www.wcprj.com 2026 Page: 01-23 Review Article

World Current Pharmaceutical Research Journal

ISSN (O): Applied Volume: 02 Issue: 04

A COMPREHENSIVE REVIEW ON THE PHARMACOLOGICAL ACTIVITIES OF *COCOS NUCIFERA* AND *ARACHIS HYPOGAEA*

Ms. S. Swetha[1]*, S. Yamini[2], B. Yuvaraj[2], P. Yuvaraj[2], R. Yuvaraj[2]

[1]*Department Pharmacology, Assistant Professor, [2] B. Pharm Final Year

Aadhi Bhagawan College of Pharmacy, Rantham, Thiruvannamalai, Tamilnadu.

Article Received: 13 February 2026

Article Revised: 05 March 2026

Published on: 25 March 2026

***Corresponding Author: Ms. S. Swetha**

Department Pharmacology, Assistant Professor, Aadhi Bhagawan College of Pharmacy, Rantham, Thiruvannamalai, Tamilnadu.

DOI: https://doi.org/10.5281/zenodo.19337755

ABSTRACT

Agro-industrial by-products have recently gained scientific interest as sustainable sources of bioactive compounds with therapeutic value. Coconut peel and peanut skin are rich in polyphenols, flavonoids, tannins, and proanthocyanidins that exhibit strong antioxidant and metabolic regulatory properties. Emerging experimental evidence indicates that these phytochemicals influence lipid metabolism, adipocyte differentiation, and energy homeostasis through multi-target mechanisms. Studies demonstrate that bioactive constituents from these plant wastes inhibit pancreatic lipase activity, regulate adipogenic transcription factors, enhance fatty acid oxidation, and improve metabolic signaling pathways such as AMPK activation. Additionally, their ability to modulate oxidative stress and gut microbiota composition further supports their metabolic benefits. The complementary phytochemical profiles of coconut peel and peanut skin suggest a possible synergistic interaction that may enhance anti-obesity efficacy when used in combination. Their utilization in nutraceutical or functional food formulations also promotes environmental sustainability through waste valorization. Although preclinical findings are promising, further investigations including toxicity assessment, dosage standardization, and well-designed clinical trials are necessary to establish their translational potential in metabolic disorder management.

KEYWORDS: Coconut peel; Peanut skin; Obesity; Polyphenols; Proanthocyanidins; AMPK activation; Lipase inhibition; Adipogenesis; Gut microbiota; Functional foods; Nutraceuticals.

1. INTRODUCTION

Obesity is a rapidly growing global health concern characterized by excessive fat accumulation that increases the risk of metabolic disorders such as type 2 diabetes mellitus, cardiovascular diseases, hypertension, and non-alcoholic fatty liver disease. Modern pharmacological treatments for obesity often produce adverse effects, leading to increased interest in plant-based, natural, and waste-derived therapeutics. Agro-industrial by-products such as fruit peels and husks are now recognized as valuable sources of bioactive compounds with significant pharmacological potential.

Natural plant-based compounds have gained significant attention in recent years for their potential anti-obesity effects due to their safety, low toxicity, and multiple mechanisms of action. These compounds help in reducing fat absorption, suppressing appetite, inhibiting fat cell formation, enhancing lipid metabolism, and improving insulin sensitivity. Plant sources such as coconut peel and peanut skin are rich in polyphenols, flavonoids, tannins, phenolic acids, and dietary fibers, which contribute to effective body weight management. Therefore, exploration of natural anti-obesity agents plays a vital role in developing safe and sustainable therapeutic approaches for obesity management

Coconut peel and peanut skin, which are generally considered agricultural by-products or waste materials, are rich sources of bioactive phytochemicals such as polyphenols, flavonoids, phenolic acids, tannins, proanthocyanidins, resveratrol, and dietary fibers. These bioactive constituents exert significant pharmacological actions including inhibition of digestive enzymes, suppression of adipocyte differentiation, enhancement of lipid metabolism, improvement of insulin sensitivity, and reduction of oxidative stress and inflammation. Through these multiple mechanisms, coconut peel and peanut skin exhibit potent anti-obesity effects.

The pharmacological evaluation of coconut peel and peanut skin provides a promising approach for the development of safe, effective, and economical natural anti-obesity formulations. Their utilization not only supports sustainable waste management but Also contributes to the advancement of nutraceutical and phytopharmaceutical products for the prevention and treatment of obesity. Obesity results from an imbalance between energy intake and energy expenditure, leading to excessive adipose tissue expansion. At the molecular level, obesity is associated with increased adipogenesis, chronic low-grade inflammation, oxidative stress, insulin resistance, and dysregulation of lipid metabolism. Key regulatory pathways such as AMPK-(activated protein kinase), PPAR-γ(Peroxisome Proliferator-Activated Receptor Gamma), C/EBP-α(CCAAT/Enhancer-Binding Protein Alpha), and SREBP-1c(Sterol Regulatory Element-Binding Protein-1c) play crucial roles in fat accumulation and metabolic disturbances.

Although synthetic anti-obesity drugs are available, they often produce adverse effects and limited long-term efficacy. Therefore, there is growing interest in plant-based natural products that are safer, cost-effective, and act through multiple mechanisms. These bioactive compounds exert anti-obesity effects by inhibiting digestive enzymes, suppressing adipocyte differentiation, activating AMPK-mediated fatty acid oxidation, improving insulin sensitivity, modulating gut microbiota, and reducing oxidative stress and inflammation.

Furthermore, the combination of coconut peel and peanut skin may provide a synergistic therapeutic effect due to their complementary phytochemical composition and multi-target pharmacological action. Utilization of these agro-waste materials not only contributes to sustainable waste management but also supports the development of eco-friendly nutraceutical and phytopharmaceutical formulations for obesity management. Bioactive compounds from coconut peel and peanut skin regulate adipogenesis by downregulating transcription factors such as PPAR-γ and C/EBP-α, while activating AMPK and CPT-1(Carnitine Palmitoyltransferase-1) pathways to enhance fatty acid oxidation. The combination may produce additive or synergistic effects due to multi-pathway metabolic regulation.

1.1 MEASUREMENT OF OBESITY:

According to WHO guidelines, obesity is measured primarily using anthropometric indices that assess body fat based on height, weight, and fat distribution. The Body Mass Index (BMI) is the standard measurement recommended by the World Health Organization. It is calculated as weight in kilograms divided by height in meters squared (kg/m^2). WHO classifies adults as overweight when BMI is ≥ 25 kg/m^2 and obese when BMI is ≥ 30 kg/m^2. Obesity is further subdivided into Class I (30–34.9 kg/m^2), Class II (35–39.9 kg/m^2), and Class III (≥ 40 kg/m^2), the latter also referred to as morbid obesity.

In addition to BMI, WHO recognizes waist circumference and waist-to-hip ratio (WHR) as important measures of central (abdominal) obesity, which is strongly associated with metabolic and cardiovascular risk. A waist circumference ≥ 102 cm in men and ≥ 88 cm in women, or a WHR > 0.90 in men and > 0.85 in women, indicates increased health risk. For children and adolescents, WHO recommends BMI-for-age growth charts, where obesity is defined as a BMI greater than +2 standard deviations above the WHO growth reference median.

1.2 ROLE OF FOODS:

Dietary factors play a central role in the development of obesity, and their effects can be partly understood through pharmacological mechanisms that regulate appetite, metabolism, and energy storage. Highly processed foods rich in sugars and saturated fats stimulate reward pathways in the brain, particularly those involving dopamine, in a manner similar to addictive substances, promoting overconsumption. Excessive carbohydrate intake increases insulin secretion, which enhances lipogenesis and inhibits lipolysis, favoring fat accumulation. Additionally, certain food components influence hormones such as leptin and ghrelin, disrupting normal appetite regulation and leading to leptin resistance over time. From a pharmacological perspective, these diet-induced alterations in neurotransmitters and hormonal signaling parallel drug–receptor interactions, helping explain how chronic exposure to energy-dense foods contributes to sustained weight gain and obesity.

1.3 PATHOPHYSIOLOGY OF OBESITY:

Energy Intake > Energy Expenditure

↓

Adipocyte Hypertrophy & Hyperplasia

↓

↑ PPAR-γ, C/EBP-α Activation

↓

Chronic Inflammation (↑ TNF-α, IL-6)

↓

Insulin Resistance & Metabolic Dysfunction

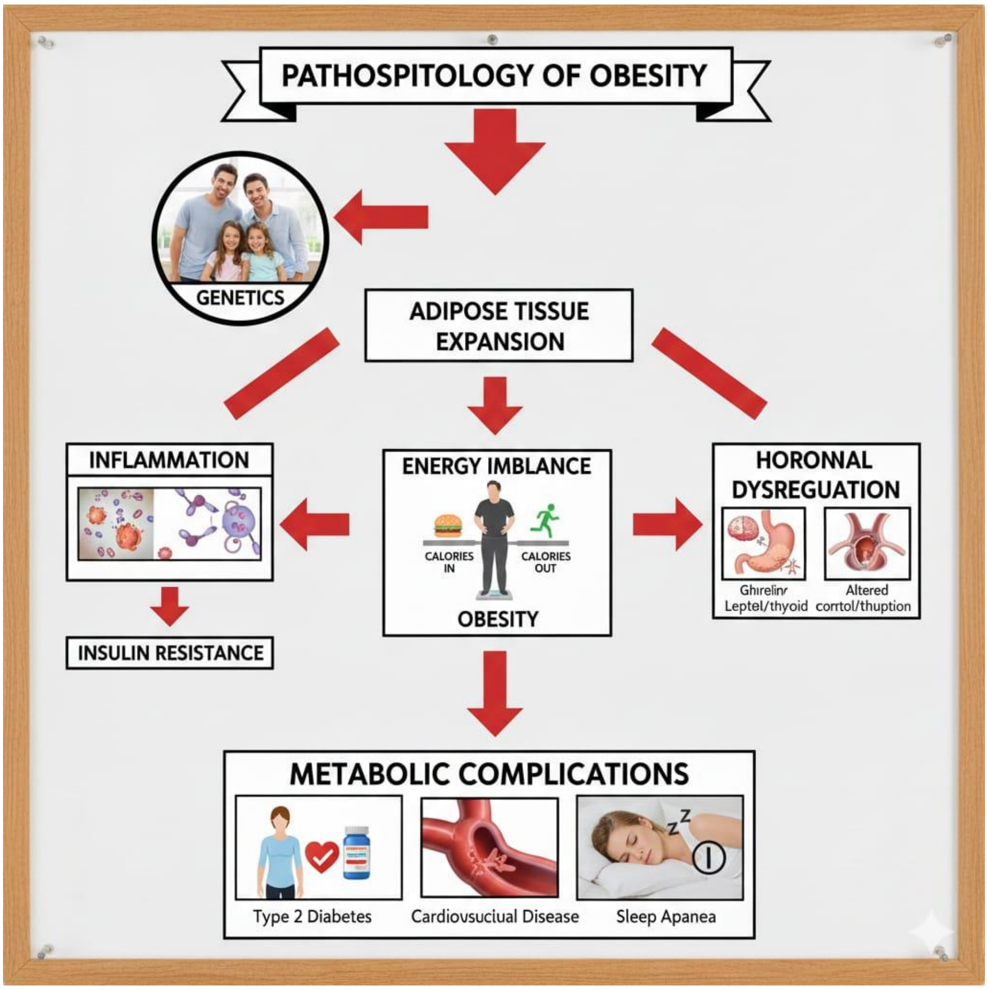


Fig. 1: Pathology Of Obesity.

Coconut (Cocos nucifera L.) peel and peanut (Arachis hypogaea L.) husk are commonly discarded agricultural wastes. However, these materials are rich in polyphenols, dietary fiber, flavonoids, tannins, and phenolic acids that contribute to antioxidant, anti-inflammatory, hypolipidemic, and anti-obesity effects. Their ability to modulate lipid metabolism, inhibit adipogenesis, enhance satiety, and improve gut microbiota highlights their promise as sustainable and cost-effective anti-obesity agents.

2. PLANT PROFILE

2.1 COCONUT

Coconut (Cocos nucifera L.) is a perennial palm widely cultivated in tropical and subtropical regions. While the edible endosperm and coconut water are extensively utilized, the coconut peel (exocarp and mesocarp) remains underutilized. Coconut peel contains abundant polyphenols, dietary fibers, lignin, and flavonoids that play a crucial role in regulating lipid metabolism and reducing oxidative stress, thereby contributing to anti-obesity activity.

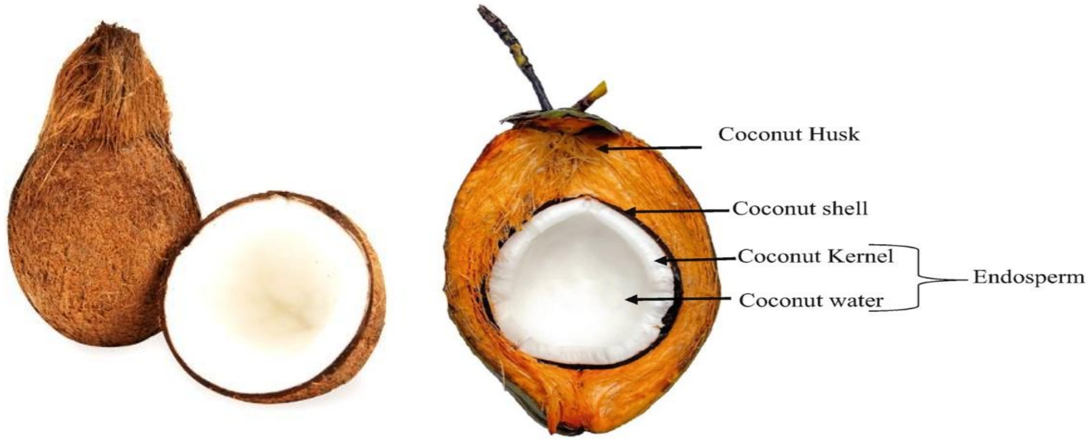


Fig. 2: Cocount.

- **SYNONYMS:** Cocos indica Royle, Cocos nana Griff, Cocos viridis Hassk,Calappa nucifera (L.) Kuntze
- **BIOLOGICAL SOURCE**: Coconut peel obtained from the fruit of Cocos nucifera L.
- **FAMILY**: Arecaceae

2.1.1 TAXONOMY

- Kingdom: Plantae
- Clade: Angiosperms
- Clade: Monocots
- Order: Arecales
- Genus: Cocos
- Species: Cocos nucifera

2.1.2 VERNACULAR NAMES:

- English: Coconut
- Tamil: (Thengai)
- Hindi: Nariyal
- Malayalam: Thenga
- Telugu – Kobbari
- Kannada – Tengu.
- Sanskrit – Narikela.

2.1.3 DESCRIPTION

Coconut is a tall palm tree producing large drupaceous fruits. The peel is fibrous, brown, and thick, forming the outer protective layer of the fruit.

2.1.4 MORPHOLOGY

Coconut is a tall, unbranched palm tree with a slender trunk and a crown of large, pinnate leaves. The fruit is a large, fibrous drupe consisting of an outer green to yellow exocarp, a thick fibrous mesocarp (husk or peel), and a hard endocarp enclosing the edible kernel and coconut water. The coconut peel is fibrous, tough, and rich in polyphenols, dietary fiber, and bioactive compounds with potential anti-obesity activity.

- **HABITAT**- Tall, perennial, unbranched palm reaching 20–30 m height.
- **LEAVES** - Large pinnately compound leaves forming a crown at the top.
- **FRUIT** - Large fibrous drupe with thick mesocarp (peel) and hard endocarp.
- **SEED** - Single large seed with white kernel and coconut water.

2.1.5 CHEMICAL CONSTITUENTS

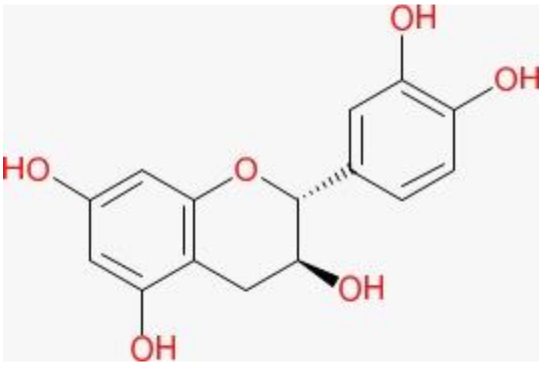


Fig. 3: Flavonoids (Catechin, Epicatechin).

Flavonoids: Flavonoids such as catechin and epicatechin, present in coconut peel, exhibit potent anti-obesity effects through multiple molecular, biochemical, and physiological pathways. These bioactive compounds regulate lipid metabolism, inhibit fat absorption, suppress adipogenesis, and improve metabolic functions.

Tannins: Tannins are polyphenolic compounds abundantly present in coconut peel, mainly as condensed tannins, which exhibit significant anti-obesity activity through multiple biochemical and physiological mechanisms.

Phenolic acids (gallic acid, ferulic acid,caffeic acid)**:**

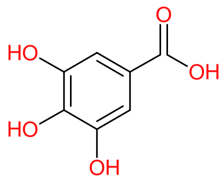


Fig: 4 Phenol compound

Phenolic acids such as gallic acid, ferulic acid, and caffeic acid, present in coconut peel, exhibit potent anti-obesity activity through multiple biochemical and molecular mechanisms. These compounds regulate lipid metabolism, inhibit fat absorption, suppress adipogenesis, and improve metabolic health.

Table: 1 Phenolic acid

S. No	Phenolic Acid	Main Actions
1	p-Coumaric acid	* Inhibits fat accumulation * Antioxidant activity * Anti-inflammatory effect
2	Ferulic acid	* Improves lipid metabolism * Activates AMPK pathway * Anti-diabetic and insulin-sensitizing effect
3	Caffeic acid	* Enhances lipolysis (fat breakdown) * Reduces oxidative stress * Regulates metabolic pathways

2.1.6 APPLICATION:

Inhibition of Digestive Enzymes: Catechin and epicatechin inhibit pancreatic lipase, α-amylase, and α-glucosidase, leading to reduced digestion and absorption of dietary fats and carbohydrates. This results in lower calorie intake and prevention of excess fat deposition.

Suppression of Adipogenesis (Fat Cell Formation): These flavonoids down regulate adipogenic transcription factors such as PPAR-γ and C/EBP-α, thereby inhibiting differentiation of pre-adipocytes into mature adipocytes and reducing adipose tissue expansion.

Enhancement of Lipid Metabolism and Fat Oxidation: Catechin and epicatechin activate AMP-activated protein kinase (AMPK), which enhances fatty acid oxidation, increases energy expenditure, and stimulates thermogenesis, resulting in increased breakdown of stored fat.

Antioxidant Activity: They exhibit strong antioxidant properties by scavenging free radicals and reducing oxidative stress, which prevents oxidative stress-induced adipogenesis and improves metabolic function.

Anti-Inflammatory Effects: Catechin and epicatechin suppress inflammatory mediators such as TNF-α, IL-6, and NF-κB(Nuclear Factor Kappa-Light-Chain-Enhancer of Activated B Cells), reducing chronic inflammation associated with obesity and improving insulin sensitivity.

Regulation of Glucose Metabolism and Insulin Sensitivity: These flavonoids improve insulin signaling, enhance glucose uptake in skeletal muscle and adipose tissue, and reduce insulin resistance, thereby preventing obesity-associated metabolic disorders.

Dietary fiber: Coconut peel is rich in dietary fibers, mainly cellulose, hemicellulose, pectin, and lignin, which play a vital role in body weight regulation and prevention of obesity through multiple physiological mechanisms.

Increase in Satiety and Reduction of Appetite: Dietary fibers absorb water and swell in the stomach, increasing gastric distension and delaying gastric emptying. This promotes a feeling of fullness (satiety), reduces hunger, and decreases overall food intake, thereby helping in weight control.

Reduction of Fat and Calorie Absorption: Fibers bind to dietary fats and bile acids in the intestine, reducing fat digestion and absorption. This leads to decreased calorie uptake and promotes fecal excretion of fats, thereby preventing fat accumulation.

Regulation of Glucose Absorption and Insulin Response: Dietary fibers slow down carbohydrate digestion and glucose absorption, preventing sudden spikes in blood glucose levels. This improves insulin sensitivity and reduces insulin resistance, which helps prevent fat storage and obesity-related metabolic disorders.

Modulation of Gut Microbiota: Fibers act as prebiotics, promoting the growth of beneficial gut bacteria. These bacteria produce short-chain fatty acids (SCFAs) such as acetate, propionate, and butyrate, which regulate lipid metabolism, reduce inflammation, and improve energy homeostasis.

Enhancement of Lipid Metabolism: Dietary fibers increase bile acid excretion and stimulate cholesterol metabolism, leading to improved lipid profiles, reduced fat storage, and enhanced fat oxidation.

Reduction of Inflammation and Oxidative Stress: Fibers indirectly reduce chronic inflammation and oxidative stress by improving gut health and metabolic regulation, thereby preventing obesity-associated complications.

2.1.7 SIMPLE EXTRACTION PROCEDURE

Coconut Peel – Cocos nucifera

Method: Hydro-alcoholic Maceration (70% Ethanol)

Procedure:

- Collect fresh coconut peel (mesocarp), wash thoroughly to remove impurities.
- Shade dry for 7–10 days until completely moisture free.
- Grind into coarse powder.
- Soak the powder in 70% ethanol (1:10 ratio) in a closed container.
- Keep for 48–72 hours with occasional shaking.
- Filter using muslin cloth/Whatman filter paper.
- Concentrate the filtrate using water bath at low temperature (40–50°C).
- Store the dried extract in an airtight container.

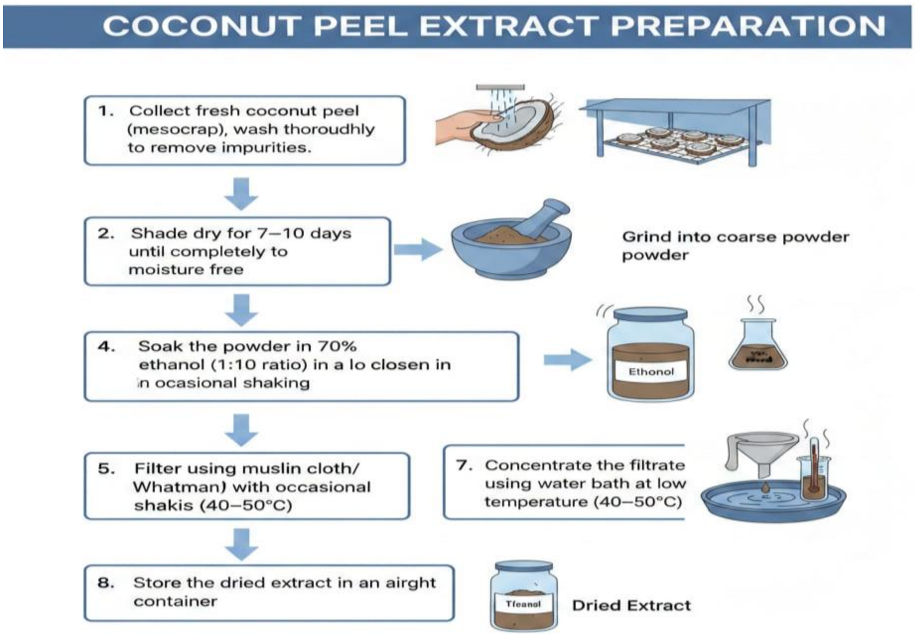


Fig. 5: Simple extraction.

Justification

70% ethanol effectively extracts both polar (phenolic acids, flavonoids) and moderately non-polar compounds.

Hydro-alcoholic extraction gives higher polyphenol yield.
Simple, economical, and suitable for pharmacological studies.
Preserves heat-sensitive bioactive compounds.

2.1.8 Medicinal Uses:

Coconut skin/testa and husk extract have demonstrated various health-promoting activities:

Wound Healing: The sheath scales can be applied directly to wounds; their fibrous nature acts as a "bandage" to stop bleeding (hemostatic), while their phytochemicals promote rapid healing.

Antimicrobial and Antifungal: The testa and husk extracts have significant antibacterial and antifungal properties, making them effective against skin pathogens, including Candida and various dermal mycosis (skin fungi).

Antioxidant Activity: Due to high phenolic content, the extracts show high radical scavenging capabilities (ABTS and DPPH radicals), protecting cells from oxidative stress.

Anti-inflammatory: Extracts are used in traditional medicine to reduce skin inflammation, such as in dermatitis or burns.

Antineoplastic (Anti-cancer) Activity: Research indicates that husk extracts exhibit cytotoxicity against certain cancer cells (e.g., human erythroleukemia K562 cells).

Skin Care: When converted into activated charcoal, it is used to cleanse skin, unclog pores, and remove dead skin cells and impurities.

2.1.9 ANTI-OBESITY MECHANISM:

- Inhibition of lipid absorption
- Reduction of adipocyte differentiation
- Enhancement of fatty acid oxidation
- Improvement of gut microbiota balance

2.2 PEANUT

Peanut (Arachis hypogaea L.) is a leguminous crop cultivated worldwide for its edible seeds. Peanut husk, a major agricultural by-product, is rich in polyphenols, resveratrol, lignans, and insoluble fibers. These bioactive compounds exhibit antioxidant and lipid-lowering properties that play a vital role in body weight regulation and obesity prevention.

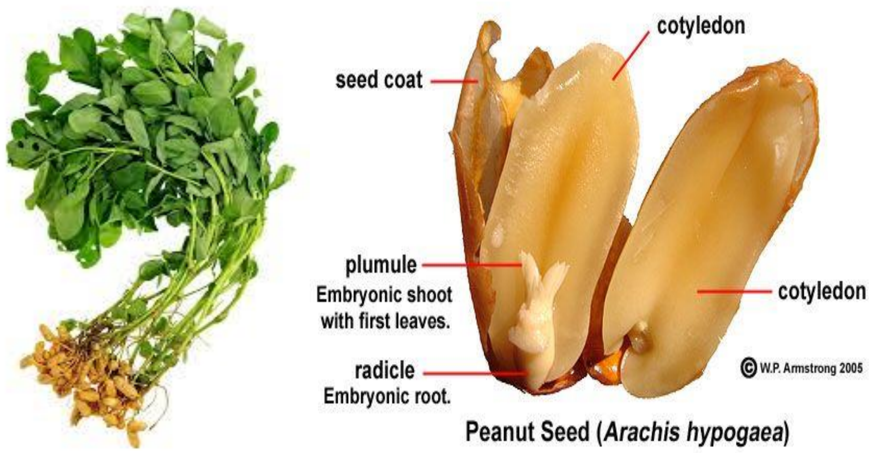


Fig: 6 *Arachis hypogaea L.*

- **SYNONYMS:** Arachis nambyquarae Hoehne, Arachis rasteiro Hoehne, Arachis vulgaris Lam, Arachis procumbens Poir.
- **BIOLOGICAL SOURCE**: Peanut husk obtained from the pods of Arachis hypogaea L.
- **FAMILY**: Fabaceae

2.2.1 TAXONOMY

- Kingdom: Plantae
- Clade: Angiosperms
- Clade: Eudicots
- Order: Fabales
- Family: Fabaceae
- Genus: Arachis
- Species: Arachis hypogaea

2.2.2 VERNACULAR NAMES:

- English: Peanut
- Tamil: (Verkadalai)

- Hindi: Moongphali
- Telugu – Verusenaga
- Kannada – Kadlekai
- Malayalam – Nilakkadala.

2.2.3 DESCRIPTION:

Peanut husk is the dry, fibrous outer shell that encloses the peanut seeds.

2.2.4 MORPHOLOGY

Peanut is a low-growing, annual, herbaceous plant with a prostrate to erect growth habit. The plant bears compound leaves and yellow flowers. After fertilization, the peg elongates and penetrates the soil, where the pod develops. The peanut seed is covered by a thin reddish-brown skin (testa), which is rich in polyphenols, flavonoids, tannins, and proanthocyanidins exhibiting strong anti-obesity properties.

- **HABITAT-**Low-growing annual herb, 30–50 cm tall.
- **LEAVES-**Pinnately compound leaves with two pairs of leaflets.
- **FRUITS**-Underground legume (pod) containing 1–4 seeds.
- **SEEDS**-Covered with reddish-brown testa rich in polyphenols.

2.2.5 CHEMICAL CONSTITUENTS:

Resveratrol: Resveratrol is a natural polyphenolic compound abundantly present in peanut skin (peel). It exhibits strong anti-obesity activity through multiple molecular and physiological pathways. Inhibition of Adipogenesis (Fat Cell Formation)

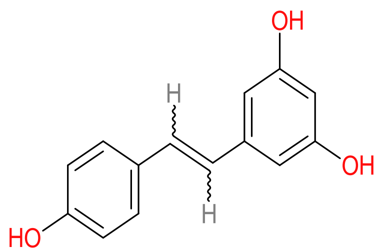


Fig. 7: Resveratrol.

Down regulating key transcription factors: PPAR-γ (Peroxisome Proliferator-Activated Receptor-γ)C/EBP-α (CCAAT-enhancer-binding protein-α)

Activation of AMPK Pathway (Energy Metabolism Regulation) Resveratrol activates AMP-activated protein kinase (AMPK), a key regulator of energy balance.

- ❖ Increases fatty acid oxidation
- ❖ Decreases lipid synthesis
- ❖ Enhances glucose uptake
- ❖ Enhancement of Lipolysis (Fat Breakdown)

Resveratrol promotes breakdown of stored triglycerides by:

- ❖ Activating hormone-sensitive lipase (HSL)
- ❖ Activating adipose triglyceride lipase (ATGL)
- ❖ Thermogenesis Activation (Heat Production)

Resveratrol stimulates brown adipose tissue (BAT) and increases:

- ❖ UCP-1 (Uncoupling Protein-1) expression
- ❖ Anti-Inflammatory Effect
- ❖ Obesity is associated with chronic low-grade inflammation.

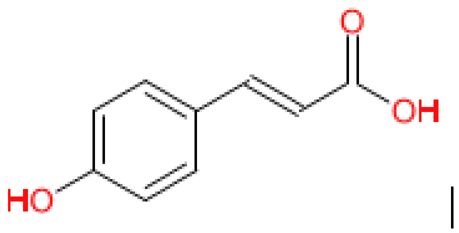
Resveratrol reduces inflammatory mediators:

- ❖ TNF-α
- ❖ IL-6
- ❖ CRP
- ❖ Antioxidant Activity

Resveratrol scavenges free radicals and reduces oxidative stress:

- ❖ Protects mitochondria
- ❖ Improves metabolic efficiency

1. **phenolic acid** (p-coumaric acid,ferulic acid,caffeic acid)**:**



- ❖ Inhibition of Adipogenesis (Fat Cell Formation)

Phenolic acids suppress the differentiation of pre-adipocytes into mature adipocytes by:

Down-regulating adipogenic transcription factors:

- PPAR-γ
- C/EBP-α
- SREBP-1c(Sterol Regulatory Element-Binding Protein-1c)
- Activation of AMPK Pathway (Energy Balance Control)

These phenolic acids activate AMP-activated protein kinase (AMPK):

- ↑ Fatty acid oxidation
- ↓ Lipogenesis (fat synthesis)
- ↑ Glucose uptake
- Enhancement of Lipolysis (Fat Breakdown)

They stimulate fat breakdown by:

- Increasing hormone-sensitive lipase (HSL)
- Increasing adipose triglyceride lipase (ATGL)
- Inhibition of Digestive Enzymes (Reduced Fat Absorption)

Phenolic acids inhibit:

- Pancreatic lipase
- α-amylase & α-glucosidase
- Anti-Inflammatory Activity

They suppress inflammatory mediators:

- TNF-α
- IL-6
- NF-κB
- Antioxidant Activity:

Strong free-radical scavenging activity:

- ↓ Oxidative stress
- Protects mitochondria
- Improves lipid metabolism

Table 2: Phenolic acid.

S. No	Phenolic acid	Main actions
1	p-Coumaric acid	Inhibits fat accumulation, antioxidant, anti-inflammatory
2	Ferulic acid	Improves lipid metabolism, AMPK activation, anti-diabetic
3	Caffeic acid	Enhances lipolysis, reduces oxidative stress, metabolic regulation

2. Flavonoids(Catechin, Epicatechin, Quercetin)**:**

Table: 3 Flavonoids

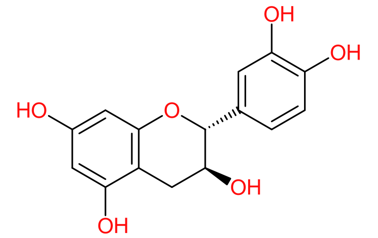
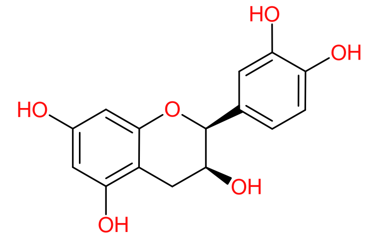
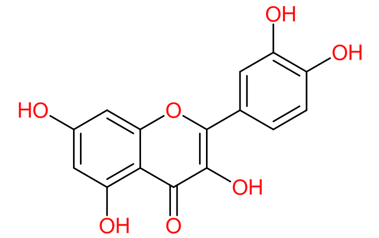
		
CATECHIN	EPICATECHIN	QUERCETIN

Table: 4 Flavonoids role in obesity

S. No	Flavonoid	Major anti-obesity actions
1	Catechin	Activates AMPK, enhances fat oxidation, antioxidant
2	Epicatechin	Improves lipid metabolism, increases lipolysis
3	Quercetin	Inhibits adipogenesis, reduces inflammation, boosts thermogenesis

3. Proanthocyanidins (condensed tannins)**:**

Proanthocyanidins also known as condensed tannins, are abundant polyphenolic compounds present in peanut (Arachis hypogaea) skin. They exhibit potent anti-obesity effects through multiple biochemical and molecular mechanisms

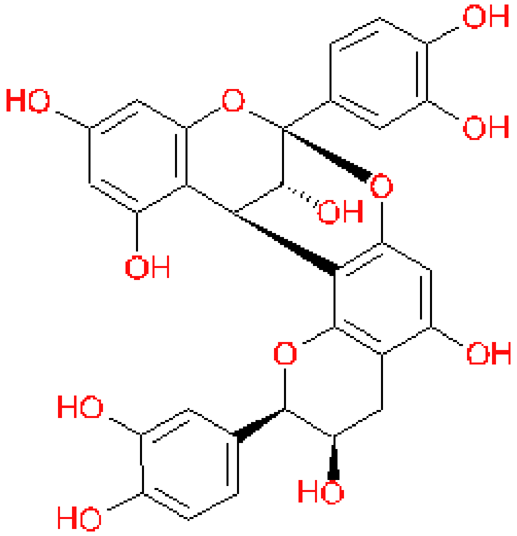


Fig. 8: Proanthocyanidins.

2.2.5 SIMPLE EXTRACTION PROCEDURE:

Peanut Skin – Arachis hypogaea:

Method: Ethanolic Maceration

Procedure:

- Separate peanut skins from seeds manually.
- Shade dry for 3–5 days.
- Pulverize into fine powder.
- Soak in 80% ethanol (1:10 ratio) for 48 hours.
- Shake intermittently for better extraction.
- Filter and concentrate under reduced temperature.
- Dry and store in airtight container.

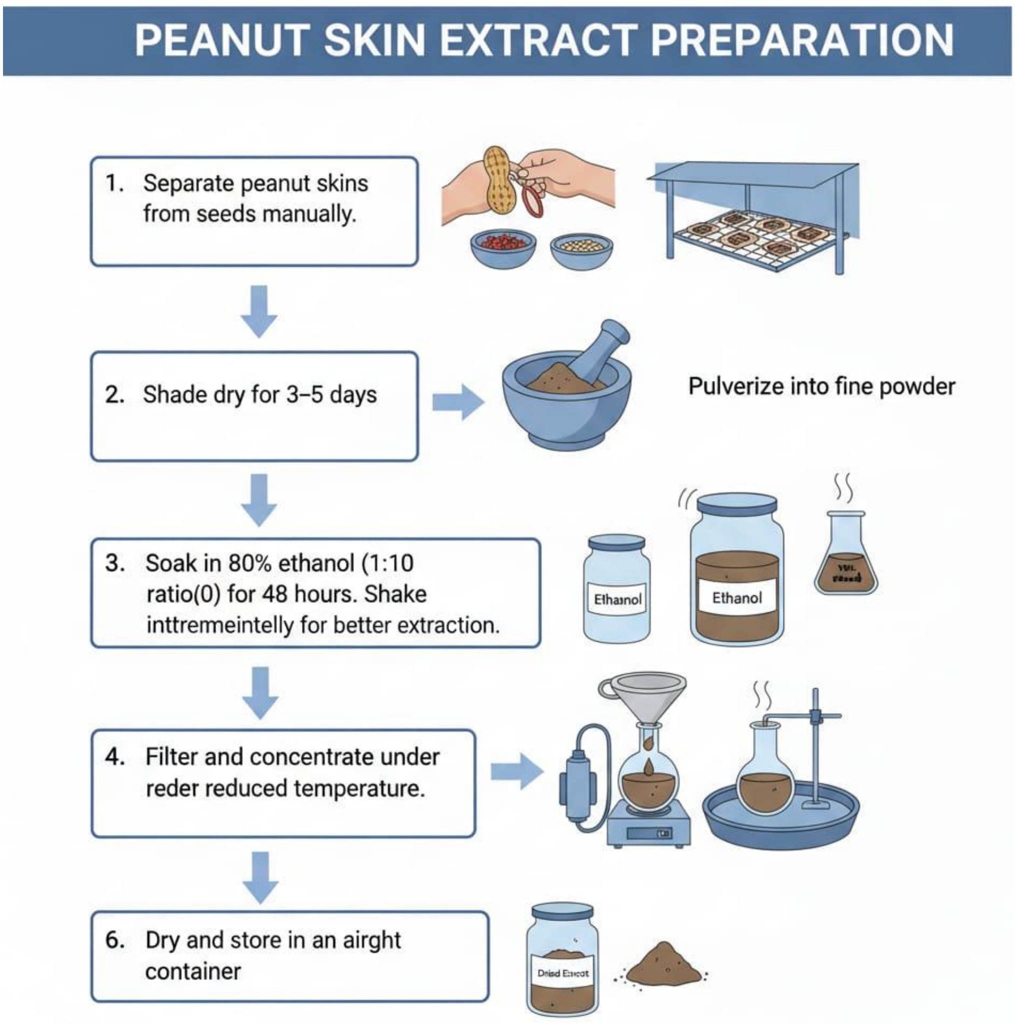


Fig. 9: Simple extraction.

Justification:

Ethanol is highly effective for extracting resveratrol, proanthocyanidins, flavonoids, and tannins. Safer and less toxic compared to methanol. Provides high antioxidant and anti-obesity active compound recovery. Suitable for nutraceutical and pharmaceutical applications.

2.2.6 Medicinal Benefits:

Antioxidant and Anti-inflammatory Agent: Peanut skin acts as a powerful antioxidant by neutralizing free radicals, which reduces oxidative stress linked to aging and chronic diseases. They also contain tannins and phenolic acids that exhibit strong anti-inflammatory effects.

Cardiovascular Health: The polyphenols, specifically proanthocyanidins in the skin, protect the heart by reducing oxidative damage to blood vessels, lowering LDL (bad) cholesterol, and increasing HDL (good) cholesterol.

Neuroprotective Effects: Research indicates that peanut skin extracts can protect against neurodegenerative disorders, such as Alzheimer's and Parkinson's disease, by protecting neurons from oxidative stress.

Blood Sugar Regulation: The fiber and polyphenols in the skin help stabilize blood pressure and reduce sudden spikes in blood sugar levels, making them beneficial for managing diabetes.

Gut Health Improvement: The dietary fiber in the skin acts as a prebiotic, supporting the growth of beneficial gut bacteria and strengthening the intestinal lining.

Anti-Cancer Potential: Studies suggest that bioactive compounds in peanut skins may inhibit the growth and spread of certain cancer cells, such as leukemia cells.

Traditional Uses: In Traditional Chinese Medicine (TCM), peanut skins are used to stop bleeding, disperse blood stasis, and reduce swelling.

2.2.7 ANTI-OBESITY MECHANISM

- Suppression of adipogenesis
- Reduction of triglyceride accumulation
- Improvement of insulin sensitivity
- Appetite regulation

4. LITERATURE REVIEW:

Table: 5 Literature review

S. No.	PLANT/PART	SOLVENT	ACTIVITY	RESULT	REFERENCE
1.	Coconut Peel	Ethanol	Anti-obesity	Significant reduction in body weight and serum lipid levels in high-fat diet-induced obese rats	Logesh et al., 2025
2.	Coconut Peel	Methanol	Antioxidant	High free radical scavenging activity due to polyphenols	Arivalagan et al., 2018
3.	Peanut Skin	Aqueous	Anti-obesity	Decreased adipocyte size and fat accumulation Research findings	Bansode et al., 2019
4.	Peanut Skin	Ethanol	Hypolipidemi-c	Reduced total cholesterol and triglycerides	Francisco & Resurreccion, 2009
5.	Coconut peel	Methanol	Antioxidant	Showed strong DPPH radical scavenging activity (>70%) due to high phenolic content	Arivalagan et al., 2018
6.	Coconut peel	Ethanol	Anti-inflammatory	Significantly reduced inflammatory mediators (NO, TNF-α) in vitro	Seneviratne & Dissanayake, 2019
7.	Coconut peel	Aqueous	Dietary fiber activity	High insoluble fiber content improved bowel function and gut health	Prades et al., 2016
8.	Coconut peel	Ethanol	Antimicrobial	Inhibited growth of E. coli and S. aureus	Silva et al., 2017
9.	Coconut peel	Hydro-alcoholic	Antioxidant	Increased total antioxidant capacity and protected cells from oxidative damage	Kumar et al., 2021
10.	Coconut peel	Acetone	Antioxidant	Demonstrated effective free radical scavenging activity	Singh et al., 2022
11.	Peanut skin (Arachis hypogaea)	Methanol	Antioxidant	Exhibited very high antioxidant activity, higher than whole peanuts	Yu et al., 2005
12.	Peanut skin	Ethanol	Cardioprotecti-ve	Reduced LDL oxidation and improved lipid profile	Francisco & Resurreccion, 2009
13.	Peanut skin	Aqueous	Antidiabetic	Improved insulin sensitivity and lowered blood glucose levels	Lou et al., 2014
14.	Peanut skin	Methanol	Neuroprotecti-ve	Reduced oxidative stress and neuronal cell damage	Limmongkon et al., 2017
15.	Peanut skin	Ethanol	Antimicrobial	Delayed lipid oxidation and extended shelf life of food products	Nepote et al., 2004
16.	Peanut skin	Acetone	Phenolic content	Showed highest total phenolics and flavonoids among tested solvents	Ballard et al., 2010

17.	Peanut skin	Hydro-alcoholic	Anti-inflammatory	Significantly reduced inflammatory cytokines	Zhao et al., 2019
18.	Coconut peel & Peanut skin	Methanol	Comparative antioxidant	Peanut skin showed higher antioxidant potential than coconut peel	Kumar et al., 2021

3.1 ADDITIONAL CONTENT:

SYNERGISTIC EFFECT OF COCONUT PEEL AND PEANUT SKIN

Synergistic Anti-Obesity Effect

The combination of coconut peel (Cocos nucifera L.) and peanut skin (Arachis hypogaea L.) may produce a synergistic anti-obesity effect due to complementary phytochemical profiles.

Coconut peel is rich in:

- Dietary fiber
- Catechin and epicatechin
- Gallic acid
- Ferulic acid
- Tannins

Peanut skin is rich in:

- Resveratrol
- Proanthocyanidins (condensed tannins)
- Quercetin
- Phenolic acids
- Lignans

When combined, these phytochemicals act through multiple pathways simultaneously, leading to enhanced therapeutic efficacy.

Mechanism of Synergism

1. Dual Inhibition of Fat Absorption

Both materials inhibit: Pancreatic lipase, α-amylase, α-glucosidase

Combined inhibition results in stronger reduction of calorie absorption.

2. Enhanced AMPK Activation

Resveratrol (peanut skin) + catechins (coconut peel) both activate AMPK pathway.

AMPK activation leads to:

- ↑ Fatty acid oxidation
- ↓ Lipogenesis
- ↑ Energy expenditure

Combined activation enhances metabolic regulation more effectively than single extract.

3. Stronger Antioxidant Protection:

Proanthocyanidins + phenolic acids + flavonoids together:

- Reduce oxidative stress
- Protect mitochondria
- Prevent oxidative stress-induced adipogenesis
- This reduces obesity-associated inflammation.

4. Improved Gut Microbiota Modulation

- Dietary fiber (coconut peel) + polyphenols (peanut skin):
- Increase beneficial bacteria (Lactobacillus, Bifidobacterium)
- Increase SCFA (Short-Chain Fatty Acids)production
- Improve metabolic homeostasis
- This supports long-term weight regulation.

5. Multi-Target Pharmacological Action

The combination provides

a) Anti-obesity
b) Hypolipidemic
c) Antidiabetic
d) Anti-inflammatory
e) Hepatoprotective
f) Cardioprotective
g) Thus, it acts as a multi-target metabolic regulator.

4. CONCLUSION

Coconut peel and peanut husk, traditionally considered agricultural waste, demonstrate remarkable anti-obesity potential due to their rich phytochemical composition. Their ability to regulate lipid metabolism, inhibit adipogenesis, and improve antioxidant status supports their application as natural anti-obesity agents. Utilizing these bio-wastes not only provides an eco-friendly solution but also contributes to the development of sustainable nutraceuticals. Further clinical studies and formulation research are required to validate their efficacy and safety in human populations.

Coconut peel (Cocos nucifera L.) and peanut skin (Arachis hypogaea L.), traditionally considered agricultural waste materials, are rich sources of bioactive phytochemicals including flavonoids, phenolic acids, proanthocyanidins, lignans, resveratrol, tannins, and dietary fibers. These compounds exert significant anti-obesity effects through inhibition of digestive enzymes, suppression of adipogenesis, activation of AMPK-mediated lipid metabolism, enhancement of fatty acid oxidation, modulation of gut microbiota, and reduction of oxidative stress and inflammation.

The combination of coconut peel and peanut skin may produce a synergistic therapeutic effect due to complementary mechanisms of action, resulting in enhanced regulation of energy metabolism and fat accumulation. Their utilization not only provides a cost-effective and sustainable approach for obesity management but also promotes agro-waste valorization and development of eco-friendly nutraceutical formulations. However, further in vivo studies, clinical trials, toxicity evaluation, and formulation optimization are necessary to establish their safety, dosage standardization, and long-term efficacy in human subjects.

COMPARATIVE PHYTOCHEMICAL PROFILE

Table: 6 Comparative Phytochemical Profile.

Component	Coconut peel	Peanut skin
Dietary fiber	High	Moderate
Resveratrol	Low	High
Proanthocyanidins	Moderate	High
AMPK activation	Yes	yes

REFERENCES

1. Balasubramaniam, V. et al. (2019). Polyphenols from coconut by-products and their health benefits.
2. Lopes, M. et al. (2018). Anti-obesity effects of agricultural waste-derived polyphenols.
3. Yu, J. et al. (2020). Peanut husk bioactive compounds and metabolic regulation.
4. Authors: S. R. Kothari, R. J. Nair, A. MathewYear: 2024Title: Perspectives on the cardioprotective, neuroprotective and anti-obesity functions of coconut (Cocos nucifera

L.)Journal: Food Bioscience, Elsevier Website: https://www.sciencedirect.com/science/article/pii/S221242922400186X

5. Authors: Lan He, Zhan Su, Shuangshuang WangYear: 2024Title: The anti-obesity effects of polyphenols: molecular mechanisms and signaling pathwaysJournal: Frontiers in Nutrition Website: https://pubmed.ncbi.nlm.nih.gov/39539361/
6. Authors: Fu Jin-Feng, Wang Ping-Ping, Chen Chun et al.Year: 2025Title: Dietary Polyphenols in Obesity Management: Critical InsightsJournal: Journal of Food Science Website: https://pubmed.ncbi.nlm.nih.gov/40504654/
7. Authors: Rajan Logesh, Deepak Solanki, Kumarappan Chidambaram et al.Year: 2025Title: Flavonoid-rich peanut shell extract targeting pancreatic lipase to regulate lipid metabolismJournal: Molecular Nutrition & Food
8. Authors: Xiao-Meng Sun, Hai-Qing Ye, Jing-Bo Liu et al.Year: 2018Title: Assessment of ant…Nutraceuticals in Obesity Management and ControlEditors: Raj K. Keservani, Alka LohaniYear: 2025Publisher: Apple Academic Press (CRC / Taylor & Francis) Website: https://www.routledge.com/product/isbn/9781040228104
9. Authors: Rishipal R. Bansode, Priscilla Randolph, Mohamed Ahmedna et al.Year: 2019
Title: Dietary supplementation with peanut skin polyphenolic extracts reduces hepatic lipid accumulationJournal: Journal of Medicinal Food Website: https://pubmed.ncbi.nlm.nih.gov/25184693
10. Authors: Pornpat Aom Jantip, Chandra K Singh, Nihal Ahmad et al.Year: 2025
Title: Peanut skin polyphenols and bioavailability of A-type proanthocyanidinsJournal: Journal of Food Science Website: https://pubmed.ncbi.nlm.nih.gov/39949260/
11. Authors: Fu Jin-Feng et al. Year: 2025 Title: Dietary polyphenols in obesity management Journal: Journal of Food Science Website: https://pubmed.ncbi.nlm.nih.gov/40504654/Research
Website: https://pubmed.ncbi.nlm.nih.gov/41273125/
12. Logesh R., et al. (2025) – Anti-obesity potential of peanut shell extract via pancreatic lipase inhibition and lipid metabolism modulation. https://pubmed.ncbi.nlm.nih.gov/41273125/
Al Mamun A., et al. (2024) – Dietary polyphenols in immune modulation and obesity: molecular insights and therapeutic potential. https://www.mdpi.com/2218-273X/14/2/221