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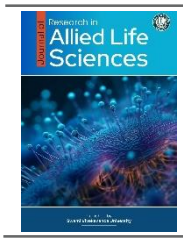

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Exploring the Impact of Dairy Consumption on PCOD Development

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Abstract: *Polycystic Ovarian Disorder (PCOD), first identified in 1935, is recognized as one of the most prevalent disorders among women. The symptoms of PCOD include irregular menstrual cycle, hyperandrogenism, polycystic ovaries, insulin resistance, obesity and weight gain, infertility etc. Factors such as insulin resistance, hyperinsulinemia, obesity, and dietary habits are believed to be linked to PCOD. This study aimed to investigate the relationship between the consumption of dairy products and PCOD. A descriptive cross-sectional study involving 1,000 students was carried out in three different girls' schools in Konnagar. Dietary intake was assessed using a validated food frequency questionnaire. Body mass index was found to be inversely related to PCOD. A significant direct relationship was observed between milk consumption and PCOD. The study's findings suggest that ovarian disease and medication use are directly connected to PCOD.*

Milk consumption has been linked to elevated levels of androgen and insulin hormones in the body. PCOD is characterized by hormonal imbalances, particularly an excess of androgens (male hormones) and insulin resistance. Therefore, the consumption of milk, which can influence these hormone levels, may exacerbate the symptoms or severity of PCOD. Reduction in consumption of dairy products and consumption of plant-based milk alternatives, such as soy milk and almond milk could be a solution to overcome this problem.

Keywords: *Polycystic ovarian disease, Adolescent obesity, Lactose, Insulin Resistance, Dairy products*

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1. Introduction

Polycystic Ovarian Disorder (PCOD), first identified in 1935, is recognized as one of the most prevalent disorders among women. The symptoms of PCOD include irregular menstrual cycle, hyperandrogenism, polycystic ovaries, insulin resistance, obesity and weight gain, infertility etc. Factors such as insulin resistance, hyperinsulinemia, obesity, and dietary habits are believed to be linked to PCOD. This study aimed to investigate the relationship between the consumption of dairy products and PCOD. A descriptive cross-sectional study involving 1,000 students was carried out in three different girls' schools in Konnagar. Dietary intake was assessed using a validated food frequency questionnaire. A significant direct relationship was observed between milk consumption and PCOD. The study's findings suggest that ovarian disease and medication use are directly connected to PCOD.

Dairy products are a staple in many diets worldwide, providing essential nutrients such as calcium, vitamin D, and protein. However, they also contain natural hormones, saturated fats, and lactose—a naturally occurring sugar—that may influence hormonal health. Studies have shown that the hormonal content of dairy, including estrogen and progesterone, can disrupt the delicate hormonal balance in women, potentially exacerbating conditions like PCOD. Additionally, lactose metabolism can impact insulin levels, a key factor in the pathophysiology of PCOD, as insulin resistance is a hallmark feature of the disorder.

Milk consumption has been linked to elevated levels of androgen and insulin hormones in the body. PCOD is characterized by hormonal imbalances, particularly an excess of androgens (male hormones) and insulin resistance. Therefore, the consumption of milk, which can influence these hormone levels, may exacerbate the symptoms or severity of PCOD. Reduction in consumption of dairy products and consumption of plant-based milk alternatives, such as soy milk and almond milk could be a solution to overcome this problem.

While dairy products are traditionally regarded as a healthy food group, their consumption might pose challenges for women with PCOD. Some evidence suggests that high-fat dairy, cheese, and butter may aggravate symptoms such as weight gain, acne, and menstrual irregularities. Moreover, lactose intolerance or poor digestion of dairy can lead to inflammation and alterations in gut health, further compounding hormonal disturbances.

This introduction provides a foundation for understanding the potential links between dairy consumption, lactose, and PCOD. Exploring these relationships is crucial for developing dietary interventions that can improve symptom management and overall quality of life.

2. Research Design and Methodology

Description of the work –

More than 1000 pupils of 5 schools in Konnagar Panchayet area at Hooghly District in West Bengal

were selected for data collection. A cross-sectional descriptive study was conducted among participants. Research instruments were interviewing schedule, anthropometric assessment tools, clinical and biochemical assessment tools. (Thapa *et al*, 2009). The permission of ethical committee (Human) of Swami Vivekananda University, Barrackpore was done as per the ethical standard of the committee. The participants were informed about the study and obtained parental consent (if any), for the legal representative of the children prior to the study. The stratified sampling technique was applied because we conducted four sub-sampling in next phase. Both quantitative and qualitative survey was done in terms of factors affecting the adolescent obesity. For data collection anthropometric measurement, biochemical assessment, Clinical assessment and diet survey method (ABCD) of participants were employed. To determine the actual sample size **inclusion** (selection criteria, age between 11-16yrs) and **exclusion criteria** (omitting sample, below 11yrs and above 16 yrs samples data will be rejected) was followed. After that response were collected through questionnaire method. Some questionnaire responses were open and some were closed. Different types of questionnaires were formed (MCQ type) and data collection was done from respondents. Different attributes like sleep disturbance, hunger, physical activity, leisure time activity, taking fast food, taking any beverages, taking any medicines, any health disorder, having periods regular, having ever hospitalized, good economic condition, any sibling, good mental health, having chocolate and ice cream, physical exercise all were collected. The Other parameter was included in the questionnaire as required.

Nutritional assessment of the individual subject. Survey based data collection successively done in every 3 months. Depending upon the data available two groups were formed (stratified sampling), group1-PCOD diagnosed and Group-2-Non PCOD. For Experimental study food habit and physical exercise regime all were recorded. For Experimental study before and after adopting the prescribed changed food habit and physical exercise regime all would be recorded.

3. Results and Discussions

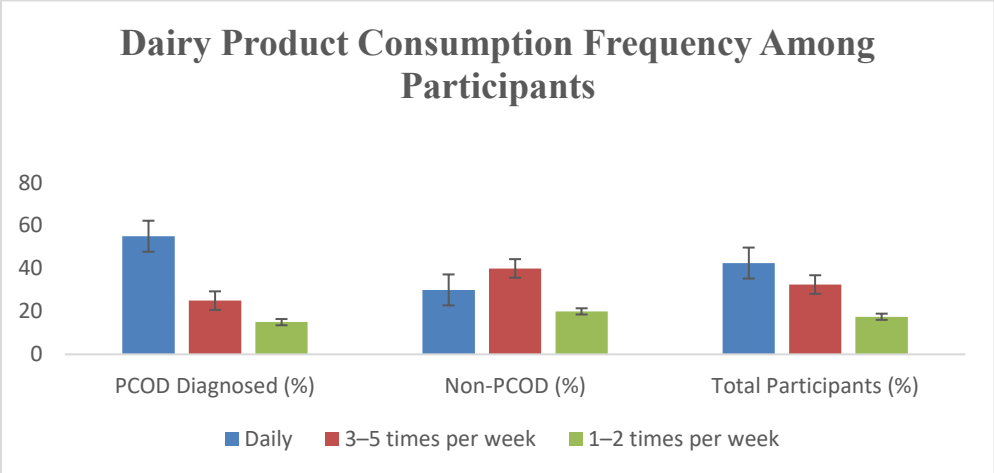

Fig 1: Dairy Product Consumption Frequency Among Participants

Fig 1 indicates that a higher frequency of dairy consumption correlates with a greater prevalence of PCOD. Daily consumers of dairy show the highest percentage of PCOD diagnoses (55%), suggesting a possible association between frequent dairy intake and the onset or exacerbation of PCOD symptoms. This aligns with previous studies indicating that dairy hormones or high insulin levels triggered by frequent intake may influence PCOD development. **Fig 2** highlights milk as the most commonly consumed dairy product by PCOD-diagnosed participants (60%). This could be due to the widespread use of milk in daily diets. Cheese, while less commonly consumed, appears to be associated with PCOD, possibly due to its higher fat and calorie content. This suggests that not just the quantity but also the type of dairy product may play a role in PCOD symptoms.

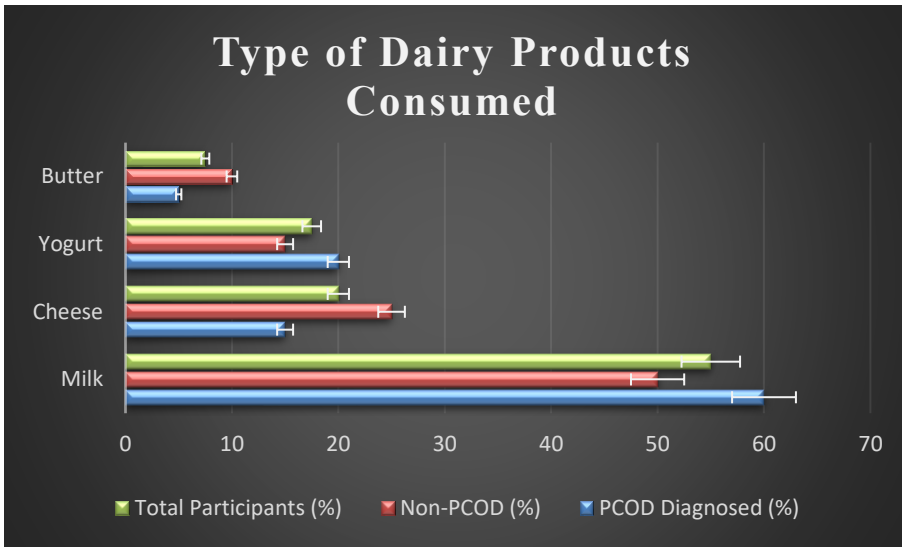

Fig 2: Type of Dairy Products Consumed

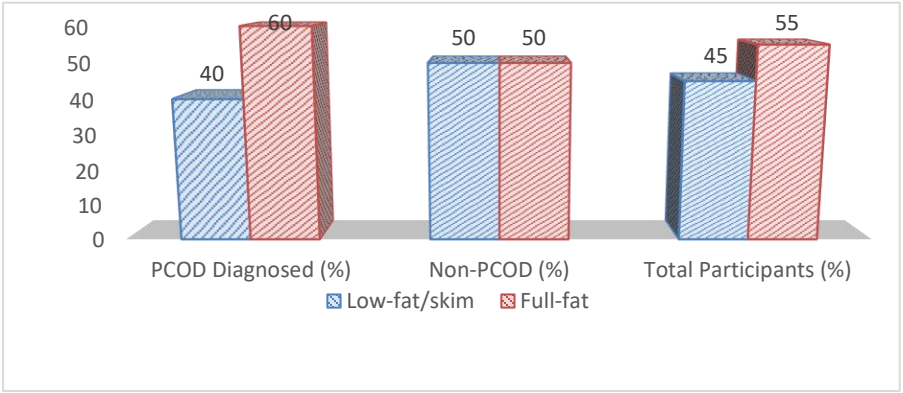

Fig 3: Type of fat content of Dairy Products Consumed

Fig 3 indicates that participants with PCOD are more likely to consume full-fat dairy (60%) than low-fat or skim dairy (40%). This finding could indicate a link between higher saturated fat content and PCOD

symptoms, potentially contributing to hormonal imbalances and weight gain, both risk factors for PCOD.

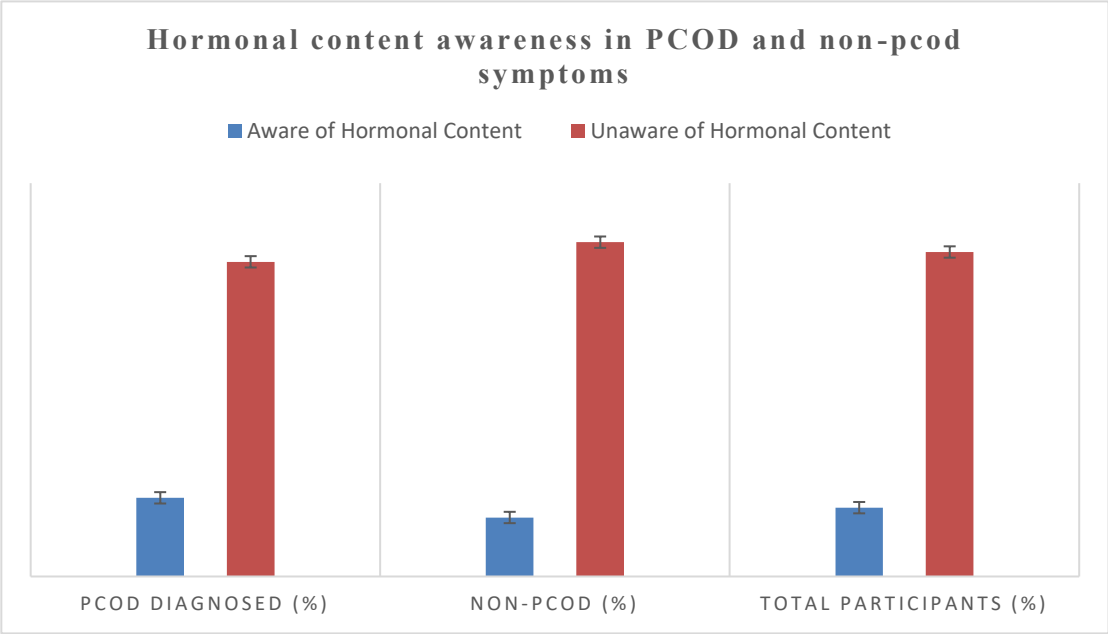

Fig 4: Hormonal Content in Dairy and PCOD Symptoms

Fig 4 The majority of participants (80% of PCOD-diagnosed individuals) are unaware of the hormonal content in dairy. Dairy contains naturally occurring hormones, such as estrogen and progesterone, which might exacerbate hormonal imbalances in PCOD patients. This lack of awareness suggests an area for dietary education to manage PCOD symptoms more effectively

Fig 5 exhibits highest rate of insulin resistance (70%), a known factor in PCOD pathology. The association between frequent dairy intake and insulin resistance may be due to the effect of milk proteins on insulin-liked growth factor (IGF-1), which can worsen insulin sensitivity and exacerbate PCOD symptoms.

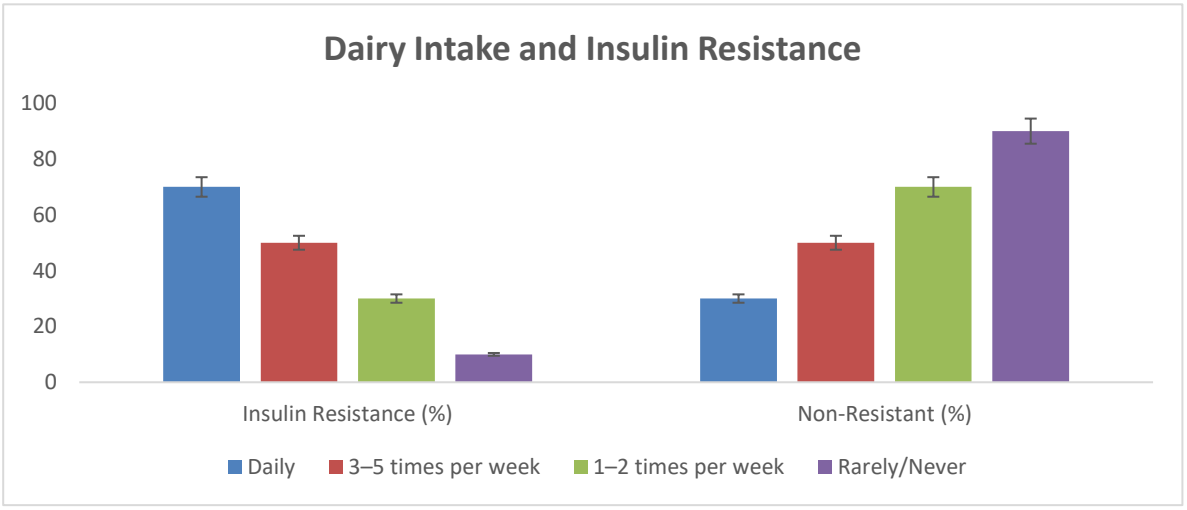

Fig 5: Dairy intake and insulin resistance

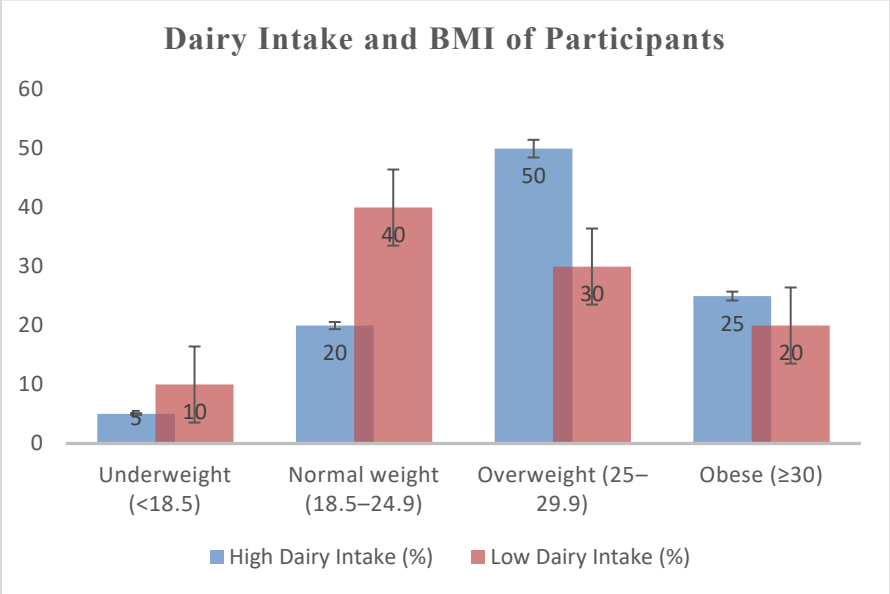

Fig 6: Dairy Intake and BMI of Participants

Fig 6 indicates higher dairy intake is observed among overweight and obese participants, with 50% of high dairy consumers classified as overweight. Obesity is a significant risk factor for PCOD, and this table suggests that high dairy consumption may contribute to or exacerbate weight gain. The caloric density and hormonal content of full-fat dairy could be potential contributors. Cheese and butter consumption are associated with more severe PCOD symptoms, likely due to their high fat and calorie content. Milk and yogurt show a more balanced distribution across symptom severity levels, possibly due to their lower fat content and the presence of probiotics in yogurt, which may offer some health benefits.

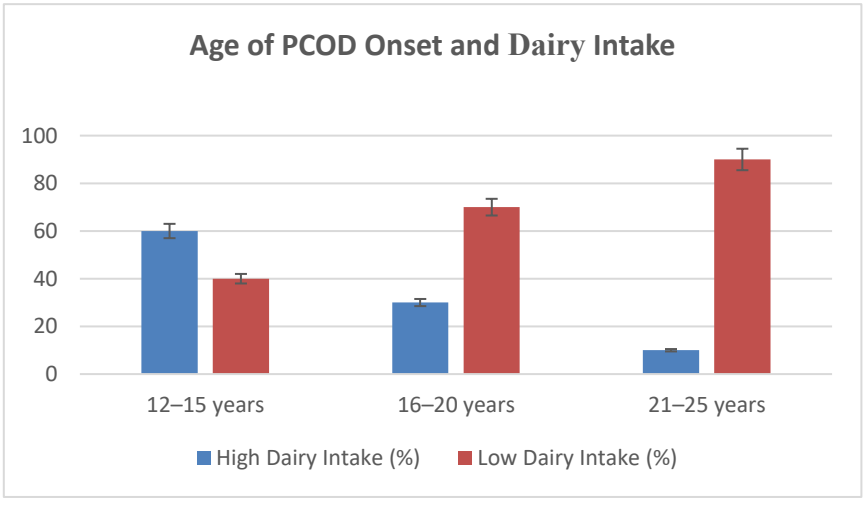

Fig 7: Dairy Product Type and Severity of PCOD Symptoms

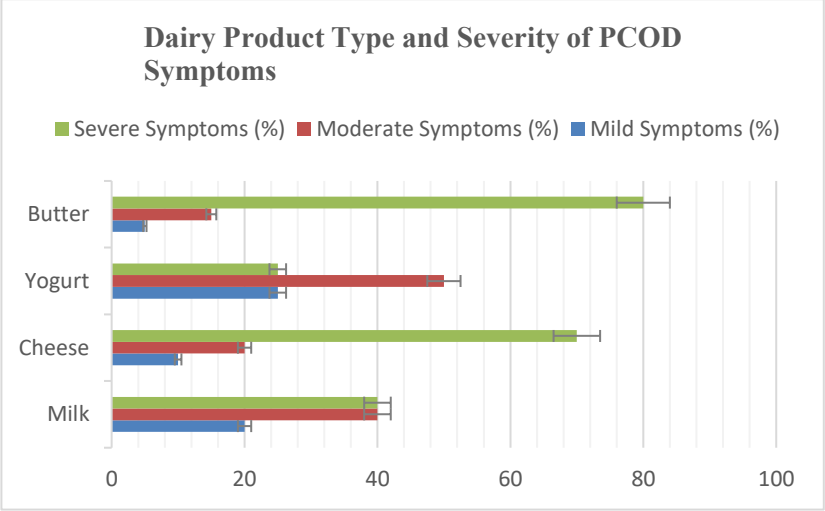

Fig 8: Age of PCOD Onset and Dairy Intake

Participants with higher dairy intake tend to experience an earlier onset of PCOD, with 60% reporting onset between ages 12–15. This supports the hypothesis that dietary habits during adolescence may influence the development of PCOD. Early dietary intervention could potentially delay or mitigate PCOD onset.

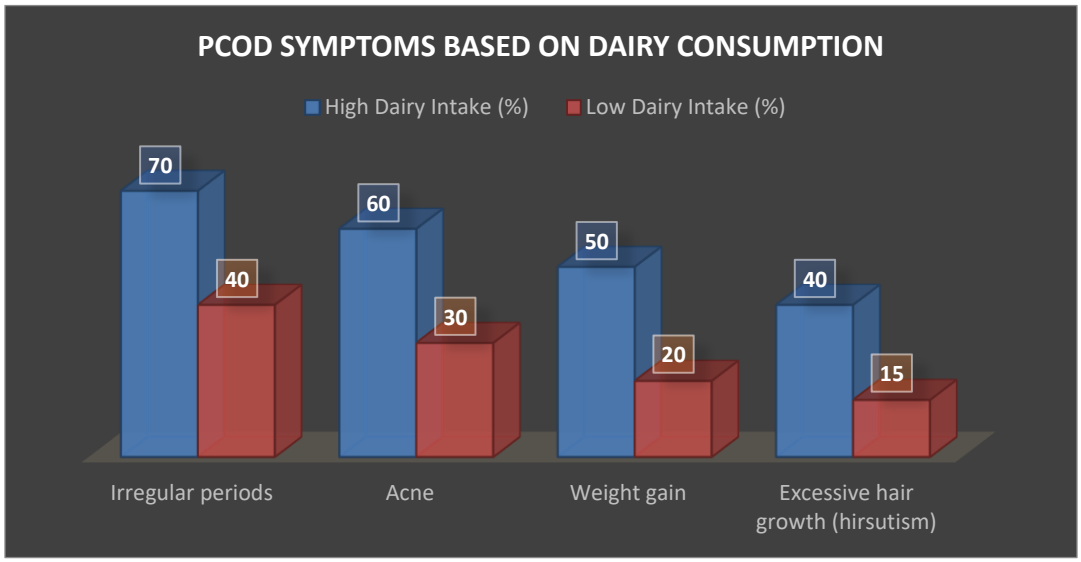

Fig 9: PCOD Symptoms Based on Dairy Consumption

Participants with high dairy intake report more severe symptoms, such as irregular periods (70%), acne (60%), and weight gain (50%). These findings align with studies that suggest dairy may exacerbate insulin resistance, androgen excess, and inflammation, contributing to PCOD symptoms.

Table 1: Exploring the relationship between Polycystic Ovarian Disease (PCOD) and milk intake, summarizing the potential effects and recommendations

Aspect	Effect of Milk Intake on PCOD	Recommendations for Milk Intake in PCOD
Insulin Response	Milk has a moderate insulin response, which may affect insulin sensitivity, especially in women with PCOD.	Choose lower-GI dairy options like yogurt, or consume milk in moderation.
Hormone Levels	Conventional milk may contain natural and added hormones that could influence androgen levels, potentially worsening symptoms like acne or hair growth.	Opt for organic, hormone-free milk or consider plant-based alternatives.
Calcium and Nutrient Intake	Milk is a good source of calcium, vitamin D, and protein, which are beneficial for women with PCOD, especially for bone health.	Incorporate moderate amounts of dairy or fortified alternatives to support calcium needs.
Inflammation	Some individuals with PCOD are sensitive to dairy, which can trigger inflammation and exacerbate symptoms.	For those sensitive to dairy, try lactose-free or plant-based alternatives like almond or oat milk.
Weight Management	Full-fat milk may contribute to weight gain if consumed in excess, impacting PCOD symptom management.	Choose low-fat or fat-free options, or use milk substitutes if needed for weight management.
Glycemic Impact	Milk has a low glycemic index but can raise insulin levels, potentially affecting blood sugar balance in PCOD.	Pair milk with high-fiber foods or protein to stabilize blood sugar response.
Acne and Skin Health	Dairy, especially skim milk, has been linked to increased acne in some studies, potentially worsening PCOD-related skin issues.	Limit intake if dairy worsens acne, and consider fermented dairy like yogurt or kefir.
Satiety	The protein in milk can improve satiety, which may help reduce overeating and aid weight control in PCOD.	Consume in moderate amounts, especially as part of balanced meals, to promote fullness.

For individuals with PCOD, moderate milk intake is generally safe but should be personalized. Options like organic milk, plant-based alternatives, or fermented dairy can provide nutritional benefits without exacerbating symptoms. Monitoring one's response to dairy and adjusting accordingly can support better symptom management.

Table 2: Lactose content in various dairy products and how they may affect individuals with Polycystic Ovarian Disease (PCOD)

Dairy Product	Average Lactose Content (grams per serving)	Impact on PCOD	Recommendations for PCOD and Lactose Sensitivity
Whole Milk (1 cup)	12 g	Moderate insulin response, potential bloating for lactose-sensitive individuals	Consume in moderation, consider lactose-free milk or limit if symptoms occur
Skim Milk (1 cup)	12 g	Can cause insulin spikes; may worsen acne in some	Limit intake if acne or insulin response is a concern; lactose-free skim milk is an option
Yogurt (1 cup)	4-17 g (varies with type)	Contains probiotics beneficial for gut health; lower lactose due to fermentation	Greek yogurt or low-lactose yogurt may be easier to digest
Greek Yogurt (1 cup)	4-6 g	Lower in lactose, high in protein, which aids satiety	Good choice for PCOD-friendly snacks; opt for plain, unsweetened options
Cheddar Cheese (1 oz)	<0.5 g	Very low lactose, unlikely to impact insulin levels	Generally safe for lactose-sensitive individuals with PCOD
Mozzarella Cheese (1 oz)	<0.5 g	Low lactose content, minimal impact on blood sugar	Safe for most individuals with PCOD and lactose sensitivity
Butter (1 tbsp)	0.1 g	Minimal lactose, unlikely to affect PCOD symptoms	Safe in small amounts; minimal impact on insulin or lactose sensitivity
Cottage Cheese (1/2 cup)	3-4 g	Moderate lactose; may cause bloating in sensitive individuals	Opt for small portions or lactose-free versions if needed
Ice Cream (1/2 cup)	5-6 g	High sugar and lactose; can trigger insulin response	Limit intake; consider lactose-free or low-sugar alternatives
Lactose-Free Milk (1 cup)	0 g	Lactase enzyme added, reducing lactose content	Good alternative for those with lactose sensitivity, minimal impact on PCOD symptoms

Individuals with PCOD who are sensitive to lactose may benefit from choosing lower-lactose or lactose-free dairy options, like hard cheeses or lactose-free milk, to avoid bloating or digestive discomfort. Additionally, fermented options like Greek yogurt provide protein and probiotics, which may support gut health and aid in managing PCOD symptoms.

Including sufficient protein from both animal and plant sources can help manage PCOD symptoms by supporting blood sugar stability, insulin sensitivity, and weight management. By integrating protein with other macronutrients and spreading intake across meals, individuals with PCOD may experience improved energy, reduced cravings, and more balanced hormonal health.

Lactose, a naturally occurring sugar found in dairy products, may play an indirect role in influencing female hormone balance. While lactose itself is not a hormone or directly involved in endocrine pathways, its consumption through dairy products can have downstream effects on hormonal regulation, particularly in women with conditions like PCOD (Polycystic Ovarian Disease) or other hormone-related disorders. Dairy products often contain hormones like estrogen, progesterone, and insulin-like growth factor-1 (IGF-1). Lactose consumption is often accompanied by the intake of these naturally occurring hormones in milk. Excess estrogen from dairy can disrupt the natural balance of estrogen and progesterone in women, potentially exacerbating conditions like PCOD, endometriosis, and premenstrual syndrome (PMS).

4. Conclusions

High dairy intake, particularly daily consumption, is associated with increased rates of insulin resistance. Since insulin resistance is a core feature of PCOD, reducing or modifying dairy consumption could be an effective management strategy. Adolescents consuming high amounts of dairy are more likely to be overweight or obese, which further exacerbates PCOD symptoms and severity. These include the intake of dairy hormones, effects on insulin and IGF-1 levels, and impacts on gut health. Women with pre-existing conditions like PCOD, insulin resistance, or estrogen dominance may benefit from monitoring their dairy and lactose intake to manage hormonal imbalances effectively. Participants with daily or frequent dairy intake show a higher prevalence of PCOD. Full-fat dairy products, such as cheese and butter, are associated with more severe symptoms compared to low-fat or skim dairy products. This indicates that the fat content in dairy may play a role in exacerbating PCOD-related complications. A majority of participants are unaware of the hormonal content in dairy, which might contribute to the worsening of PCOD symptoms by amplifying existing hormonal imbalances. Early dietary interventions could mitigate this risk.

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