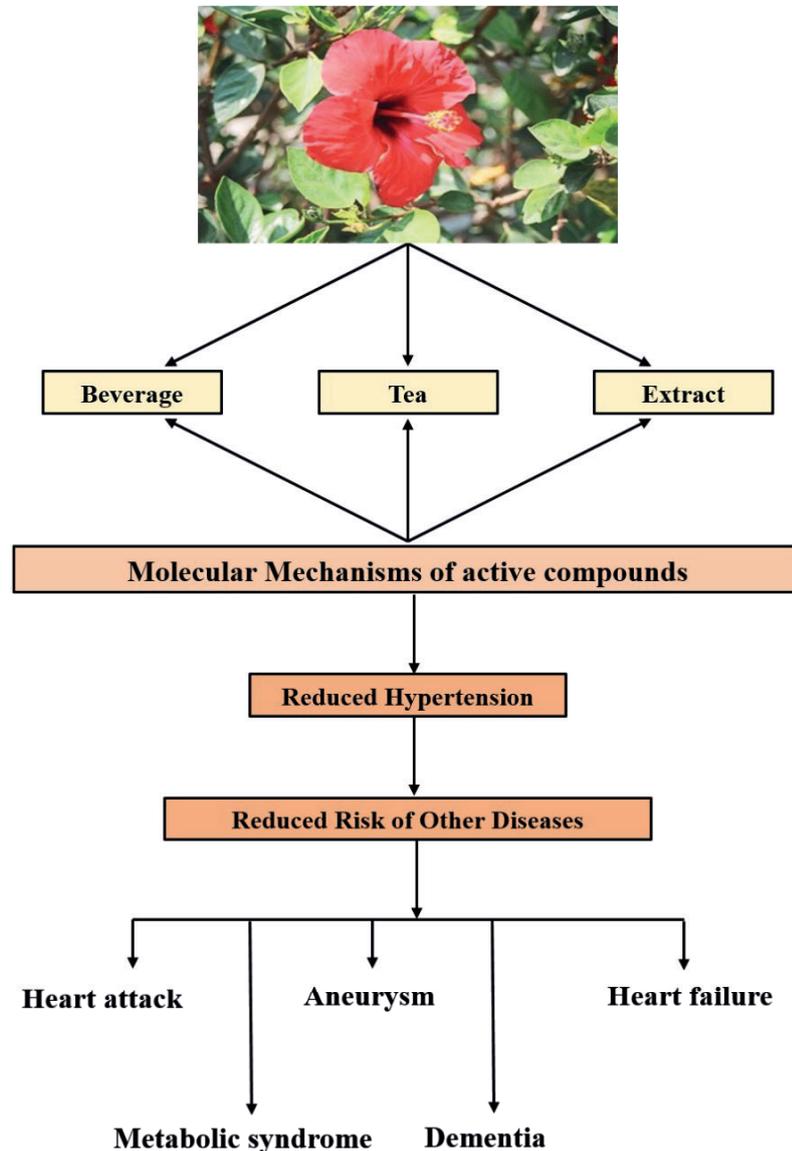


Figure 5: Illustrating the Basic Representation of Hibiscus sabdariffa use for Reducing Hypertension Governed by Different Mechanisms of Action of Active compounds.

pressure. It has been found that different therapeutic doses can produce positive effects on sour tea. One of the earliest investigations on how *H. sabdariffa* affects blood pressure was carried out by Haji Faraji et al [5].

Apart from the encouraging results of *H. sabdariffa* in risk modulation, Factors related to metabolic syndrome, as well as its safety and toxicological implications, must be considered. There are several products available on the market that include Hibiscus sabdariffa, which can contribute to up to half of the total composition and is widely used as a core compound of herbal tea. “Roselle” tea is a popular dietary product in several regions of the world, with the assumption that it is healthy and natural, with some possible health advantages. Yet, due to the risk of the botanicals reacting with the synthetic treatments, the natural substance

could not be suitable for medicated patients or susceptible populations (pregnant women and children).

Medicinal Herb and Synthetic drug interactions happen when the pharmacokinetic profiles of one or both products are dramatically changed by their co-administration, which causes a rise in adverse effects, cytotoxicity, or therapeutic failure. Hydrochlorothiazide, diclofenac, acetaminophen, and were eliminated less often after taking water extracts of *H. sabdariffa*. Johnson et al., however, found that the inhibition activity of roselle extract on cytochrome P450 might not always result in substantial medicinal herb and synthetic drug interactions in their in vitro studies. The appropriate use of different extracts of Hibiscus sabdariffa while taking other medicines also calls for more clinical research in this area [16].

The low level of the toxic effect of *H. sabdariffa* was documented in a few pre-clinical trials. According to Akindahunsi and Olaleye, a healthy dosage level is between 150 and 180 mg/kg per day. They also found that using a greater amount over an extended period can damage the liver, whereas a smaller dose has a less severe effect. According to their research, 15 doses of 250 mg/kg extract drastically increased the levels of aspartate “aminotransferase (AST)”, “alanine aminotransferase (ALT)”, and “albumin” in the serum of Wistar albino rats [17].

5. CONCLUSION

Hibiscus is safe and, unlike the other blood-pressure medications, has few adverse effects. The majority of the studies found in the literature by the reviewers have been either underpowered or inconclusive. All of these findings suggest that larger samples be used in future research to correctly determine the effects of “*H. sabdariffa*” on the blood pressure of individuals having hypertension. In addition to that there are also toxicological and safety issues concerning the use of “*Hibiscus sabdariffa*” for the treatment of a variety of ailments particularly when it comes to the treatment of hypertension which is now becoming an increasing burden on global health. Therefore, more detailed studies addressing the safety and toxicity are required before incorporating Phyto-based medication in treatment.

References

1. B. M. Egan, S. E. Kjeldsen, G. Grassi, M. Esler, and G. Mancia, “The global burden of hypertension exceeds 1.4 billion people: Should a systolic blood pressure target below 130 become the universal standard?” *Journal of Hypertension*, vol. 37, no. 6, pp. 1148–1153, 2019. doi: 10.1097/HJH.0000000000002021.
2. J. J. Bigna et al., “Global burden of hypertension among people living with HIV in the era of increased life expectancy: A systematic review and meta-analysis,” *Journal of Hypertension*, vol. 38, no. 9, pp. 1659–1668, 2020. doi: 10.1097/HJH.0000000000002446.
3. G. Musunguzi, S. Anthierens, F. Nuwaha, J. P. Van Geertruyden, R. K. Wanyenze, and H. Bastiaens, “Factors Influencing Compliance and Health Seeking Behaviour for Hypertension in Mukono and Buikwe in Uganda: A Qualitative Study,” *Int. J. Hypertens.*, vol. 2018, 2018, doi: 10.1155/2018/8307591.
4. R. Gupta, K. Gaur, and C. V. S. Ram, “Emerging trends in hypertension epidemiology in India,”

Journal of Human Hypertension, vol. 33, no. 8, pp. 575–587, 2019. doi: 10.1038/s41371-018-0117-3.

5. M. Haji Faraji and A. H. Haji Tarkhani, “The effect of sour tea (*Hibiscus sabdariffa*) on essential hypertension,” *J. Ethnopharmacol.*, vol. 65, no. 3, pp. 231–236, 1999, doi: 10.1016/S0378-8741(98)00157-3.
6. I. Da-Costa-Rocha, B. Bonnlaender, H. Sievers, I. Pischel, and M. Heinrich, “*Hibiscus sabdariffa* L. - A phytochemical and pharmacological review,” *Food Chemistry*, vol. 165, pp. 424–443, 2014. doi: 10.1016/j.foodchem.2014.05.002.
7. R. J. Walton, D. L. Whitten, and J. A. Hawrelak, “The efficacy of *Hibiscus sabdariffa* (rosella) in essential hypertension: A systematic review of clinical trials,” *Aust. J. Herb. Med.*, vol. 28, no. 2, pp. 48–51, 2016.
8. I. Da-Costa-Rocha, B. Bonnlaender, H. Sievers, I. Pischel, and M. Heinrich, “*Hibiscus sabdariffa* L. - A phytochemical and pharmacological review,” *Food Chem.*, vol. 165, no. 2, pp. 424–443, Dec. 2014, doi: 10.1016/j.foodchem.2014.05.002.
9. H. Mozaffari-Khosravi, B. A. Jalali-Khanabadi, M. Afkhami-Ardekani, F. Fatehi, and M. Noori-Shadkam, “The effects of sour tea (*Hibiscus sabdariffa*) on hypertension in patients with type II diabetes,” *J. Hum. Hypertens.*, vol. 23, no. 1, pp. 48–54, 2009, doi: 10.1038/jhh.2008.100.
10. D. L. McKay, C. Y. O. Chen, E. Saltzman, and J. B. Blumberg, “*Hibiscus Sabdariffa* L. tea (tisane) lowers blood pressure in prehypertensive and mildly hypertensive adults,” *J. Nutr.*, vol. 140, issue. 2, pp. 298–303 2010, doi: 10.3945/jn.109.115097.
11. A. Herrera-Arellano et al., “Clinical effects produced by a standardized herbal medicinal product of *Hibiscus sabdariffa* on patients with hypertension. A randomized, double-blind, lisinopril-controlled clinical trial,” *Planta Med.*, vol. 73, no. 1, pp. 6–12, 2007, doi: 10.1055/s-2006-957065.
12. C. Serban, A. Sahebkar, S. Ursoniu, F. Andrica, and M. Banach, “Effect of sour tea (*Hibiscus sabdariffa* L.) on arterial hypertension: A systematic review and meta-analysis of randomized controlled trials,” *J. Hypertens.*, vol. 33, no. 6, pp. 1119–1127, 2015, doi: 10.1097/HJH.0000000000000585.
13. M. Jalalyazdi, J. Ramezani, A. Izadi-Moud, F. Madani-Sani, S. Shahlaei, and S. Ghiasi, “Effect of *hibiscus sabdariffa* on blood pressure in patients with stage 1 hypertension,” *J. Adv. Pharm. Technol. Res.*, vol. 10, no. 3, pp. 107–111, 2019, doi: 10.4103/japtr.JAPTR_402_18.

14. P. C. Onyenekwe, E. O. Ajani, D. A. Ameh, and K. S. Gamaniel, "Antihypertensive effect of roselle (*Hibiscus sabdariffa*) calyx infusion in spontaneously hypertensive rats and a comparison of its toxicity with that in Wistar rats," *Cell Biochem. Funct.*, vol. 17, no. 3, pp. 199–206, 1999, doi: 10.1002/(SICI)1099-0844(199909)17:3 < 199::AID-CBF829 > 3.0.CO;2-2.
15. P. Ugwu, R. Ubom, P. Madueke, P. Okorie, and D. Nwachukwu, "Anti-Hypertensive Effects of Anthocyanins from *Hibiscus sabdariffa* Calyx on the Renin-Angiotensin-Aldosterone System in Wistar Rats," *Niger. J. Physiol. Sci.*, vol. 37, no. 1, pp. 113–117, Jun. 2022, doi: 10.54548/njps.v37i1.14.
16. S. S. Johnson, F. T. Oyelola, T. Ari, and H. Juho, "In vitro inhibitory activities of the extract of *Hibiscus sabdariffa* L. (family Malvaceae) on selected cytochrome P450 isoforms," *African J. Tradit. Complement. Altern. Med. AJTCAM*, vol. 10, no. 3, pp. 533–540, 2013, doi: 10.4314/ajtcam.v10i3.22.
17. A. A. Akindahunsi and M. T. Olaleye, "Toxicological investigation of aqueous-methanolic extract of the calyces of *Hibiscus sabdariffa* L.," *J. Ethnopharmacol.*, vol. 89, no. 1, pp. 161–164, 2003, doi: 10.1016/S0378-8741(03)00276-9.