WORLD JOURNAL OF PHARMACEUTICAL RESEARCH
Coden USA: WJPRAP Impact Factor 8.453
Volume 14, Issue 23, 918-936. Research Article ISSN 2277–7105

NEUTRACEUTICAL: ENRICHED LOW- GLYCEMIC MUFFINS FOR DIETARY MANAGEMENT OF PCOD

***Pagar Anushka Yogesh, Pagar Jagruti Ravindra, Patil Anushka Deepakrao, Pagar Siddhi Kishor, Pagar Kaveri Amar, Ms. Priti C. Patle**

*Loknete Dr. J. D. Pawar College of Pharmacy, Down Hill Campus, Dattabhoomi, Manur, Tal Kalwan Dist. Nashik, Affiliation To Savitribai Phule University.

Article Received on 01 Nov. 2025,
Article Revised on 21 Nov. 2025,
Article Published on 01 Dec. 2025,
https://doi.org/10.5281/zenodo.17747106

***Corresponding Author**
Pagar Anushka Yogesh
Loknete Dr. J. D. Pawar College of Pharmacy, Down Hill Campus, Dattabhoomi, Manur, Tal Kalwan Dist. Nashik, Affiliation To Savitribai Phule University.

How to cite this Article: *Pagar AnushkaYogesh, Pagar Jagruti Ravindra, Patil Anushka Deepakrao, Pagar Siddhi Kishor, Pagar Kaveri Amar, Ms. Priti C. Patle. (2025) NEUTRACEUTICAL: ENRICHED LOW-GLYCEMIC MUFFINS FOR DIETARY MANAGEMENT OF PCOD. "World Journal of Pharmaceutical Research, 14(23), 918–936.

ABSTRACT

The most common hormonal disorder is polycystic ovarian disease (PCOD).delivering females in their reproductive years. It has irregular hormone levels and insulin resistance, elevated testosterone levels, menstrual cycles, and small ovarian cysts,symptoms such as ovarian dysfunction.5–10% of people of reproductive age have PCOD.15% of women who are infertile are getting older. PCOS is characterized by intrinsic insulin resistance, a high risk of cardiovascular disease, and type 2 diabetes. This review concentrated on dietary strategies and practices that have been played a significant part in PCOS treatment. Compared to the conventional diet approach, a low-carb diet (LC) is a better and more desirable choice. Low glycemic muffins For PCOD Diseases are those that cause weight loss followed by maintenance. That Encourage weight loss, followed by weight maintenance. This research investigates the evolution and the use of low-glycemic foods as a functional food for women with PCOD. The muffin is carefully made with low-ingredient ingredients like whole grain. Almonds flour, oats, and Stevia and other natural sweeteners reduce postprandial conversation spikes in glucose. The muffins' formulation contained high fiber, according to nutritional analysis. Fiber reduced carbohydrate load, higher protein quality, and content in comparison to Convenient, efficacious, glycemic, practical, lacto palatable, and palatable food PCOS nutritional management intervention Keywords.

KEYWORDS: Dietary management, insulin resistance, low glycemic muffins, and carbohydrate.

INTRODUCTION

Six to ten percent of women worldwide who are of reproductive age suffer from polycystic ovarian disease (PCOD), one of the most common endocrine disorders. A variety of reproductive and metabolic disorders are the result of the condition's intricate interaction between hormonal imbalances, metabolic dysfunction, and genetic predisposition.[1] PCOS is a "syndrome," or collection of symptoms, that impacts ovulation and the ovaries. Ovarian cysts, elevated male hormone levels, and irregular or skipped periods are its three primary characteristics. In their reproductive years, up to nearly 27% of women suffer from polycystic ovarian syndrome, or PCOS. It is associated with irregular periods, levels of male hormones, and ovarian cysts.[2] Stein-Leventhal Syndrome is another name for PCOD (Polycystic Ovary Syndrome). Clusters of tiny, pearl-sized cysts in the ovaries are frequently caused by PCOD. The cysts contain immature eggs and are filled with fluid. This disorder may be influenced by both environmental and genetic factors. Physical appearance changes, irregular menstrual cycles, diabetes, heart attacks, obesity, mood disorders, endometrial cancer, and sleep apnea are all consequences of PCOD if left untreated. PCOD typically affects women between the ages of 14 and 44.[3] An adult follicle, which is also a cystic structure, forms during a typical menstrual cycle with ovulation. An ovulation-ready mature follicle has a diameter of approximately 18 to 28 mm. Despite having many tiny antral follicles with eggs inside, polycystic ovaries lack proper development and maturation, which results in no ovulation. This is the main distinction between polycystic and normal ovaries. Menstrual periods are irregular for women with polycystic ovaries because they do not ovulate regularly.[4]

PCOD's visible symptoms, such as weight gain, hirsutism, and acne, can lead to social retraction, low self-esteem, and issues with body image. Stress and emotional turmoil are exacerbated by the emotional toll of infertility, cultural expectations, and misconceptions about the condition. The challenges women face in overcoming these psychological barriers are made worse by the lack of knowledge and support regarding mental health conditions linked to PCOD.[5] The incapacitating mental illness known as obsessive-compulsive disorder (OCD) is typified by a constant stream of undesirable thoughts followed by repetitive mental or physical behaviors intended to alleviate the anxiety these events evoke. PCOD, or polycystic ovarian disease[6] Two or three of the following are present in the Rotterdam

criteria, which are commonly used to define PCOS: polycystic ovaries, oligo/anovulation, and clinical or biochemical hyperandrogenism. The clinical characteristics of women with PCOS are varied and include metabolic, psychological, cosmetic, and reproductive aspects.[7]

OBJECTIVE

1. To determine the causes of PCOS/PCOD in female college students
2. To determine the proportional prevalences of lifestyle factors across various dimensions.
3. To learn more about how physical activity affects PCOS and PCOD.
4. To observe how stress affects PCOS and PCOD.[8]
5. Evaluating the impact of lifestyle factors such as BMI, diet, physical activity, stress, and family history of PCOD was the study's goal.
6. 750 samples from schools and colleges participated in the cross-sectional descriptive Study.[9]

FEATURE

Excessive levels of male hormones and ovarian cysts are the two primary features of PCOS. However, women with PCOS may encounter the following common problems.

- An excessive amount of body hair is known as hirsutism.
- irregular or nonexistent times
- prolonged menstruation
- Acne, oily skin, and other skin conditions
- Hair loss and thinning on the scalp
- Resistance to insulin
- Problems with body weight and fertility.[10]

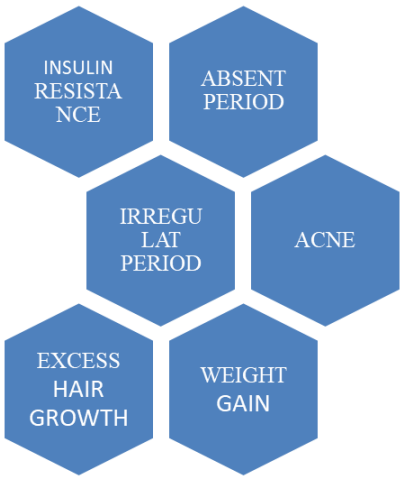

Fig. 1: Symptoms Of PCOD.

SYMPTOM

[Any of the following symptoms may be present].

- Period irregularities are the most common symptom of PCOD. Period irregularities or anxiety are the initial symptoms of PCOD. To detect PCOD, pay close attention to your monthly cycle.
- Overgrowth of facial hair: This condition is known as hirsutism. Women with PCOD grow their hair excessively because their ovaries secrete a lot of androgens, a masculine hormone. Up to 70% of women with PCOS have hirsutism, a common clinical manifestation of hyperandrogenism. Hormonal fluctuations linked to PCOS cause excessive hair growth, which can affect the face, arms, back, chest, thumbs, toes, and abdomen.[11]
- Anxiety and depression; PCOS, the most common cause of infertility, which is caused by irregular ovulation. periods that are heavy, especially those that happen late. Distention, heaviness, and stabbing pain are all symptoms of pelvic pain. Pain when menstruating or ovulating. bleeding while a cycle is going on. Weight gain around the waist, dandruff, acne, thinning hair (which mimics male baldness), and increased hair growth on the face, chest, stomach, back, thumbs, or toes are examples of physical changes that typically occur later but are not alway present.

CAUSES OF PCOS

- inflammation of the ovaries and uterus.
- Hereditary susceptibility
- Children's strong adrenal stimulation
- Increased insulin levels
- Pregnancy pills
- An imbalance in hormones
- Stress
- In children, strong adrenal gland stimulation
- The buildup of toxins.[12]

HISTORY

Despite polycystic ovaries being first described in France in 1844, two New York gynecologists, Irving F. Stein and Michael L. Leventhal, diagnosed women with what is now known as severe PCOS in 1935. The women described had amenorrhea (no periods),

polycystic ovaries (large ovaries with multiple cysts), and severe hirsutism (unwanted hair).[13] In the late 1950s and early 1960s, Janet MacArthur, Joseph W. Goldzieher, and others began to write detailed descriptions of women who had PCOS. In 1958, McArthur et al. employed a functional bioassay to measure serial daily excretion of interstitial-cell-stimulating hormone (ICSH/LH) from 24-hour urine samples using the weights of immature rat testicles and prostates.[14]

ETIOLOGY

PCOS is caused by three main factors: insulin resistance, ovarian and adrenal hyperandrogenism, and abnormal gonadotropin discharges. Uncontrolled regulation of gonadotropin-releasing hormone (GnRH) can lead to excessive secretion of testosterone, estradiol, and dehydroepiandrosterone; follicular arrest; elevated anti-Mullerian hormone (AMH); decreased FSH; and increased luteinizing hormone (LH). An increase in circulating androgens may result from these disorders' disruption of ovarian steroid hormone synthesis, which may be particularly noticeable in women with polycystic ovarian syndrome. In hyperinsulinism and hypogonadism, insulin tends to stimulate the gonadal and adrenal glands to produce more androgens. Hyperinsulinism is a major risk factor for PCOS.[15] The etiology of PCOD is complex and includes interactions between genetic predisposition, environmental exposures, and lifestyle factors. The finding that a family history of metabolic or reproductive disorders increases vulnerability suggests that there may be a genetic component. Moreover, exposure to endocrine-disrupting chemicals, poor eating habits, and sedentary lifestyles can all exacerbate hormonal imbalances.[16]

PATHOPHYSIOLOGY

Polycystic ovarian syndrome (PCOS) develops and progresses through a number of levels and mechanisms, including:

1. Hormonal imbalances: Compared to normal, women with PCOS have lower levels of the female hormone progesterone and higher amounts of the androgen hormone in men. irregular periods, acne, and other PCOS symptoms can result from this hormonal imbalance.
2. Insulin resistance: A large number of women with PCOS also have impaired body utilization of insulin due to insulin resistance High blood insulin levels may result from this, which may hasten the onset of PCOS.

3. Inflammation: Because chronic low-grade inflammation can impact insulin sensitivity and hormone production, it may alsocontribute to the development of PCOS.
4. Genetic factors: A higher incidence of PCOS has been noted in families, suggesting that the condition may be inherited.
5. Environmental factors: The development may also be influenced by exposure to environmental pollutants, including endocrine disruptors.[17]

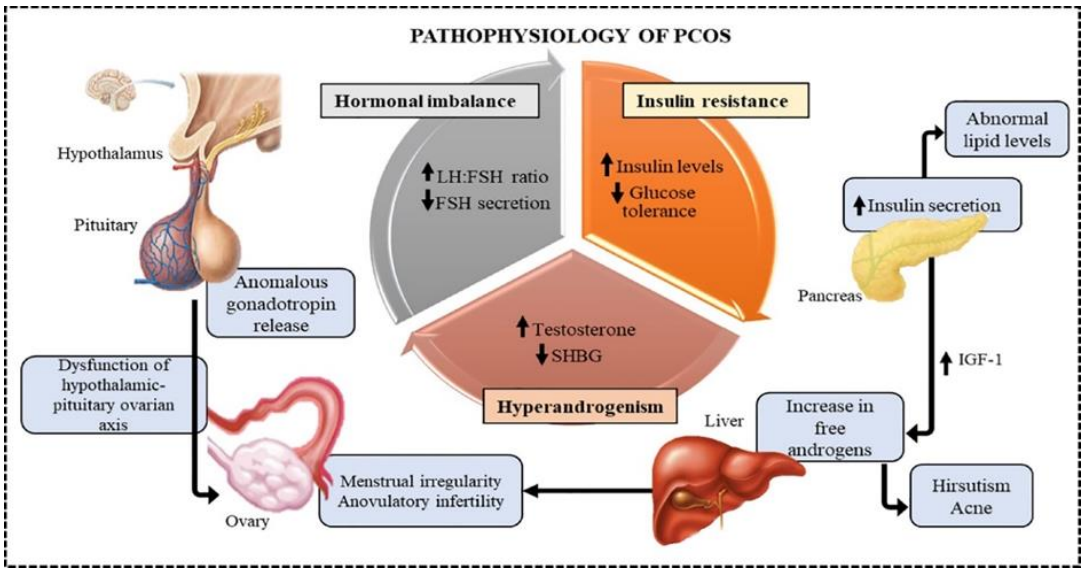

Fig. 2: Pathophysiology Of PCOS.

DIGNOSIS

Given that PCOS is a syndrome and cannot be diagnosed using a single diagnostic criterion, women with PCOD can be identified using any two of the three clinical criteria listed below. An irregular or prolonged menstrual cycle is known as oligomenorrhea. Excessive androgen production, or hyperandrogenism Multiple ovarian follicles, or the ovaries' polycystic appearance An irregular menstrual cycle, or oligomenorrhea, occurs when there is a lapse of more than three menstrual cycles.[18] Rhazes documented a number of symptoms that are suggestive of polycystic ovarian disease and hyperandrogenism together with menstrual irregularities (oligomenorrhea, amenorrhea, and DUB), such as hirsutism, obesity, acne, hoarseness of voice, and infertility. Hippocrates (460–370 BC) was the first to record that women who experienced prolonged amenorrhea, obesity, and infertility also had hirsutism, or an abundance of facial and body hair. Galen (130–200 AD) made similar observations. In classical Unani literature, hirsutism is described as a side effect of prolonged amenorrhea that is linked to other masculine characteristics such as acne, male body contour, and hoarseness of voice. It was Ibn Sina and Ismail Jurjani who described the pathophysiology of hirsutism.

It was believed that the main tenet of hirsutism was the alteration of women's typical temperaments.[19]

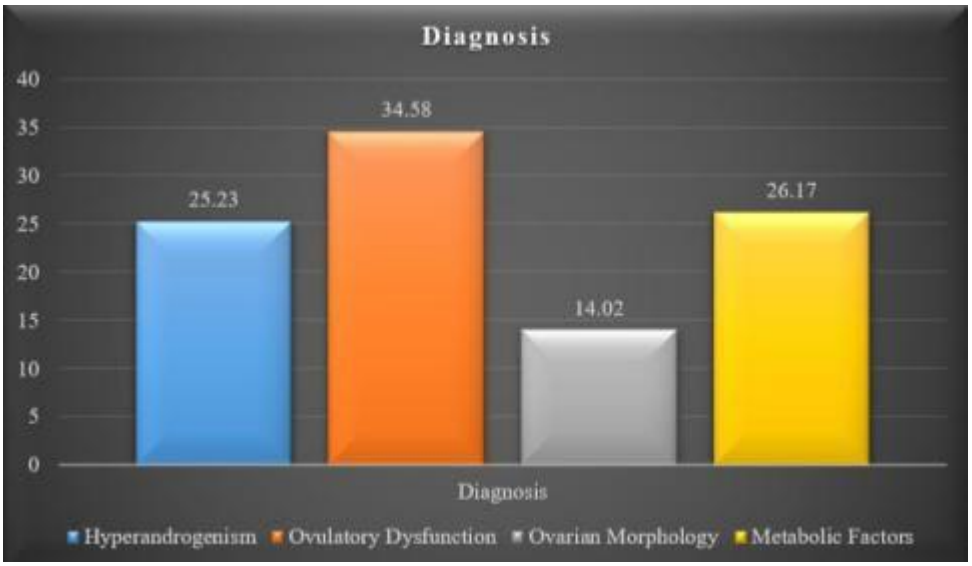

Fig 3: Diagnosis Of PCOD.

RESISTANCE TO INSULIN

The condition known as insulin resistance occurs when the body's increased production of insulin in the bloodstream is not enough to meet the metabolic needs of peripheral tissues. That being said, this is merely a rough description of the disorder. Due to the complex clinical, pathophysiologic, and molecular spectrum of insulin resistance, a consensus definition is still elusive. It is acknowledged that one of the main characteristics of PCOS is insulin resistance (IR). Compared to women in good health, both obese and lean PCOS patients seem to have higher levels of insulin resistance.[20] For overweight women with PCOS, insulin resistance is typically the primary cause. The extra tissue fat is frequently results in a person developing resistance to insulin's effects. A high risk of developing compensatory hyperinsulinemia, which can result in hyperandrogenism and gonadotropin aberration, is brought on by this impaired insulin function.[21] The thickening of the ovaries' theca cells due to hyperinsulinemia and insulin resistance results in anovulation and infertility. Insulin promotes steroidogenesis in steroidogenic organs such as the adrenal cortex and the ovary by stimulating the corresponding trophic hormones. Because it stimulates the action of LH, hyperinsulinemia is the primary cause of excessive ovarian or adrenal androgen secretion. Additionally, sex hormone binding globulin (SHBG), a crucial circulatory protein that regulates testosterone levels, is synthesized less frequently when hyperinsulinemia is present, which raises the concentration of free circulating testosterone.[22]

OVARIAN AND INSULAIN FUNCTION

The ovary follicles line the granulosa and theca cells. Theca cells aid in the conversion of cholesterol into the weak male hormone androstenedione. After passing through neighboring granulosa cells, theca cells transform androstenedione into estrone, a weak form of female hormone, and estradiol, a strong form of female hormone. Insulin resistance in females causes the ovaries and, consequently, the adrenal glands to produce more male hormones by stimulating cytochrome P450c 17-α. Both the ovaries and, consequently, the adrenal glands contribute to the excess of male hormones in polycystic ovary syndrome. elevated pituitary gland secretion of LH, which is triggered by elevated blood insulin levels.[21,23] Hyperinsulinemia from adiposity-dependent insulin resistance can further sensitize thecal cells to LH stimulation and hinder follicle development because insulin and LH act together to increase ovarian theca cell androgen production. Insulin-like growth factor 1 (IGF1) and/or FSH-induced granulosa cell steroidogenesis can be inhibited by the coexistence of these insulin-LH interactions with excess adipose-derived leptin.[24]

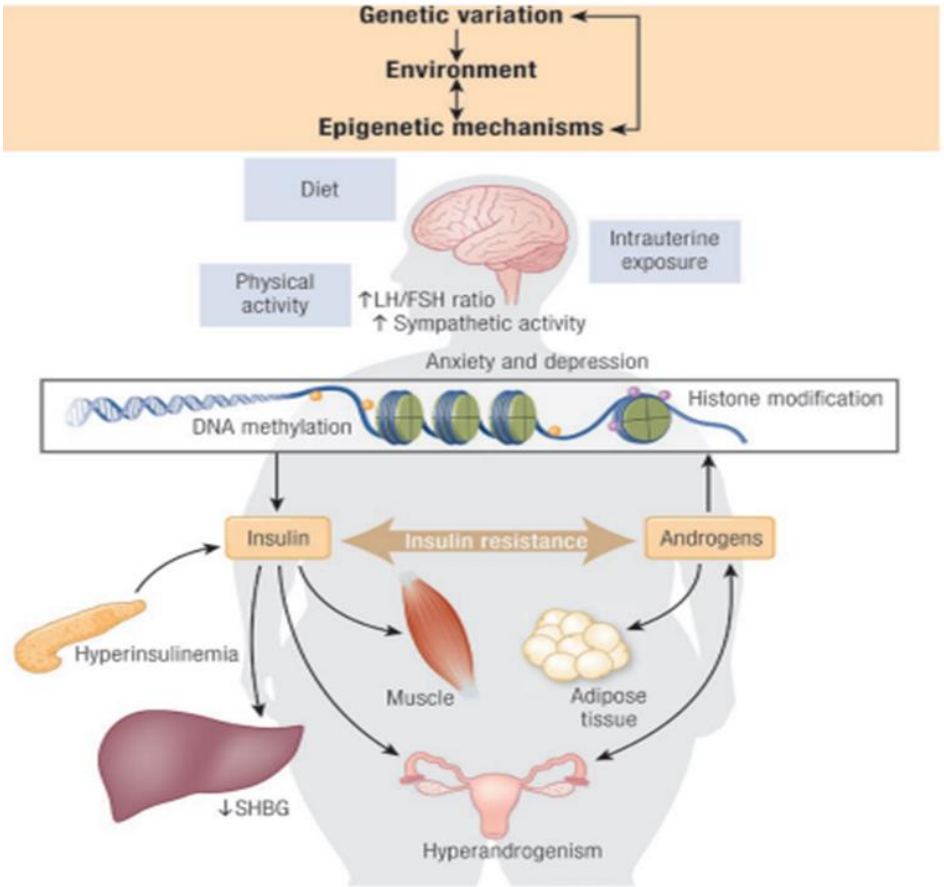

Fig. 4: Ovarian And Insulin Function.

LOW GLYCEMIC MUFFINS

Because they are convenient and easy to distribute, bakery goods like cakes and muffins are enjoyed by modern consumers. Muffins are small, cake-like, quick breads that can be savory or sweet. Their flavor and tender texture are the main reasons why people like them. Since wheat flour, the primary ingredient in all baked goods, has a medium to high GI, adding ingredients like sugar raises the GI even more, making baked goods unsuitable for diabetics.[25] The aging process causes a number of morphological, metabolic, and cognitive changes in the human body. A healthy diet is a key indicator of a successful aging process. The progression of chronic conditions like type II diabetes, dyslipidemia, and coronary heart disease is facilitated by inappropriate dietary patterns in the elderly. This impairs cognitive and functional abilities, which lowers one's quality of life (Kaur et al., 2019). Low glycemic index foods, sufficient amounts of calcium and protein, and balanced amino acids should be included in the diet of the elderly in order to meet their nutritional needs while reducing their risk of metabolic disorders[26] to determine the association between insulin resistance and body composition in the PCOS population, as well as the efficacy of a high-glucose meal load in detecting insulin resistance and impaired glucose tolerance in PCOS-afflicted women, in lieu of the traditional oral glucose tolerance test (OGTT).[27] The majority of PCOS treatments start with a set of lifestyle adjustments, such as diet, exercise, and weight loss. Losing weight is one of the best strategies to manage PCOS symptoms and regulate the menstrual cycle. Using the glycemic index (GI) to determine which foods have the least effect on blood sugar levels, low glycemic diets (LGD) may help people lose weight.[28] The advantages of losing weight in PCOS patients are widely known, but to the best of our knowledge, no research has been done on the ideal diet composition. Weight loss and weight maintenance have been demonstrated to be facilitated by low glycemic load (GL) diets in overweight people without PCOS who have high postprandial insulinemia. In addition to decreasing hunger, overeating, and weight gain, lowering postprandial insulin concentrations has been suggested to boost fat oxidation (and spare carbohydrate stores) for a few hours after a meal. The majority of women with PCOS exhibit a significant compensatory hyperinsulinemia following carbohydrate consumption, suggesting that diets with a low GL may offer particular benefits to this population. The cardiovascular effects of weight loss and satiety may both be enhanced by low-GI carbohydrates.[29]

INGREDIENTS

FLOUR WITH A LOW GI

1. Almond flour

Almond meal, which can be made with or without the skins, is a finely ground almond. The skins on almonds will give the flour a richer color, so it can be used for rustic breads or other baked goods like dark-colored chocolate desserts or gingerbread. When almond flour is made without the peel, the blanched almonds have a pale ivory color. Its use can be advantageous for cakes and muffins. It has fewer carbohydrates, more minerals, and a slightly sweeter taste. Compared to wheat flour, almond flour offers additional health advantages, such as lowering "bad" LDL cholesterol andinsulin resistance. Higher nutritional values are found in foods that contain 20–40%, 60 percent, more more almond flour.

Fig. 5: Almond flour.

2. Flour From Coconuts

The fruit of the palm tree Cocos nucifera is used to make gluten-free coconut flour. It can be combined with other gluten-free flours to create a gluten-free flour substitute, or it can fully replace wheat flour in recipes. Light ivory in color, this flour is high in fiber and has a subtle coconut flavor. The improvement includes stable blood sugar levels, healthy digestion, and heart health. Because of coconut flour's ability to bind water, less flour was required to get the desired result.

Fig. 6: Flour From Coconuts.

3. Flour made from oats

Whole oats are finely ground to create oat flour. A popular gluten-free alternative to wheat flour. Oat flour contains good amounts of fiber (10 g), calcium (50 mg), magnesium (130 mg), and vitamin B1 (0.4 mg). Oat flour's subtle sweetness works well in a wide range of recipes, such as those for bread, brownies, pancakes, muffins, and other baked goods. A strong source of protein (15%), oat flour has a high biological value. Due to its high concentrations of beneficial amino acids, the flour can be used in proportion and is an intriguing addition to both wheat and wheat-rye white bread.

Fig. 7: Flour made from oats.

4. Chickpea Flour

Besan or gram flour are other names for chickpea flour, which is made from ground chickpeas, sometimes called garbanzo beans. It is typically used in Middle Eastern, Mediterranean, and Indian cooking to make dishes like pakoras. In 100 g of flour, it contains a lot of protein (58 g), fat (22 g), and carbohydrates (6 g). It also contains a lot of potassium (584 mg), magnesium (115 mg), and phosphorus (391 mg). The protein, fiber, and mineral content of the bread were enhanced by combining gluten-free chickpea flour with wheat flour. Chickpea flour-enriched breads demonstrated improved organoleptic qualities.[30]

Fig. 8: Chickpea Flour.

5. Meal from flaxseed

Also known as linseed press cake or meal, flaxseed cake is a by-product of oil extraction. It has been used for a long time as a nutrient-dense ingredient in animal feed, but more people are realizing its potential in food production. Dietary fiber reduces cholesterol and limits the absorption of glucose; it is particularly prevalent in flaxseed cake. Furthermore, cold-pressed flaxseed cake contains high concentrations of polyphenolic compounds (ranging from 3.62 to 4.00 mg/g dry matter), which have a strong scavenging property for free radicals. Additionally, it may enhance the sensory qualities of food products. The nutritional composition of flax, including the proportions of protein, carbs, and fiber, varies, however, depending on the variety and processing methods.[31]

Fig. 9: Meal from flaxseed.

NATURAL SWEETENERS

1. Stevia

Stevioside, dulcoside A, steviolbiosides, and rebaudiosides (Reb A, B, C, D, E, and F) are among the complex mixture of sweet diterpeneglycosides found in Stevia rebaudiana leaves. Stevioside and rebaudioside-A are the two primary steviol glycosides found in stevia rebaudiana. Stevioside, the primary component that gives stevia its sweetness, accounts for 5–15% of the dried leaves.

Fig. 10: Stevia.

2. Erythritol

Natural sources of polyols include fermented foods like soy sauce and fruits and vegetables like grapes and mushrooms. The sweetness, low calorie content, and noncariogenic nature of these sugar alcohols are their most valuable characteristics.[32]

HEALTHY FIBERS

1. Olive oil

Since ancient times, olive oil has been a staple of the Mediterranean diet because of its advantageous nutritional profile and ease of extraction. Olive oil is becoming more and more popular worldwide due to its health benefits. Consuming olive oil is thought to have many health benefits because of its high concentration of bioactive compounds with anti-inflammatory, anti-cancer, antibacterial, and antioxidant properties as well as monounsaturated fatty acids. This rise in demand has been reflected in the remarkable growth of the global olive oil market over the past 60 years.[33]

Fig. 11: Olive oil.

FIBER BOOSTER

1. Flaxseed

Growing in popularity as a functional food that may help with the problems associated with unhealthy aging is flaxseed, a plant-based source of lignans, dietary fiber, and the n-3 PUFA alpha-linolenic acid (ALA). Flaxseed has long been prized for its nutritional and therapeutic qualities, but recently, its potential to enhance blood pressure, lipid profiles, glucose metabolism, and other cardiometabolic outcomes has drawn attention from researchers. In addition to targeting cardiometabolic risk factors, its bioactive ingredients also alter basic biological processes that are essential to aging, like oxidative stress and inflammation.[34]

Fig. 12: Flaxseed.

2. Cinnamon

Cinnamon (Verum cinnamon) The substantial therapeutic potential of cinnamon in the treatment of PCOD has been revealed by recent studies. Among the active ingredients, methyl hydroxyl chalcone polymer (MHCP) in particular exhibits insulin-mimetic characteristics. Significant metabolic effects have been demonstrated in clinical trials using cinnamon extract (1-6 g daily). Cinnamon's polyphenolic compounds promote glucose absorption and insulin receptor phosphorylation. Long-term supplementation has been shown to decrease fasting insulin and glucose levels, enhance glycemic control with decreased HbA1c levels, enhance insulin receptor substrate-1 (IRS-1) phosphorylation, and increase glucose transporter-4 (GLUT4) translocation.[35]

Fig. 13: Cinnamon.

3. Chia seed

(Salvia hispanica L.) Chia sprouts Flaxseeds have 30–45% lipid, 20–25% protein, and 28% fiber, whereas chia seeds have 20.5% protein, 30.7% lipid, and 34.4% fiber. These seeds' soluble fibers lengthen the gastrointestinal transit time and increase the viscosity of the gastric content, which delays gastric emptying. Because of this, the small intestine's contents become more viscous, which slows down the absorption of carbohydrates, lowers the

glycemic index, slows down the release of insulin, and increases feelings of fullness. These characteristics render these seeds beneficial for the nutritional control of obesity and its associated disorders.[36]

Fig. 14: Chia seed.

Table No. 1: Ingredient.

Ingredient	Quantity
Oat flour	1 cup(100g)
Almond flour	1/2cup (50g)
Eggs	2
Chia seeds	1 tsp
Baking soda	½ tsp
Stevia or erythritol	1-2 tsp
Cinnamon	½ tsp
Mashed banana (ripe)	1 medium
Chocolate	Optional
Flaxseed	½ tsp

METHODOLOGHY

Put the banana in a big bowl and mash it until it's smooth. and stevia erythritol, as well as the two eggs. Add 1 cup (100 g) of oat flour, chia seeds (1 tsp), baking soda, oat flour, almond flour ½ cup (50 g), cinnamon (1-2 tsp), and flax seed (1-2 tsp) and stir with a sweetener. Mix each ingredient thoroughly until it's all combined. Add the blueberries and fold. and chocolate (if desired) or any other low-GI ingredient, such as chopped walnuts. Prepare the batter mixture and preheat the oven to 180°C (350°F) in a muffin tray lined with paper. Grease it lightly or line it. Evenly fill the muffin cups with the batter. To ensure a toothpick inserted in the center comes out clean, bake for 18 to 22 minutes. Allow to cool for ten minutes prior to serving. Keep at room temperature in an airtight container for up to three days.[37]

CONCLUSION

When people with polycystic ovarian disease (PCOD) include low glycemic index (GI) muffins in their diet, it can help effectively manage the condition. These muffins' stable blood glucose and insulin levels—which are essential for hormonal balance in PCOS—are maintained by their whole grain, nut, seed, and natural sweetener content. In addition to supporting weight management and the control of PCOD symptoms, regular consumption of low-GL foods can lower insulin resistance and low testosterone levels.

REFERENCE

1. Koppisetti T, Sireesha K, Sreya S, Sowjanya S, Kavitha V, Kamala G. A Review of Therapeutic Applications of Nutraceuticals in Polycystic Ovarian Disease. Journal of Pharma Insights and Research, 2025 Feb 5; 3(1): 130-8.
2. George S, Alex A. Assessment of symptoms and diet intake in young adult with polycystic ovary syndrome (PCOS). Journal of Scientific Research, 2021; 65(4).
3. Wardhan R. Polycystic ovarian cyst disorder (PCOD): causes and control. Best Pract Res Clin Obstet Gynaecol, 2016; 18(5): 685-706.
4. Anjali CS, George M, Das P, Soji S. PCOD in female reproductive age: A review. World J Pharm Res., 2019 Oct 27; 9(1): 677-84.
5. Kapoor G, Hasan Z. PCOD: Effects of Mental, Cognitive, and Physical Health on Women with PCOD in age group between 18-30 years. International Journal of Interdisciplinary Approaches in Psychology, 2025 May 1; 3(5): 542-55.
6. Shrivastava V, Batham L, Mishra S, Mishra A. Management of symptoms associated with obsessive-compulsive disorder (ocd) and polycystic ovarian disease (pcod) through an integrated approach including yagya therapy. Interdisciplinary Journal of Yagya Research, 2019 May 13; 2(1): 39-51.
7. Akhter F, Siddiqua A. Management of Adolescent PCOD: A Real Challenge. Sch Int J Obstet Gynec, 2024; 7(2): 64-9.
8. Nema P, Joseph J, Mal P, Shukla A. PCOS/PCOD as result of lifestyle and stress among college-going female students. Indian Journal of Health, Sexuality and Culture, 2024 Jun 30; 10(Spcl): 40-8.
9. Binu S. INVESTIGATING THE IMPACT OF LIFESTYLE FACTORS ON PCOD: A COMPREHENSIVE ANALYSIS OF BMI, DIET, PHYSICAL ACTIVITY, STRESS, AND FAMILY HISTORY.

10. Minocha N. Polycystic ovarian disease or polycystic ovarian syndrome: how to identify and manage-a review. Archives of Pharmacy Practice, 2020; 11(2-2020): 102-6.
11. Havaldar VD, Jadhav NY, Shinde SS, Mali SS, Mali KK, Shinde AA, Rajput RA. A review on PCOS: Its causes, symptoms, pathogenesis and management. World, 2024; 7(01): 014-21.
12. Shetye SM, Bhoir RS, Chavan SS. The Herbal Approachto PCOD: Efficacy, Safety, and Future Directions. Asian Journal of Pharmaceutical Research and Development, 2025 Jun 15; 13(3): 97-104.
13. Farid N, Marsh K, Brand-Miller J. Low GI Diet for Polycystic Ovarian Syndrome: Your Definitive Guide to Using the Glycemic Index to Manage Polycystic Ovarian Syndrome. Hachette UK; 2011 Sep 1.
14. Witchel SF, Azziz R, Oberfield SE. History of polycystic ovary syndrome, premature adrenarche, and hyperandrogenism in pediatric endocrinology. Hormone research in paediatrics, 2022 Nov 29; 95(6): 557-67.
15. Shetye SM, Bhoir RS, Chavan SS. The Herbal Approachto PCOD: Efficacy, Safety, and Future Directions. Asian Journal of Pharmaceutical Research and Development, 2025 Jun 15; 13(3): 97-104.
16. Joshi M, Dube S. Comprehensive study of Dietary and Lifestyle Factors contribute Polycystic Ovarian Disease (PCOD): A Survey Based Study.
17. Pandey A, Pal AK, Chawla G, Ansari S, Mandal J. A Review on Health Care Surveillance of PCOD. Health, 2023; 3: 03-15.
18. Minocha N. Polycystic ovarian disease or polycystic ovarian syndrome: how to identify and manage-a review. Archives of Pharmacy Practice, 2020; 11(2-2020): 102-6.
19. Firdose KF, Shameem I. An approach to the management of poly cystic ovarian disease in Unani system of medicine: A review. Int j appl res., 2016 May; 2(6): 585-90.
20. Diamanti-Kandarakis E, Christakou CD. Insulin resistance in PCOS. Diagnosis and management of polycystic ovary syndrome, 2009 Jan 22: 35-61.
21. Soumya V, Venkatesh P, Sharfudeen S. Polycystic ovary disease (PCOD)-an insight into rodent models, diagnosis and treatments. Journal of Clinical and Medical Images, 2021; 5: 1-3.
22. Havaldar VD, Jadhav NY, Shinde SS, Mali SS, Mali KK, Shinde AA, Rajput RA. A review on PCOS: Its causes, symptoms, pathogenesis and management. World, 2024; 7(01): 014-21.

23. Stener-Victorin E, Padmanabhan V, Walters KA, Campbell RE, Benrick A, Giacobini P, Dumesic DA, Abbott DH. Animal models to understand the etiology and pathophysiology of polycystic ovary syndrome. Endocrine reviews, 2020 Aug; 41(4): bnaa010.
24. Hussain SZ, Beigh MA, Qadri T, Naseer B, Zargar I. Development of low glycemic index muffins using water chestnut and barley flour. Journal of Food Processing and Preservation, 2019 Aug; 43(8): e14049.
25. Qaisar A. Efficacy of millets on improved glycemic response, lipid metabolism and combating oxidative stress and osteosarcopenia in older adults: A review. About the College.
26. Freeman R, Pollack R, Rosenbloom E. Assessing impaired glucose tolerance and insulin resistance in polycystic ovarian syndrome with a muffin test: an alternative to the glucose tolerance test. Endocrine Practice, 2010 Sep 1; 16(5): 810-7.
27. Saadati N, Haidari F, Barati M, Nikbakht R, Mirmomeni G, Rahim F. The effect of low glycemic index diet on the reproductive and clinical profile in women with polycystic ovarian syndrome: A systematic review and meta-analysis. Heliyon, 2021 Nov 1; 7(11).
28. Farid N, Marsh K, Brand-Miller J. Low GI Diet for Polycystic Ovarian Syndrome: Your Definitive Guide to Using the Glycemic Index to Manage Polycystic Ovarian Syndrome. Hachette UK; 2011 Sep 1.
29. Sindhu S. Exploring the use of gluten-free flours in innovative bakery product development: A comprehensive review. Exploring the use of gluten-free flours in innovative bakery product development: A comprehensive review, 2024 May 29; 12(2): 478-83.
30. Gumul D, Kruczek M, Szary-Sworst K, Sabat R, Wywrocka-Gurgul A. Quality, nutritional composition, and antioxidant potential of muffins enriched with flax cake. Processes, 2025 Jun 13; 13(6): 1875.
31. Gao J. *Physicochemical and sensory quality of muffin made with Stevianna® or inulin as sucrose replacer* (Doctoral dissertation, Lincoln University).
32. Nemli E, Günal-Köroğlu D, Apak R, Capanoglu E. Potential of Plant-Based Oil Processing Wastes/By-Products as an Alternative Source of Bioactive Compounds in the Food Industry. Foods, 2025 Aug 2; 14(15): 2718.
33. Thompson LU, Chen JM, Li T, Strasser-Weippl K, Goss PE. Dietary flaxseed alters tumor biological markers in postmenopausal breast cancer. Clinical cancer research, 2005 May 15; 11(10): 3828-35.

34. Koppisetti T, Sireesha K, Sreya S, Sowjanya S, Kavitha V, Kamala G. A Review of Therapeutic Applications of Nutraceuticals in Polycystic Ovarian Disease. Journal of Pharma Insights and Research, 2025 Feb 5; 3(1): 130-8.
35. Akkuş ÖÖ, Özdemir Y, Özbek Ç, Öncel B, Nane BY. Does flaxseed and chia use affect postprandial glucose, insulin and subjective saturation response in healthy individuals? Effect of chia and flaxseed on glycemic control and satiety. Journal of Surgery and Medicine, 2023 Jul 21; 7(8): 434-40.

Marsh, K., Steinbeck, K., Atkinson, F., Petocz, P., & Brand-Miller, J. (2010). Effect of a low glycemic index compared with a conventional healthy diet on polycystic ovary syndrome. The American Journal of Clinical Nutrition, 92(1): 8392. https://doi.org/10.3945/ajcn.2009.8420