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

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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.

![PRISMA flow chart](image)

**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>
<thead>
<tr>
<th>Source</th>
<th>Country</th>
<th>Title</th>
<th>Design</th>
<th>Results</th>
</tr>
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<tbody>
<tr>
<td>(Arundita et al., Indonesia 2020)</td>
<td>(+)-Catechin &amp; Proanthocyanidin Fraction of Uncaria gambir Roxb. Improve Adipocytes Differentiation &amp; Glucose Uptake of 3T3-L1 Cells Via Sirtuin-1, Peroxisome Proliferator-ACTivated Receptor γ (PPAR γ), Glucose Transporter Type 4 (GLUT-4) Expressions</td>
<td>Laboratory experimental study</td>
<td>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.</td>
<td></td>
</tr>
<tr>
<td>(Arundita et al., Indonesia 2020)</td>
<td>In Vitro Alpha-glucosidase Activity of Uncaria gambir Roxb. and Syzygium polyanthum (Wight) Walp. from West Sumatra, Indonesia</td>
<td>Laboratory experimental study</td>
<td>Gambir catechins have an alpha-glucosidase inhibitory effect, while the proanthocyanidin portion of Gambir exhibits this effect more intensely.</td>
<td></td>
</tr>
</tbody>
</table>

**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.

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REFERENCES


