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Hibiscus Tea and its Therapeutic Potential in Weight Reduction: Integrative Review

Chá de Hibiscus e seu Potencial Terapêutico na Redução de Peso: Revisão Integrativa

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Abstract

The calyx of the Hibiscus plant are used in the form of an infusion in popular medicine with the purpose of contributing to the weight loss of its users. Therefore, the objective of this work was to verify in the literature the therapeutic potential of *Hibiscus sabdariffa* tea for weight loss. This is an integrative review done in the following databases: Scopus, PubMed, Science Direct, Web of Science. The final sample consisted of 6 articles. Half of the selected articles had the clear objective of evaluating weight loss, the others evaluated anti-metabolic and anti-stress properties, obesity-related adipogenesis and control of lipid indicators. In the selected studies, the most used part of the plant was the calyx, being fresh and dry. Factors such as the concentration and form of supply of the *Hibiscus sabdariffa* extract seem to be points to be taken into account in experiments that have food intake as an influence on the other variables. The studies brought evidence that *Hibiscus sabdariffa* extracts contribute to weight loss and to the suppression of weight gain in human and animal groups with metabolic disorders, without change for the healthy human/animal group. However, studies on the long-term maintenance of weight loss, once achieved, the efficacy and safety of its use, are still insufficient according to the collected evidence.

Keywords: Weight Loss. Hibiscus. Tea.

Resumo

Os cálices da planta Hibiscus são utilizados na forma de infusão na medicina popular com o propósito de contribuir na perda ponderal de seus usuários. Diante disto, o trabalho teve como objetivo verificar na literatura o potencial terapêutico do chá de Hibiscus sabdariffa para a perda ponderal. Trata-se de uma revisão integrativa realizada nas bases: Scopus, PubMed, Science Direct, Web of Science. A amostra final foi formada por 6 artigos. Metade dos artigos selecionados tinham como objetivo claro avaliar a perda de peso, os demais avaliavam as propriedades antimetabólicas e antiestresse, adipogênese relacionada à obesidade e controle dos indicadores lipídicos. Nos estudos selecionados, a parte da planta mais utilizada foi o cálice, sendo eles frescos e secos. Fatores como a concentração e a forma de fornecimento do extrato do Hibiscus sabdariffa parecem ser pontos a serem levados em consideração em experimentos que tenham a ingestão alimentar como influência sobre as demais variáveis. Os estudos trouxeram evidencias de que os extratos de Hibiscus sabdariffa contribuem para a perda de peso e para a supressão do ganho de peso em grupos humanos e animais com disfunções metabólicas, sem alteração para o grupo de humanos/animais saudáveis. No entanto, estudos sobre a manutenção a longo prazo da perda de peso, uma vez alcançada, a eficácia e segurança de seu uso, ainda são insuficientes de acordo com as evidências coletadas.

Palavras-chave: *Redução de Peso. Hibiscus. Chá.*

1 Introduction

Hibiscus sabdariffa is a plant originating from South and Southeast Asia and North Africa.[1] It is set in subtropical and tropical climate, it contains stems that branch from the base whose development is perenifolium and is presented in three different classes: green, red and dark red, of which red is the most explored.[2]

The active potential of medicinal plants is due to chemical substances belonging to the classes of terpenes, phenolic and nitrogenous compounds that are secondary metabolites produced by the plant organism.[3] The molecules studied were generated as a consequence of plant adaptability to the environment as a defense mechanism against pathogens and predators.[4]

These chemical compounds metabolized secondarily by plants may have different actions in the biological system, thus justifying the interest in these substances and their interaction, for example, with the genetic material.[5]

Therefore, the Hibiscus plant is usually known as Hibiscus Flower, and it is known that as in other cultures, its chalices are used as a substrate for its wide consumption in the form of infusion in folk medicine.[6]

The aqueous extract made from the chalice contains predominantly anthocyanins responsible for the pigment of the vegetable and metabolite derivatives such as flavonoids and polyphenols, among other less relevant bioactive compounds.[7] Therefore, the main benefits of Hibiscus, such as: antioxidant action, anti-inflammatory, impacts on

metabolic disorders, obesity, dyslipidemia, liver diseases and insulin resistance are due to these compounds.[8]

Based on the facts explained above, this work aims to verify in the literature the therapeutical potential of the tea *Hibiscus sabdariffa* which contribute to the ponderal loss.

2 Material and Methods

This study is an integrative review of the literature, with a rigorous method for establishing defined criteria on the question of research, sampling and data collection, analysis and presentation of the results based on a previously developed research protocol. The purpose is to gather and synthesize results of primary studies on the subject and research question.

2.1 Guide Question

The review was organized following the following steps: identification of the problem and guiding question; search in the literature using inclusion and exclusion criteria; data collection through a previously prepared form; data analysis and presentation of information.[9.10]

The guiding question was: Does the use of Hibiscus sabdariffa contribute to weight loss?

2.2 Search strategy and descriptors

The search, in the databases, was carried out in March and April 2022 through the use of the proxy licensed by the Universidade Anhanguera Uniderp through the Coordenação de Aperfeiçoamento de Pessoal de Nível Superior - Capes[1], accessed via the Portal de Periódicos da Capes[2] in the following databases: SCOPUS (Elsevier), PubMed Central – PMC, Science Direct (Elsevier), Web of Science –Main Collection.

For the search in the databases, the indexed descriptors and their respective synonymies were used in the Medical Subject Headings (MeSH):

1# ("Hibiscus sabdariffa")

2# ("Weight Loss" OR "Loss, Weight" OR "Losses, Weight" OR "Reduction, Weight" OR "Reductions, Weight" OR "Weight Losses" OR "Weight Reduction" OR "Weight Reductions")

The synonymies were used in order to identify as many publications related to the subject addressed as possible. There was only one intersection with the use of AND operator, namely: 1# AND 2#.

2.3 Selection, inclusion criteria and data extraction

The inclusion criteria were complete articles available in full in databases and articles that address *Hibiscus sabdariffa* and weight loss. Editorials, letters to the editor, abstracts, expert opinion, other reviews, correspondence, reviews, book chapters, theses and dissertations. Duplicate articles were considered only once. Time frame was not established with the objective of exploring as much as possible of publications on the subject studied.

The pre-selection was through the reading of the titles and application of the inclusion and exclusion criteria. Then, the full reading of the texts that were selected to compose the sample was performed.

In the data analysis and extraction, an instrument was elaborated with the following data: identification of the publication (article title, indexed databases, authors, country, language and year of publication), name of the scientific journal, methodological aspects of the study (method employed, type of approach and objective or research question of the study), risk factors, limitations and conclusions.

2.4 Methodological evaluation of the studies

To critically evaluate the studies, it was identified the classification of the type of evidence of the research from the reference of the Collaborator Center of the Joanna Briggs Institute (JBI), which classifies the evidence according to the methodological design of the studies (Level I - evidence obtained from a systematic review of randomized controlled trials; Level II - evidence obtained from a randomized controlled trial; Level III.1 - evidence obtained from well-delineated controlled clinical trials without randomization; Level III.2 - Evidence obtained from well-designed cohort studies or case-control studies; Level III.3 - Evidence obtained from multiple time series, with or without intervention and dramatic results in uncontrolled experiments and Level IV - opinions of respected authorities based on clinical criteria and experience, descriptive studies or reports from expert committees.[11]

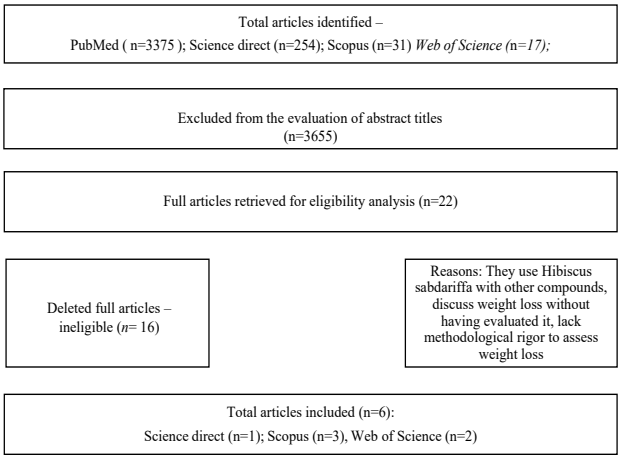
2.5 Search results

The bibliographic search resulted in 254 studies in the Science Direct database, 31 in Scopus, 17 Web of Science, and 3375 in PubMed, totaling 3677 publications. After completing the first level of eligibility analysis, from the previous reading of all titles and abstracts, 22 articles were selected for full reading. After the final refinement of the search, the *corpus* of the review was composed of six articles. The details of the steps taken to select the articles were presented in a descriptive way in Figure 1.

1 http://www.capes.gov.br

2 http://www-periodicos-capes-gov-br.ez18.periodicos.capes.gov.br/

Figure 1 - Flowchart of the methodological steps for the construction of the corpus of the review, according to the PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) guidelines



Source: the authors.

3 Results and Discussion

The studies were distributed according to the country of realization, year of publication, language, journal, type of approach and level of evidence (Table 1).

Table 1 - Distribution of studies according to the country, year and language of publication, journal, methodology used, type of approach and level of evidence

Variables	Attendance	%
Country of study		
Mexico	2	33.33%
Indonesia	1	16.67%
Thailand	1	16.67%
China	1	16.67%
Malaysia	1	16.67%
Total	6	100.00%
Publication year		
2007	1	16.67%
2009	1	16.67%
2020	1	16.67%
2021	1	16.67%
2011	1	16.67%
2018	1	16.67%
Total	6	100%
Publication Idiom		
English	6	100%
Total	6	100%
Journal		
Journal of Ethnopharmacology	1	16.67%
Journal of Biomedicine and Biotechnology	1	16.67%
Evidence-Based Complementary and Alternative Medicine	1	16.67%
Biomedicine & Pharmacotherapy	1	16.67%
Journal of Agricultural and Food Chemistry	1	16.67%
Functional Foods in Health and Disease	1	16.67%
Total	6	100%
Approach		
Quantitative	6	100%
	6	100%
Level of evidence		
II - Evidence obtained in individual studies with experimental design	5	66.67%
III - Evidence of quasi-experimental studies	1	33.33%
Total	6	100%

Source: the authors

The selected articles were all published in English, in a variety of international journals, between the years 2007 and 2018, 50% of the last five years and 50% published between five and 15 years. In recent years, the focus on plant research has increased around the world to discover the immense potential of medicinal plants used in various traditional systems.[12]

The first reports of the use of *Hibiscus sabdariffa* (*HS*) found in the theoretical framework of the recovered literature are for the treatment of hypertension.[13.14] However, studies evaluating its use as an antidiabetic herbal medicine, anti-obesity, anti-stress, control of anti-ethanol properties, prevention in the control of insulin resistance and control of lipid profile have been increasing in recent years, as it can be observed in recent studies recovered in this search.

Regarding the institution of origin of the authors, three are linked to universities, two to institutes and only one study does not characterize institutional bond. Regarding the country of origin of the publication, 33.3% were made in Mexico, and the others were distributed equally in Indonesia, Thailand, China and Malaysia.

The concentration of works in these regions can be explained by the territorial distribution of the plant. *HS* is available in China, Thailand, Sudan, Mexico and some other countries with smaller suppliers.[15] The authors also portray that the quality of hibiscus depends heavily on geographical origin, the most desirable product being that of Thailand and Sudan, however, the main suppliers worldwide are China and Thailand. This justifies the fact that the studies found focus on regions where *HS* is more available, demonstrating still little scope/dimension of research with the potential of *HS* for medicinal purposes in other parts of the world.

As for the level of evidence, which takes into account the methodological design[16], four articles were classified as level II and two as level III. 1 because it is a non-randomized research. The identification of the level of evidence provides subsidies for a critical evaluation of research results and, therefore, to subsidize the making of better clinical decisions.[17] Thus, 66.7% of the studies that make up this review present strong evidence strength and only 33.3% present moderate evidence strength.

Regarding the study drawings, it is possible to observe that in all of them the experimental samples were *in vivo*, and 83.3% used rats/mice and only 16.6% used people and the

duration of the studies ranged from 21 to 70 days.

The advances reported in scientific studies allow the potential of *HS* to be divided into three lines: therapeutic effect on lipid metabolism; antihypertensive effect; apoptotic effects on gastric carcinoma cells.[18] With this, in order to present the results of this review in a synoptic format, Table 2 was elaborated which emphasizes relevant information from the selected studies.

Table 2 - Synthesis of the studies evaluated for the objectives and main results

Studies	Author (year)	Type of Study (NE)*	Objectives	Main results
1	Alacon-Aguilar et al. (2007)	II	To determine whether a standardized aqueous extract of *Hibiscus sabdariffa* has an effect on body weight in an obese animal model induced by the administration of monosodium glutamate to mice	*Hibiscus sabdariffa* (HS) extract significantly suppressed body weight gain from the 7th week in mice with induced obesity, with no effect on the healthy control subgroup (P>0.05). Treatment with HS reduced food intake in healthy mice and mice induced obesity, without differences compared to the respective control group.
2	Carvajal-Zarrabal et al. (2009)	II	The aim of the present study was to investigate the action of the calyx of Hibiscus *sabdariffa cup extract* on fat absorption, excretion and body weight, since no information regarding these aspects of lipid metabolism was found.	No significant differences were observed between the experimental groups that consumed *Hibiscus sabdariffa extract* (EHS) and body weight control; however, body weight gain in the groups that consumed 10 and 15 g of EHS was significantly lower (P< 0.01) than in the control group. Food consumption in the experimental group that consumed 15 g of EHS decreased (P<0.05).
3	Yushi & Meutia (2020)	III.1	We assume that the hibiscus has not only anti-metabolic properties, but also anti-stress effects. Hibiscus is probably developed as a herbal medicine that has an impact on improving the economy of the Indonesian people.	There was a significant decrease in body weight (CP) (p=0.021), total cholesterol (CT) (p=0.001), triglycerides (TGs) (p=0.014), high-density lipoprotein (HDL) (p=0.001) and low-density lipoprotein (LDL) (p=0.010) after using the hibiscus.
4	Janson et al. (2021)	II	The focus of our study investigated the protective effects of hibiscus extract on the mechanism of adipogenesis to prevent complications of obesity-related insulin resistance in obese rats induced by a high-fat diet.	The results showed that the hibiscus had the potential to reduce body weight, food intake, lipid profiles, lipid peroxidation, insulin and duodenal glucose uptake, while significantly increased the uptake of glucose from adipose and muscle tissue when compared to the group with a hyper-lipid diet. Hibiscus can prevent lipid accumulation.
5	Chiung-Huei et al. (2011)	III.1	To analyze the composition of Hibiscus *Sabdariffa Polyphenolic Extract* (EPH) and to observe whether EPH could cause changes in serum insulin, glucose, lipid profile, oxidative stress and biomarkers characteristic of AGE/RAGE and CTGF, therefore, prevent or reduce diabetic injury.	The polyphenolic extract of *Hibiscus sabdariffa* (EPH) has an in vivo hypoglycemic capacity, with ant insulin-resistant potential. Treatment with EPH reduced the plasma level of triglycerides and cholesterol. EPH has an antioxidant capacity. EPH has a weight balancing ability. However, treatment with EPH prevented weight loss, and lost weight was recovered after 14 weeks. With EPH, the experimental animals with type 2 diabetes recovered weight, implying a recovery of metabolic balance.
6	Omar et al. (2018)	II	To investigate the effects of Hibiscus *sabdariffa* aqueous extract (HS) in different doses as a possible reducing agent in diet-induced obese rats and their toxicological effects.	The aqueous extract of *Hibiscus sabdariffa* (HS) is a rich source of anthocyanins. The extract also has high antioxidant properties that can be caused by these anthocyanins. The anti-obesity effect of the aqueous extract of HS was demonstrated by a significant reduction in weight gain and abdominal weight (p<0.05) between the treated and untreated groups, which was dose-dependent. The study showed that oral administration of HS for ten weeks did not cause any toxicity effect in obese rats.

*NE= Level of Evidence - Classification of the type of evidence from the research based on the reference of the Collaborating Center of the Joanna Briggs Institute (JBI), where, II= evidence obtained from a randomized controlled clinical trial; III. 1- Evidence obtained from well-delineated controlled clinical trials, without randomization.

Source: Search data.

It is known that medicinal plants are well used as a therapeutic resource for the treatment of various pathologies.[19]The information available on *H. sabdariffa* shows a wide range of traditional and potentially new health applications and therapeutic targets associated with such uses. Of the six studies, three have as clear objective to evaluate weight loss, the others evaluate as central point the effect on anti-ethanol and anti-stress properties[20], adipogenesis to

prevent complications of insulin resistance related to obesity[21] and control of lipid profile indicators[22].

In the selected studies, the most used part of the plant was the calyx, being fresh and dry. In terms of extraction, studies 1, 3, 4 and 6 used aqueous extract of *HS*, while study 2 used an ethanolic extract and study 5 used a polyphenolic extract. *In general, HS preparations,* particularly *HS tea* and aqueous extracts, can be considered safe.[15] Study 6 corroborates with the above citation, because when using aqueous extract, it was verified safety in the use of this type of extract, without liver or renal alterations. However, despite these claims, Study 1 observed on the 15th and 45th day of evaluation, high values of alanine aminotransferase (ALT), which is indicative of tissue injury caused by toxic agents. The authors of study 5 stated that the use of polyphenolic extract of *HS* is safe*,* since it was not harmful to the liver and kidneys.

Study 1 was conducted with healthy and obese mice, the aqueous extract of *HS* was administered orally, with a dosage of 120mg/kg/day, for 60 days.[23] Among the variables analyzed in the study, the most important for this review is body weight gain, however the variables food and liquid intake, cholesterol and triglyceride levels may influence weight gain. There was no reduction in triglyceride and cholesterol levels due to the use of *HS,* however, there was a significant reduction in weight gain in obese animals from the seventh week ($p<0.05$), reduction in food intake ($p<0.05$) and increase in liquid intake ($p<0.05$) in both groups. The reduction in weight gain within the group of obese animals was 9.6% for those who took *HS extract* , without effects for the group of healthy animals. The mechanisms by which *HS* causes a reduction in body weight gain are not yet clear, but, the authors bring that this reduction in weight gain of obese animals may have been due to lower food intake.

Whereas, in study 2, 40 male Sprague-Dawley rats, aged 6 weeks, were used. These animals were divided into four groups, group 1 was fed with the basal diet and the other groups received the same diet supplemented with dry extract in HS ethanol at levels of 5% (group 2), 10% (group 3) and 15% (group 4) for four weeks. Body weight gain in groups 3 (+ 18g) and 4 (+ 6g) was significantly lower than in group 1 (+ 47g). Only group 2 showed no difference. According to the authors, the extracts of HS, in intermediate concentrations (10%) and higher (15%) used in this experiment, because they did not increase body weight, proved to be potential anti-obesity components.

However, the authors bring an important caveat, the significant decrease in food consumption in the 15% group, may be related to a problem of palatability of the diet, when the concentration was increased. In their study they also observed a decrease in consumption when animals received *HS extract.*[23] However, in Study 1, although the concentration provided was the same as that of this treatment in question (15%), the mode of supply was different, one was aqueous extract (Study 1) and the other was dry extract (Study 2).

Thus, factors such as the concentration and form of supply of the extract seem to be points to be taken into account in experiments that have food intake as an influence on the other variables. However, they suggest that the validation of their findings requires further studies.

In study 3, 18 elderly women with metabolic syndrome (with high blood pressure and high blood glucose and dyslipidemia (high cholesterol or triglycerides) were randomly separated into two groups. The treatment was *HS tea* at a dose of 2g, twice a day. The authors bring that there were significant reductions (p*HS*, with a reduction of 0.87kg at the end of the 21 days of evaluation. In addition to reductions in total cholesterol, triglycerides, high-density lipoprotein (HDL), low-density lipoprotein (LDL). However, this study does not conclude about weight loss, only that a potential HS-based asset can be developed as an anti-obesity, antihypertensive, antidyslipidemic and others drug.

Metabolic syndrome has been characterized as a combination of several metabolic risk factors such as hypertension, insulin resistance, dyslipidemia, excess adipose tissue and cardiovascular disease.[15] Robust, randomized and controlled clinical trials with well-characterized HS preparations are important to corroborate the beneficial effects in pre- and slightly hypertensive patients.

Study 4 was developed with 28 male Sprague Dawley rats which were divided into four groups: control (C), fed with a standard commercial diet; the hyper-lipid diet (HL) fed with a high-fat diet;the HL diet supplemented with 250 mg/kg.pc of *HS*(HLR250); and the HL diet supplemented with 500 mg/kg.pc of *HS* (HLR500). The experimental period was 8 weeks. The results showed that *HS* had the potential to reduce the body weight of animals that consumed a HL diet. And when comparing the group that consumed a HL diet with groups HLR250 and HLR500, a significant reduction in weight was observed in the animals that consumed *HS.*

As with Study 2, Study 4 does not conclude about the effect of *HS* on body weight suppression of tested animals. The conclusion revolves around the decrease in lipid accumulation, improves insulin sensitivity and resistance.

In Study 5, 64 male Sprague Dawley rats were evaluated for 14 weeks. The rats were divided into eight groups with different diets, namely: control group (normal diet); group EPH200 (normal diet with 200 mg/kg of polyphenolic hibiscus extract (EPH) added); group HL (hyper-lipid diet); group HL EPH100 (hyper-lipid diet with 100 mg/kg EPH added); group HL + EPH200 (hyper lipidic diet with 200 mg/kg HPE added); group HL + Diabetes, HL + Diabetes |+ EPH100; and group HL + Diabetes EPH2 In this study, diabetic rats of all groups lost weight after a few weeks. The authors point out that this is a common behavior in clinical findings among type 2 diabetic patients, represented by an imbalance in energy expenditure caused by impairment of insulin function. On

the other hand, diabetic animals that consumed a HL + EPH diet (100 or 200) recovered the weight lost in the subsequent weeks, implying a recovery of metabolic balance.

In their findings, the authors reported that molecular mechanisms by which *HS extract* works to prevent insulin resistance related to obesity and diabetes remain poorly understood.[21]

There is a similarity between the results obtained between studies 1 and 5, where only animals with obesity and diabetes, respectively, had the effect of HS-based treatments on body weight gain. Studies about the influence of *HS* on groups of animals with metabolic disorders should be done in order to identify the actions that lead to such results, in order to later evolve to treatment in humans.

Study 6 was conducted for 10 weeks with 24 male Sprague Dawley rats divided into six groups: Normal group (GN) fed with commercial diet; Control obese group (GOBC) that received a hyper-lipid diet, and obese groups 1, 2 3, and 4 who received a hyper-lipid diet with inclusion of 150, 200, 250 and 300 mg/kg *of HS*, respectively.[24] The authors point out that the higher *the HS dose* the lower was of the weight gain among rats in groups 1, 2, 3 and 4, that is, *the HS* suppressed weight gain in obese rats. By observing weight gain among all treatments, it was possible to verify that group 4 (300 mg/kg *of HS*) presented the lowest weight gain. Findings in study 2 corroborate with this study, where, the higher the concentration of HS extract used, the lower the weight gain in the animals.

4 Conclusion

The present review sought to investigate scientific evidence related to the use of *Hibiscus sabdariffa* and weight loss. The studies brought evidence that *Hibiscus sabdariffa* extracts contribute to weight loss and to the suppression of weight gain in human and animal groups with metabolic disorders, without change for the healthy human/animal group.

Hibiscus sabdariffa is presented as an alternative in the treatment of obesity , however studies on the long-term maintenance of weight loss, once achieved, the efficacy and safety of its use, are still insufficient according to the collected evidence.

Among *the parts of the Hibiscus flower* the morphological part used was the chalice, without explanation of why the use of this specific part, which is considered a gap. Advances in the sample number, influence of metabolic dysfunctions, chemical composition, toxicology, standardization of the products used and methodological rigor of future studies are necessary to realize the therapeutic potential of *Hibiscus sabdariffa.*

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