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Balinese Local Plants in Regulating Body Weight: A Review

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Abstract: Obesity and overweight have become major global health concerns. In Indonesia, one in five school-aged children is overweight or obese, with increasing rates observed in Bali. Dietary imbalance, sedentary lifestyles, and metabolic dysregulation contribute to abnormal body weight gain. In light of the limitations of synthetic drugs, plant-derived bioactive compounds have attracted attention as safer and multi-target alternatives for regulating body weight. This review aims to synthesise current scientific evidence on the potential of Balinese local plants in regulating body weight, identify their bioactive compounds and underlying mechanisms, and highlight research gaps to guide future nutraceutical development. This systematic review, conducted in accordance with the PRISMA 2020 guidelines, examined literature published between 2020 and 2025 retrieved from PubMed, ScienceDirect, and Google Scholar. The keywords *Balinese plants*, *body weight*, *obesity*, *anti-obesity*, *plant extract*, and *bioactive compounds*, eight studies met the inclusion criteria. The identified Balinese local plants, including Clitoria ternatea, Zingiber cassumunar, Phyllanthus acidus, Murraya paniculata, Hibiscus rosa-sinensis, Elaeocarpus grandiflorus, Tagetes erecta, and Lagerstroemia speciosa, demonstrated significant potential in regulating body weight. Their mechanisms included AMPK activation, inhibition of pancreatic lipase, suppression of adipogenesis, induction of thermogenesis, and modulation of antioxidants. Balinese local plants exhibit multi-pathway potential in regulating body weight through metabolic and physiological modulation.

Keywords: Balinese Local Plants; Body Weight Regulation; Obesity.

Introduction

Obesity and overweight among children and adolescents have reached alarming proportions worldwide. Recent estimates indicate that more than 2.11 billion adults and approximately 493 million children and adolescents (aged 5-24 years) are currently living with overweight or obesity [1]. A large-scale meta-analysis of 2,033 studies across 154 countries, involving 45.9 million participants, reported an overall obesity prevalence of 8.5% (95% CI 8.2-8.8) among children and adolescents, ranging from 0.4% in Vanuatu to 28.4% in Puerto Rico. The prevalence was markedly higher in countries with a Human Development Index (HDI) of 0.8 or higher, particularly in high-income regions. Compared to 2000-2011, a 1.5-fold increase in childhood obesity was observed between 2012-2023, and obesity was strongly associated with depression, hypertension, and metabolic disorders [2]. This global trend is mirrored in developing nations such as Indonesia, reflecting a growing global health challenge.

In Indonesia, the rates of overweight and obesity have continued to rise over the past decade. According to UNICEF (2023), approximately 1 in 5 school-aged children were classified as overweight or obese. National surveys reported an overweight prevalence of 11,9% and obesity of 7,8% among children aged 5-12 years, while the prevalence of overweight among adolescents aged 13-15 years reached 10,8%. Another study found that 17,5% of children aged 6-12 years were either overweight or obese [3, 4]. At the provincial level, in Tabanan Regency, Bali, there were 8,138 recorded obesity cases among 87,246 individuals examined in 2023, encompassing children, adolescents, and adults [5]. These statistics highlight the escalating prevalence of obesity and its public health implications at both national and regional levels.

The pathophysiology of obesity involves a complex interplay of energy imbalance, metabolic dysregulation, hormonal signalling, and chronic low-grade inflammation [6-8]. Key molecular targets such as AMP-activated protein kinase (AMPK), peroxisome proliferator-activated receptor gamma (PPARγ), and lipoprotein lipase (LPL) are known to regulate lipid metabolism and adipogenesis [9, 10]. Modulation of these pathways forms the basis of both pharmacological and nutraceutical strategies to control body weight. Lifestyle transitions associated with modern dietary patterns characterized by high consumption of processed foods rich in fats and sugars, coupled with declining physical activity, have been recognized as major contributors to excessive weight gain, particularly among children and adolescents. These behavioral changes disrupt energy homeostasis and alter hormonal and metabolic signalling pathways involved in body weight regulation. At the biological level, dietary intake, energy expenditure, and body weight maintenance are governed by complex interactions among metabolic, hormonal, and behavioral factors [11, 12].

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Given the multifactorial nature of obesity, there is growing scientific interest in identifying bioactive compounds derived from natural products that may help modulate metabolic homeostasis. Compounds such as flavonoids, polyphenols, alkaloids, and terpenoids have demonstrated anti-obesity mechanisms, including the inhibition of lipase, suppression of adipogenesis, and enhancement of fatty acid oxidation. Studies on tropical medicinal plants such as *Camellia sinensis*, *Garcinia cambogia*, and *Curcuma longa* have reported significant improvements in lipid profiles, antioxidant status, and body composition [13, 14]. These findings highlight the potential of plant-based interventions as safer, sustainable alternatives for managing obesity and metabolic disorders. Despite the global emphasis on plant-derived bioactive compounds, research focusing on local tropical plants used in traditional medicine systems remains limited. Bali, with its rich biocultural heritage, offers an untapped reservoir of local plants that may be beneficial for metabolic regulation.

This systematic review, therefore, aims to synthesize current evidence on the potential of Balinese local plants in regulating body weight, summarize their bioactive mechanisms, and identify research gaps for future investigation. The outcome is expected to contribute to the development of evidence-based nutraceuticals derived from Balinese biodiversity and to support sustainable weight management and preventive health strategies.

Research Methods

This study employed a systematic review approach in accordance with the PRISMA 2020 guidelines. Relevant articles were retrieved from *Google Scholar, PubMed,* and *ScienceDirect* using combinations of the following keywords: Balinese plants, Indonesian medicinal plants, local plants of Bali, body weight, obesity, anti-obesity, weight management, plant extract, bioactive compounds, and natural products. The search encompassed publications from 2020 to 2025, focusing on studies that investigated the metabolic and anti-obesity potential of Balinese local plants. Data were collected and analyzed to identify plant species, plant parts used, phytochemical composition, bioactive compounds, mechanisms of action, and reported effects on body weight regulation. Based on the search results, eight pieces of literature matched the topics to be discussed (Figure 1).

Table 1. Pico Framework

PICO Component	Description
Population (P)	Balinese local plants that possess potential bioactive compounds affecting body weight regulation or obesity-related parameters.
Intervention (I)	Extraction, isolation, or utilization of phytochemical compounds from these plants aimed at modulating lipid metabolism, inhibiting adipogenesis, or reducing body fat accumulation.
Comparison (C)	Comparison between different plant extracts, formulations, or treatments with control groups, standard anti-obesity drugs, or untreated conditions to assess relative efficacy.
Outcome (O)	Evaluation of anti-obesity or body weight regulatory effects, including changes in body weight, lipid profile, adipocyte morphology, glucose tolerance, or expression of metabolic markers such as AMPK and PPARγ.

A comprehensive literature search was conducted to identify relevant studies on the potential of Balinese local plants in regulating body weight. The identification process followed the PRISMA 2020 framework and utilized three major databases: *Google Scholar, PubMed,* and *ScienceDirect,* based on predefined keywords and inclusion parameters.

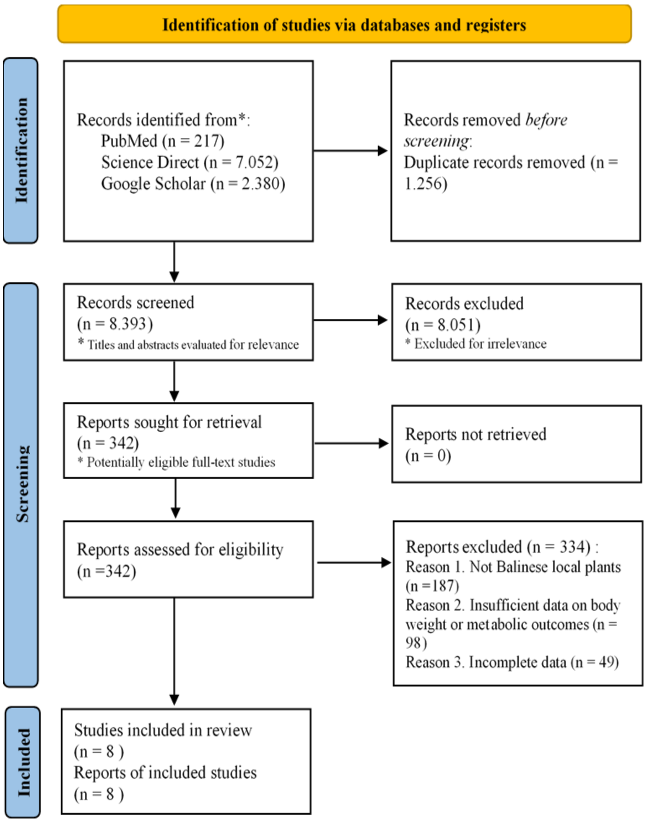

Figure 1. Literature searching strategy and identification via databases using keywords

Results and Discussion

The Balinese government, through Regulation Number 29 of 2020, officially designates several native plants as essential components of cultural, spiritual, medicinal, and environmental preservation efforts. Among these local species are plants traditionally used not only in ceremonial contexts but also in *Usada Bali* (traditional healing practices) [15]. Many of these plants have demonstrated promising biological activity relevant to modern health challenges, particularly in addressing metabolic and degenerative disorders. Thus, Balinese local plants represent an underexplored source of natural compounds with potential roles in regulating body weight and preventing metabolic disorders.

Clitoria ternatea exerts anti-obesity activity primarily through modulation of lipid and glucose metabolism [24]. The anthocyanins and flavonoids present, notably ternatins and delphinidin derivatives, suppress adipogenesis by inhibiting transcription factors such as PPARγ and C/EBPα, thereby reducing lipid droplet formation in adipocytes [25, 26]. In vivo studies have demonstrated that *C. ternatea* extract restores mitochondrial function and activates AMP-activated protein kinase (AMPK), enhancing fatty acid oxidation and energy expenditure [27]. The extract's antioxidant capacity counteracts oxidative stress and inflammation, both of which are central to the pathophysiology of obesity. *Clitoria ternatea* extract, administered at doses of 200–600 mg/kg, significantly reduced IL-6 levels, indicating strong anti-inflammatory activity related to weight regulation. The flavonoids and anthocyanins in *C. ternatea* act as antioxidants that neutralise reactive oxygen species and prevent lipid peroxidation. By reducing oxidative stress and inflammation, *C. ternatea* helps improve insulin sensitivity and lipid metabolism, preventing excessive fat accumulation. The extract also maintains endothelial health and reduces LDL oxidation, supporting overall metabolic balance [28]. Thus, *Clitoria ternatea* contributes to body weight regulation through anti-inflammatory, antioxidant, and lipid-modulating mechanisms.

Table 2. Summary of the studies

Balinese Local Name	Scientific Name	Plant Part Used	Model	Dose	Main Active Compounds	Main Findings	Mechanism
Teleng [16]	*Clitoria ternatea* L.	Flower	Mice on cholesterol- & fat-enriched diet	65 & 130 mg/kg BW	Anthocyanins, flavonoids, polyphenols	Significant reduction of metabolic disorder parameters (↓TC, ↓TG, ↓LDL, ↓glucose); restored oxidative and inflammatory markers (↑SOD, ↓TNF-α, ↑IL-10); improved gut microbiota balance (↑Bacteroidetes/Firmicutes ratio)	Antioxidant, anti-inflammatory, inhibition of α-amylase, α-glucosidase, and lipase; modulation of gut microbiota and PGC-1α expression
Bangle [17]	*Zingiber cassumunar* Roxb.	Rhizome	High-fat diet (HFD)-induced hyperlipidemic male Wistar rats	100, 200, and 400 mg/kg BW	Curcumin, essential oils, phenolics, terpenoids, and flavonoids	Ethanol extract of *Z. cassumunar* significantly reduced total cholesterol, triglycerides, SGOT, and SGPT levels in HFD rats. Antioxidant enzyme activities of catalase (CAT) and glutathione peroxidase (GSH-Px) were significantly increased, restoring lipid and oxidative balance	The mechanism involves upregulation of endogenous antioxidant enzymes (CAT, GSH-Px), suppression of lipid peroxidation, and reduction of hepatic oxidative stress. Curcumin and phenolic compounds modulate lipid metabolism by enhancing hepatic antioxidant defence and preventing lipid accumulation
Cereme [18]	*Phyllanthus acidus* L.	Leaf	Triton-induced hyperlipidemic rats	200 & 400 mg/kg BW	Phenolics, flavonoids, lignans	↓ blood glucose and lipid levels (TC, TG, LDL); 400 mg/kg gave a significant effect	Improves lipid metabolism & glucose utilization; antioxidant and hepatoprotective activity

Kemuning [19]	*Murraya paniculata* (L.) Jack	Leaf	Female Wistar rats, MSG-induced obesity model	200, 400, 800 mg/kg BW	Alkaloids, coumarins, terpenoids, flavonoids	Significant inhibition of weight gain (109,28% inhibition at 200 mg/kg); no effect on appetite or feces; safe and non-laxative	Reduces body-weight gain via lipid metabolism regulation; non-central anti-obesity mechanism
Pucuk Baang [20]	*Hibiscus rosa-sinensis* L.	Flower	High-fat–sugar-diet-induced obese rats	250 & 500 mg/kg BW	Polyphenols, flavonoids	Significant ↓ BMI (0,50 vs 0,79 g/cm² control), ↓ liver/kidney index, ↓ TC, TG, LDL, VLDL; improved antioxidant markers (↓ MDA, ↑ SOD, GSH)	Antioxidant and lipid-lowering mechanisms through phenolic acids & flavonoids
Rijasa [21]	*Elaeocarpus grandiflorus*	Leaf	Female Wistar rats (in vivo) and in silico molecular docking	200, 400, and 800 mg/kg BW	Rutin, Orientin, Luteolin, Vitexin, Isoorientin, Isovitexin, Kaempferol, Quercetin	Decreased body weight, abdominal circumference, and fat mass significantly; high-dose extract (400-800 mg/kg BW) showed the strongest anti-obesity effect	Modulation of the AMPK signalling pathway through the interaction of flavonoids with target proteins (ELAVL1, IGF1R, CREB1, AKT1, PIK3R1), enhancing energy expenditure and fatty acid oxidation
Mitir [22]	*Tagetes erecta* L.	Flower crown	*C. elegans* model was created after exposing the worms to an excess of 5% glucose in the nematode growth medium (NGM) and was performed in two *C. elegans* strains: wild-type N2 and mutant BX24 (fat-1(wa-9))	500, 250, and 125 µg/mL	Flavonoids (quercetin, rutin), phenolic acids (vanillic acid, ellagic acid), carotenoids (lutein), terpenoids	The ethanolic extracts of *T. erecta* significantly reduced lipid accumulation in obese *C. elegans* models. At 500 µg/mL, both yellow and orange flower extracts decreased fat levels by up to 89.44% and 85.68%, respectively, comparable to orlistat. Lipid droplet size ratios were also markedly reduced, indicating efficient lipid storage suppression without affecting feeding behavior.	The lipid-lowering effect is attributed to partial inhibition of pancreatic lipase activity, decreased bacterial ingestion, and modulation of lipid metabolism pathways. Polyphenolic constituents such as quercetin, vanillic, and ellagic acids are proposed to act through antioxidant effects and activation of the DAF-16/insulin-like signalling pathway, leading to improved energy and lipid homeostasis.
Tangi [23]	*Lagerstroemia speciosa* Pers.	Leaf	3T3-L1 preadipocytes and INS-1 rat insulinoma cells (in vitro)	50 mg/mL incubated for 72 h at 37 °C	Asiatic acid, Corosolic acid, Oleanolic acid, Ursolic acid	Bioconversion of *L. speciosa* leaf extract significantly enhanced its biological activity. The process increased asiatic acid	Probiotic-mediated conversion enhances triterpenoid bioavailability and activates insulin

	levels 3.8-fold, improving glucose uptake, insulin secretion, fat browning, and antioxidant capacity. Matairesinol, also detected, acts as an adiponectin receptor agonist, supporting metabolic regulation.	and adiponectin signalling pathways, improving glucose metabolism, lipid utilization, and energy expenditure. These combined effects contribute to antidiabetic and antiobesity outcomes.

The anti-obesity mechanism of *Zingiber cassumunar* is closely related to its ability to inhibit pancreatic lipase and modulate lipid digestion [29]. Total phenolic compounds of 5,48 mg GAE/g and antioxidant activity of 69,8% were obtained [30]. The rhizome's active compounds, curcumin, essential oils, phenolics, terpenoids, and flavonoids, directly reduce fat hydrolysis, thereby limiting the absorption of dietary triglycerides. Curcumin and phenolic compounds modulate lipid metabolism by enhancing hepatic antioxidant defence, preventing lipid accumulation, and improving liver function [17]. This process decreases circulating lipid levels and prevents excessive storage of triglycerides in adipose tissue. Beyond this enzymatic action, recent data indicate that cassumunar compounds enhance AMPK activity and upregulate carnitine palmitoyltransferase-1 (CPT-1), promoting β-oxidation of fatty acids in hepatic and skeletal tissues. The extract also exhibits anti-inflammatory effects by downregulating TNF-α and IL-6, mitigating chronic low-grade inflammation associated with obesity. Additionally, its antioxidant potential reduces oxidative stress in adipose cells, maintaining insulin receptor sensitivity [31]. Thus, *Z. cassumunar* demonstrates a dual mechanism that limits dietary fat absorption and enhances endogenous lipid oxidation, which physiologically translates into reduced adiposity.

The leaves of *Phyllanthus acidus* contain phenolics, lignans, and flavonoids that play central roles in lipid and glucose regulation. These compounds activate peroxisome proliferator-activated receptors (PPARα/γ) and upregulate hepatic lipase and LDL receptor expression, promoting lipid clearance from plasma [32]. Through AMPK activation, *P. acidus* enhances glucose uptake and inhibits fatty acid synthesis by suppressing acetyl-CoA carboxylase activity [33]. The antioxidative metabolites such as quercetin and gallic acid also neutralize reactive oxygen species, which otherwise impair insulin signalling and contribute to adipocyte hypertrophy. Additionally, P. acidus may influence adipokine secretion, thereby reducing leptin resistance and restoring adiponectin levels, ultimately improving metabolic homeostasis. These biochemical effects support its physiological role in attenuating lipid accumulation and enhancing metabolic flexibility in response to obesity.

Murraya paniculata leaves demonstrate anti-obesity potential through modulation of lipid metabolism rather than appetite suppression. Alkaloids and flavonoids inhibit the differentiation of preadipocytes by downregulating PPARγ and SREBP-1c expression [34]. This inhibition restricts triglyceride synthesis and adipocyte maturation, reducing overall fat mass. Recent studies have shown that *M. paniculata* enhances hepatic β-oxidation and upregulates genes associated with lipid catabolism, such as CPT-1 and ACOX1, without affecting central appetite pathways, confirming its non-anorectic mechanism [35]. Its coumarin derivatives also improve mitochondrial efficiency and reduce oxidative stress, thereby maintaining energy balance. Moreover, the extract's anti-inflammatory activity prevents obesity-induced macrophage infiltration in adipose tissue. Physiologically, this plant acts by reprogramming lipid metabolism at the cellular level, resulting in a decrease in fat accumulation and the prevention of metabolic syndrome progression.

The anti-obesity properties of *Hibiscus rosa-sinensis* are primarily attributed to its rich content of flavonoids and polyphenols, which regulate lipid metabolism and oxidative balance. These compounds, including quercetin, kaempferol, and anthocyanins, inhibit pancreatic lipase and suppress hepatic lipogenesis via downregulation of FAS and SREBP-1c genes [20]. By activating AMPK, *H. rosa-sinensis* promotes fatty acid oxidation and glucose utilization, thereby improving energy expenditure. Its potent antioxidant capacity mitigates lipid peroxidation and reduces malondialdehyde (MDA) levels, which are elevated during obesity-induced oxidative stress [36]. Furthermore, *H. rosa-sinensis* enhances glutathione (GSH) and superoxide dismutase (SOD) activities, maintaining redox homeostasis essential for insulin sensitivity [37]. These mechanisms converge to produce physiological effects that counteract adipose tissue expansion and systemic inflammation linked to obesity.

Elaeocarpus grandiflorus exerts anti-obesity effects primarily via modulation of the AMPK signalling cascade and related lipid metabolism pathways. Its dominant flavonoids, orientin, luteolin, and quercetin, act as AMPK activators, stimulating fatty acid oxidation and mitochondrial biogenesis [38]. Molecular docking and in vivo data demonstrate that these metabolites interact with metabolic regulators such as IGF1R and AKT1, enhancing energy expenditure and insulin responsiveness. The extract, at 400-800 mg/kg BW, significantly reduces adipose mass and abdominal circumference, reflecting decreased lipid deposition [21]. These effects are supported by upregulation of PGC-1α and downregulation of ACC and SREBP-1c, which together suppress adipogenesis [39]. The plant's antioxidant properties further mitigate lipid peroxidation, stabilising mitochondrial membranes and improving oxidative phosphorylation. Physiologically, *E. grandiflorus* restores energy balance by promoting lipolysis and reducing adipocyte hypertrophy through flavonoid-mediated metabolic activation.

Tagetes erecta demonstrates strong anti-adiposity effects through the combined actions of its flavonoids, phenolic, and carotenoids [40]. Quercetin and lutein act as modulators of AMPK and DAF-16/FOXO pathways, which regulate lipid storage and stress response in the *C. elegans* obesity model. At concentrations of 500 µg/mL, the ethanolic flower extract reduces fat accumulation by nearly 90%, comparable to orlistat, through suppression of pancreatic lipase and decreased lipid droplet formation [22]. These polyphenolic compounds also reduce intestinal fat absorption and modulate serotonergic signalling that influences feeding behaviour. Additionally, vanillic and ellagic acids enhance β-oxidation and mitochondrial respiration, thereby increasing thermogenic capacity. The extract's antioxidant activity protects against glucose-induced oxidative damage, supporting balanced lipid metabolism [41]. Together, these mechanisms highlight *T. erecta*'s multi-target anti-obesity action that integrates enzymatic inhibition, mitochondrial activation, and metabolic regulation.

Lagerstroemia speciosa exhibits potent metabolic regulatory effects, particularly through its triterpenoid acids corosolic, asiatic, oleanolic, and ursolic acids, which modulate glucose and lipid homeostasis. The bioconversion of *L. speciosa* leaf extract by *Lactobacillus plantarum* markedly increases asiatic acid concentration, enhancing insulin secretion, glucose uptake, and adipocyte browning. This browning process transforms white adipose tissue into metabolically active beige adipocytes, increasing thermogenesis via UCP1 activation [23]. Corosolic acid, known as a natural insulin mimetic, improves glucose utilisation and suppresses de novo lipogenesis by inhibiting PPARγ-mediated adipogenesis [42]. Matairesinol, identified as an adiponectin receptor agonist, enhances lipid catabolism and mitochondrial activity, further supporting energy expenditure. The probiotic-induced enhancement of these compounds amplifies their bioavailability and metabolic efficacy [43]. Physiologically, *L. speciosa* acts through synergistic pathways that promote lipid oxidation, thermogenic energy release, and enhanced insulin sensitivity, key processes in the prevention of obesity.

The reviewed Balinese local plants regulate body weight through complementary biochemical and physiological mechanisms. Across species, the activation of AMP-activated protein kinase (AMPK) and modulation of peroxisome proliferator-activated receptors (PPARs) appear to be the principal pathways influencing lipid and energy metabolism. Plants rich in flavonoids and polyphenols, such as Clitoria ternatea, Hibiscus rosa-sinensis, and Elaeocarpus grandifloras, enhance fatty acid oxidation, suppress adipocyte differentiation, and maintain glucose homeostasis. Meanwhile, *Zingiber cassumunar* and *Tagetes erecta* primarily act by inhibiting pancreatic lipase activity, thereby reducing intestinal fat absorption and postprandial lipid levels. *Phyllanthus acidus* and *Murraya paniculata* restore lipid and glucose balance via hepatoprotective and antioxidative effects, ensuring efficient lipid mobilisation and utilisation. The triterpenoid-rich *Lagerstroemia speciosa* further contributes to body weight regulation by promoting browning of white adipose tissue and increasing thermogenic activity.

The regulation of body weight by these plants involves coordinated effects on lipid storage, metabolic rate, and endocrine signalling. Polyphenols such as quercetin, luteolin, and kaempferol modulate adipokine expression by increasing adiponectin and reducing leptin resistance, thereby improving appetite control and insulin sensitivity. Triterpenoids such as asiatic and corosolic acid enhance mitochondrial respiration and thermogenic gene expression, leading to increased energy expenditure and reduced fat mass. Anthocyanins from *Clitoria ternatea* further modulate gut microbiota composition, increasing short-chain fatty acid production that promotes lipid oxidation and satiety. Several extracts, including *Murraya paniculata* and *Phyllanthus acidus*, demonstrate a normalising effect on serum lipid profiles and liver enzymes, indirectly supporting body weight regulation by improving metabolic efficiency.

Through a variety of molecular, metabolic, and physiological processes, this systematic study offers compelling evidence that Balinese native plants have significant potential for controlling body weight. Their bioactive components, which include phenolic acids, terpenoids, flavonoids, and triterpenes, have complex effects on energy expenditure, gut-brain communication, lipid metabolism, and mitochondrial activity. These natural substances encourage equilibrium between energy intake and utilization, which reflects a sustained approach to maintaining ideal body weight, in contrast to single-target pharmacological therapies. To verify efficacy and clarify long-term safety, future research should incorporate dose-response studies, metabolomic profiling, and human trials, despite encouraging preclinical results. In line with Bali's ecological and cultural heritage, incorporating Balinese plants into nutraceutical development fosters both biodiversity conservation and evidence-based medicine. This review integrates traditional ethnopharmacological knowledge with scientific evidence, emphasising the potential of Balinese local plants as natural regulators of body weight and enhancers of metabolic resilience.

Conclusion

Based on the reviewed literature, it can be concluded that several Balinese local plants exhibit significant potential in regulating body weight through multiple biological mechanisms. Extracts from plants such as *Clitoria ternatea*, *Zingiber cassumunar*, *Phyllanthus acidus*, *Murraya paniculata*, *Hibiscus rosa-sinensis*, *Elaeocarpus grandiflorus*, *Tagetes erecta*, and *Lagerstroemia speciosa* demonstrated promising effects in reducing body weight and improving metabolic parameters. These include lowering triglyceride, LDL, and total cholesterol levels, enhancing antioxidant enzyme activity, inhibiting lipase and adipogenesis, and stimulating thermogenesis through AMPK and PPARγ pathways. In addition to regulating body weight, these plants also prevent complications associated with obesity, such as dyslipidaemia, hyperglycaemia, and oxidative stress. This review supports the ethnobotanical learning and development of local functional foods for obesity management; however, further preclinical and human clinical studies are needed to confirm safety, dosage, and efficacy.

Author's Contribution
I. A. M Damayanti: conceived and designed the study, developed the framework of the literature searching strategy and identification via databases, and led the systematic literature search, data extraction, and manuscript drafting. S. D. Megayanti: contributed to data analysis, interpretation of findings, and critical revision of the manuscript for intellectual content. N. T. Wulansari: assisted in data validation, table preparation, and manuscript editing.

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