Proceedings of the International Conference on Nursing and Health Sciences, Volume 4 No 1, January - June 2023
e-ISSN 2774 – 5104, Global Health Science Group
http://jurnal.globalhealthsciencegroup.com/index.php/PICNHS

A SCOPING REVIEW: CATECHIN-RICH GAMBIR AS A POTENTIAL FUNCTIONAL FOR THE OBESITY MANAGEMENT

Meintansari Manik[1]*, Setyo Sri Rahardjo[2], Ratih Puspita Febrinasari[2]
[1]Clinical Nutrition Department, Nutrition Sciences of Postgraduate Program, Universitas Sebelas Maret, Jl. Ir. Sutami 36A, Surakarta, Central Java 57126, Indonesia
[2]Department of Pharmacology, Faculty of Medicine, Universitas Sebelas Maret, Jl. Ir. Sutami 36A, Surakarta, Central Java 57126, Indonesia
*meyntansari@gmail.com

ABSTRACT

Obesity is a complex and severe problem whose prevalence has increased significantly in the last few decades, posing a significant risk to human health. Various weight loss strategies are currently used, and different weight loss supplements are widely available. However, the effectiveness of some of these food supplements is still unknown. Thus, alternative therapy with a pharmaconutrition macronutrient approach is needed. A scoping review is necessary to scope the current article, summarize the scientific data, and guide future investigation into the potential use of catechin-rich gambir for obesity management. Results: Four databases were searched systematically. The scoping review covered articles published after 2013. A total of 251 articles were collected, and five studies (2 experimental studies) met the inclusion criteria. The synthesis results show that catechin-rich gambir has the potential a function in obesity management therapy. This mechanism, through the anti-obesity effect of catechins, is related to the uptake and synthesis of adipose tissue in obese individuals. Conclusions: Available evidence recommends that the catechin content in gambir has the potential for pharmaconutrition therapy for obesity management.

Keywords: catechin; gambir; obesity

INTRODUCTION

Obesity is an abnormal fat buildup from unbalanced energy levels (Fontenelle et al., 2022). It represents a disease with severe effects on public health due to its associated morbidities and epidemic proportions (Ghanemi et al., 2018). The interaction of several complex factors causes obesity, a worldwide epidemic still not fully understood (Narciso et al., 2019). According to the World Obesity Federation, the proportion of the global population with obesity over 5 years is 38% in 2023 and is expected to rise to 51% by 2035. Obesity is expected to affect nearly half of all adults (49%) in the Americas by 2035, 39% in Europe, and 11% in Southeast Asia (World Obesity Federation, 2023). The cause of obesity is an energy imbalance, or more specifically, a positive energy balance (Hall et al., 2022). An imbalance between energy consumed and energy expended will disrupt the energy homeostasis system (Galán et al., 2021; Huai et al., 2022). Ultimately, This detailed mechanism results from excess weight (Ghanemi et al., 2018). Obesity causes weight gain and an increase in energy stores in the form of fat (Gómez-Hernández et al., 2016). It is good if it stays within normal bounds and is a normal bodily process. But excessive buildup has a harmful effect. Fat deposits in the abdomen cause visceral fat to accumulate in the omentum, mesentery, liver, and pancreas (Montenegro Mendoza et al., 2022), resulting in detrimental effects for the organs involved. Excess energy intake in obesity is stored as triglycerides in adipose tissue (Arner & Langin, 2014). Triglyceride storage tends to increase in obese patients. It raises total cholesterol and low-density lipoprotein (C-LDL) while decreasing high-density lipoprotein (C-HDL) (Feingold, 2020).

Gambir is a Southeast Asian plant with many uses as an alternative medicine (Munggari et al., 2022). Gambir grows in the tropics and treats diarrhea, dysentery, and an astringent in Asia (Wibowo et al., 2021). The reference explains that fig has antioxidant, antidiabetic, antimicrobial, anti-cariogenic, and anthelmintic activities (Hilmi & Rahayu, 2018). Recent research demonstrates that gambir is rich in flavonoids such as catechin, which have antioxidants and anti-obesity properties (Yunarto et al., 2021). Catechins contained in gambir by 70-95% (Kemenkes RI, 2017). Catechins reduce blood cholesterol by inhibiting lipid absorption in the intestine and forming cholesterol micelles during digestion. Furthermore, catechins inhibit fat accumulation by suppressing fatty acid synthesis and increasing the liver's enzymatic activity in fatty acid oxidation. This results in visceral fat weight loss (Sugiura et al., 2012). To comprehend the entirety of this review, including intervention and their effects on various clinical outcomes connected to obesity, a scoping review is necessary. This review aimed to identify and assess the peer-reviewed scientific literature on catechin as a functional for obesity management.

METHOD

The review used Arksey and O'Malley's framework and five-step scoping review approach. The review is reported following PRISMA ScR (priority reporting item for systematic review and an extension for meta-analyses for scoping reviews) (Daudt et al., 2013). The included articles must be published after 2013, from any country worldwide, and investigate the potential use of catechin-rich gambir for obesity management. Articles were searched from several databases. The databases included were PubMed, PMC, Science Direct, and Google Scholar. The search strategy combines terms that include the keywords "(catechin OR -epicatechin (EC) OR EGCG) AND (Uncaria gambir OR gambir) AND (body weight OR obesity OR overweight OR adipocyte OR high-fat diet) AND (functional food OR pharmaceutical) AND (experimental study). This review used a scoping review design. The article will be accepted if it satisfies the following requirements: written in English, published in the last ten years (after 2013), full text, the study design is RCT, and related to scoping objectives.

RESULTS AND DISCUSSION

Evidence Sources

A total of 251 articles were located through the search after eliminating duplicates and screening the remaining titles and abstracts against the established inclusion and exclusion criteria. Two articles were left for full-text review. During the full-text review, 9 of 251 articles were removed due to duplication, leaving 242 articles. Another 231 articles that didn't fit the inclusion requirements were eliminated, leaving 11 for eligibility. Nine articles were eliminated because the findings did not support the study's objectives. The reference lists of the remaining papers were searched to find possibly relevant studies. The review contains two articles in total because no other research was found. The PRISMA flow diagram in Fig. 1 details the justifications for research exclusion.

Study and participant characteristics

The included papers used experiment study as the primary technique of data collecting. Subjects are culture cell type 2T2-L1 cells and in vitro unspecified cell culture. The articles from this scoping review that are included are from Indonesia. One study investigated enhanced adipocyte development in 3T3-L1 cells using PPAR, (+)-catechin of fraction Uncaria Gambir Roxb. One

investigation into the role of catechins fraction Uncaria Gambir Roxb in inhibiting alpha-glucosidase. The author of both papers came across was the same.

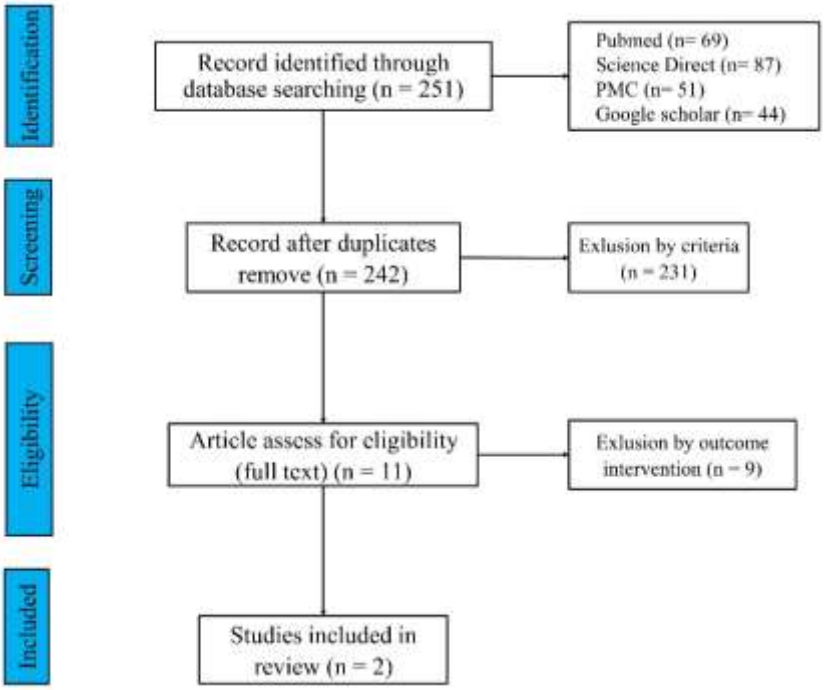

Figure 1. PRISMA flow chart.

Evidence finding

After screening many articles, the results of as many as two articles were included in the criteria that meet the requirements. The article investigates the effect of intervening catechins from various ingredients as pharma nutrition agents for obesity management. The results of the evidence findings are shown in Table 1.

Table 1.
Evidence finding

Source	Country	Title	Design	Results
(Arundita et al., 2020)	Indonesia	(+)-Catechin & Proanthocyanidin Fraction of Uncaria gambir Roxb. Improve Adipocytes Differentiation & Glucose Uptake of 3T3-L1 Cells Via Sirtuin-1, Peroxisome Proliferator-Activated Receptor γ (PPAR γ), Glucose Transporter Type 4 (GLUT-4) Expressions	Laboratory experimental study	By enhancing the activities of sirtuin-1 and metformin, (+)-catechin and proanthocyanidin fraction of Uncaria gambir Roxb. were discovered to promote adipocyte differentiation, and PPAR expressions were in charge of these processes.
(Arundita et al., 2020)	Indonesia	In Vitro Alpha-glucosidase Activity of Uncaria gambir Roxb. and Syzygium polyanthum (Wight) Walp. from West Sumatra, Indonesia	Laboratory experimental study	Gambir catechins have an alpha-glucosidase inhibitory effect, while the proanthocyanidin portion of Gambir exhibits this effect more intensely.

Resume of evidence

It is the first scoping study to gather reliable data regarding the potential benefits of catechins from gambir in preventing obesity. This scoping review focused on seeking evidence regarding the possible effects of the catechins of Uncaria Gambir Roxb. on the role of anti-obesity and weight management. The present review evidenced Uncaria Gambir Roxb.'s (+)-Catechin fraction was

discovered to promote adipocyte differentiation and development. Comparing (+)-catechin to the negative control, cell differentiation was increased by 2-3 times (Arundita et al., 2020). It is consistent with Torres et al. (2022), explaining how obese people may experience alterations in PPAR expression in adipose tissue. Increased weight loss is linked to decreased PPAR expression in adipose tissue. Polifenol's involvement in AMPK activation, the contribution of polyphenol to AMPK activation, The sirtuin-1 enzyme, and PPAR, two genes in charge of the activity of cell differentiation, would both experience increases in activity in response to an increase in AMPK activity (Arundita et al., 2020). In the same study, the effects of EGCG-type catechins were investigated. EGCG was found to reduce lipid buildup, impede 3T3-L1 cell development, and reduce cell viability. It has been proven that EGCG and epicatechin gallate inhibit pancreatic lipase. Additionally, green tea's anti-obesity properties in high-fat diet-induced obesity include the inhibition of digestive enzymes, the suppression of absorption, and the overexpression of glucose transporter-4 (Suzuki et al., 2016).

The second article came across talks about how the catechin component of gambir inhibits alpha-glucosidase. The outcome indicates that even though the proanthocyanidin fraction had an IC50 of 28,993 g/ml for its ability to inhibit alpha-glucosidase, (+)-catechin had an IC50 of 30.85 g/ml. Because proanthocyanidin group chemicals often have more OH groups than (+)-catechins and are, therefore, more polar, their IC50 value is higher than that of (+)-catechins. Regarding preventing alpha-glucosidase's action, catechins perform a similar role (Arundita et al., 2020). It is supported by previous research studying the inhibitory activity of three common types of flavonoids (Myricetin, myricetin, quercetin, and catechins) against α-glucosidase (Fu et al., 2021). There isn't much information about this process. However, we connected catechins as a natural alpha-glucosidase inhibitor (flavonoid) to GLP-1. That these inhibitors slow down glucose absorption has been reported (Dirir et al., 2022). Inhibitors of alpha-glucosidase raise GLP-1 levels after meals. The incretin hormone GLP-1, also known as glucagon-like peptide-1 (GLP-1), slows digestion, reduces hunger, and aids in making feel filled faster after eating (Aoki et al., 2019). This scoping review showed evidence of the possibility of inhibiting carbohydrate absorption to reduce the supply of calories from carbohydrates, which eventually has the potential to act as an anti-obesity.

Strengths and Limitations

Some limitations must be considered even though a thorough search was the goal. It is possible that not all relevant research was uncovered due to the few papers and depending on the quality of available studies. A few articles were related to the purpose of the review, but there's not much discussed. However, these studies can choose the most trustworthy sources and filter articles to only include the best articles, ensuring that the evidence discovered is pertinent.

CONCLUSION

In conclusion, catechin-rich gambir has the potential to function for obesity-related weight management. Available evidence recommends that the catechin content in Gambir has the potential for pharmaconutrition therapy for obesity management.

ACKNOWLEDGMENTS

This research was supported and funded by the Universitas Sebelas Maret, under grant funding Research Group Grand (HGR-UNS).

REFERENCES

Aoki, K., Sato, H., & Terauchi, Y. (2019). Usefulness of antidiabetic alpha-glucosidase inhibitors: a review on the timing of administration and effects on gut hormones. *Endocrine Journal*, *66*(5), 395–401. https://doi.org/10.1507/endocrj.EJ19-0041

Arner, P., & Langin, D. (2014). Lipolysis in lipid turnover, cancer cachexia, and obesity-induced insulin resistance. *Trends in Endocrinology and Metabolism: TEM*, *25*(5), 255–262. https://doi.org/10.1016/J.TEM.2014.03.002

Arundita, S., Ismed, F., Rita, R. S., & Putra, D. P. (2020). (+)-Catechin & Proanthocyanidin Fraction of Uncaria gambir Roxb. Improve Adipocytes Differentiation & Glucose Uptake of 3T3-L1 Cells Via Sirtuin-1, Peroxisome Proliferator-Activated Receptor γ (PPAR γ), Glucose Transporter Type 4 (GLUT-4) Expressions. *Advanced Pharmaceutical Bulletin*, *10*(4), 602. https://doi.org/10.34172/APB.2020.072

Arundita, S., Kurniawan, F., Ismed, F., Rita, R. S., & Putra, D. P. (2020). In Vitro Alpha Glucosidase Activity of Uncaria gambir Roxb. and Syzygium polyanthum (Wight) Walp. from West Sumatra, Indonesia. *Open Access Macedonian Journal of Medical Sciences*, *8*(A), 810–817. https://doi.org/10.3889/oamjms.2020.4298

Daudt, H. M. L., Van Mossel, C., & Scott, S. J. (2013). Enhancing the scoping study methodology: A large, inter-professional team's experience with Arksey and O'Malley's framework. *BMC Medical Research Methodology*, *13*(1), 1–9. https://doi.org/10.1186/1471-2288-13-48/PEER-REVIEW

Dirir, A. M., Daou, M., Yousef, A. F., & Yousef, L. F. (2022). A review of alpha-glucosidase inhibitors from plants as potential candidates for the treatment of type-2 diabetes. *Phytochemistry Reviews*, *21*(4), 1049–1079. https://doi.org/10.1007/s11101-021-09773-1

Feingold, K. R. (2020). Obesity and Dyslipidemia. In *Endotext [Internet]*. MDText.com, Inc. https://www.ncbi.nlm.nih.gov/books/NBK305895/

Fontenelle, L. C., de Araújo, D. S. C., da Cunha Soares, T., Cruz, K. J. C., Henriques, G. S., & do Nascimento Marreiro, D. (2022). Nutritional status of selenium in overweight and obesity: A systematic review and meta-analysis. *Clinical Nutrition*, *41*(4), 862–884. https://doi.org/10.1016/J.CLNU.2022.02.007

Fu, M., Shen, W., Gao, W., Namujia, L., Yang, X., Cao, J., & Sun, L. (2021). Essential moieties of myricetins, quercetins and catechins for binding and inhibitory activity against α-Glucosidase. *Bioorganic Chemistry*, *115*, 105235. https://doi.org/https://doi.org/10.1016/j.bioorg.2021.105235

Galán, J. P. M., Ontibón-Echeverri, C. M., Costa, M. C., Batista-Duharte, A., Batista, V. G., Mesa, V., Monti, R., de Paula, A. V., & Baviera, A. M. (2021). Enzymatic synthesis of capric acid-rich structured lipids and their effects on mice with high-fat diet-induced obesity. *Food Research International*, *148*, 110602. https://doi.org/10.1016/J.FOODRES.2021.110602

Ghanemi, A., Yoshioka, M., & St-Amand, J. (2018). Broken Energy Homeostasis and Obesity Pathogenesis: The Surrounding Concepts. *Journal of Clinical Medicine*, *7*(453), 1–12. https://doi.org/10.3390/JCM7110453

Gómez-Hernández, A., Beneit, N., Díaz-Castroverde, S., & Escribano, Ó. (2016). Differential Role of Adipose Tissues in Obesity and Related Metabolic and Vascular Complications. *International Journal of Endocrinology*, *2016*, 1216783. https://doi.org/10.1155/2016/1216783

Hall, K. D., Farooqi, I. S., Friedman, J. M., Klein, S., Loos, R. J. F., Mangelsdorf, D. J., O'Rahilly, S., Ravussin, E., Redman, L. M., Ryan, D. H., Speakman, J. R., & Tobias, D. K. (2022). The energy balance model of obesity: beyond calories in, calories out. *The American Journal of Clinical Nutrition*, *115*(5), 1243–1254. https://doi.org/10.1093/AJCN/NQAC031

Hilmi, H. L., & Rahayu, D. (2018). Review Artikel : Aktivitas Farmakologi Gambir (Uncaria Gambir Roxb.). *Farmaka*, *16*(2), 134–141. https://doi.org/10.24198/JF.V16I2.17643.G8749

Huai, P., Liu, J., Ye, X., & Li, W.-Q. (2022). Association of Central Obesity With All Cause and Cause-Specific Mortality in US Adults: A Prospective Cohort Study. *Frontiers in Cardiovascular Medicine*, *9*(816144). https://doi.org/10.3389/fcvm.2022.816144

Kemenkes RI. (2017). Farmakope Herbal Indonesia Edisi II. In *Jakarta: Kementerian Kesehatan RI*. Kementerian Kesehatan RI.

Montenegro Mendoza, R., Velásquez, I. M., Fontes, F., & Quintana, H. (2022). Prevalence of central obesity according to different definitions in normal weight adults of two cross-sectional studies in Panama. *The Lancet Regional Health - Americas*, *10*, 100215. https://doi.org/https://doi.org/10.1016/j.lana.2022.100215

Munggari, I. P., Kurnia, D., Deawati, Y., & Julaeha, E. (2022). Current Research of Phytochemical, Medicinal and Non-Medicinal Uses of Uncaria Gambir Roxb.: A Review. *Molecules*, *27*(19). https://doi.org/10.3390/MOLECULES27196551

Narciso, J., Nio, A., Silva, J., Rodrigues, V., Monteiro, M. J., Almeida, A. N., Saavedra, R., & Costa, A. M. (2019). Behavioral, contextual and biological factors associated with obesity during adolescence: A systematic review. *PLoS One*, *14*(4), e0214941. https://doi.org/10.1371/journal.pone.0214941

Sugiura, C., Nishimatsu, S., Moriyama, T., Ozasa, S., Kawada, T., & Sayama, K. (2012). Catechins and caffeine inhibit fat accumulation in mice through the improvement of hepatic lipid metabolism. *Journal of Obesity*, *2012*, 1–10. https://doi.org/10.1155/2012/520510

Suzuki, T., Pervin, M., Goto, S., Isemura, M., & Nakamura, Y. (2016). Beneficial Effects of Tea and the Green Tea Catechin Epigallocatechin-3-gallate on Obesity. *Molecules*, *21*(10), 1305. https://doi.org/10.3390/MOLECULES21101305

Torres, J.-L., Usategui-Martín, R., Hernández-Cosido, L., Bernardo, E., Manzanedo-Bueno, L., Hernández-García, I., Mateos-Díaz, A.-M., Rozo, O., Matesanz, N., Salete-Granado, D., Chamorro, A.-J., Carbonell, C., Garcia-Macia, M., González-Sarmiento, R., Sabio, G., Muñoz-Bellvís, L., & Marcos, M. (2022). PPAR-γ Gene Expression in Human Adipose Tissue Is Associated with Weight Loss After Sleeve Gastrectomy. *Journal of Gastrointestinal Surgery*, *26*(2), 286–297. https://doi.org/10.1007/s11605-021-05216-6

World Obesity Federation. (2023). *World Obesity Atlas 2023*. www.worldobesity.org

Yunarto, N., Sulistyaningrum, N., Kurniatri, A. A., & Elya, B. (2021). Gambir (Uncaria gambir Roxb.) as A Potential Alternative Treatment for Hyperlipidemia. *Media Penelitian dan Pengembangan Kesehatan*, *31*(3), 183–192. https://doi.org/10.22435/mpk.v31i3.4472.