

Review

NLRP3 Inflammasome in Polycystic Ovary Syndrome: Pathogenic Mechanisms and Therapeutic Potential

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Abstract: Polycystic ovary syndrome (PCOS) is a polygenic and multifactorial reproductive endocrine disorder, with chronic low-grade inflammation recognized as a contributing factor in its pathogenesis. The NOD-like receptor protein 3 (NLRP3) inflammasome is a multiprotein complex within the innate immune system whose activation leads to the production of inflammatory cytokines and inflammatory factors. A growing body of evidence indicates that the NLRP3 inflammasome plays a critical role in the pathophysiology of PCOS. This review summarizes the multifaceted roles of the NLRP3 inflammasome in the pathogenesis and treatment of PCOS, aiming to provide novel insights and directions for further investigation into the pathogenic mechanisms and clinical management of PCOS.

Keywords: NLRP3 inflammasome; polycystic ovary syndrome; inflammation; pathogenesis

1. Introduction

Polycystic ovary syndrome (PCOS) is a common reproductive endocrine disorder, affecting approximately 5%–20% of women of reproductive age worldwide [1]. Its principal clinical features include irregular menstrual cycles, anovulation or oligo-ovulation, polycystic ovarian morphology, and hyperandrogenism [2]. It is the most prevalent endocrine disorder among women of reproductive age and the leading cause of anovulatory infertility, accounting for nearly 70% of patients with anovulatory infertility [3]. In women with PCOS, despite the presence of numerous follicles, the number of high-quality mature oocytes is severely limited, which substantially impairs their intrinsic capacity for meiotic maturation and fertilization [4]. Although the etiology of PCOS remains unclear, previous studies have demonstrated that its pathogenesis is closely associated with chronic low-grade inflammation. Elevated expression levels of multiple inflammatory markers, including interleukin-1 (IL-1), interleukin-6 (IL-6), interleukin-18 (IL-18), and tumor necrosis factor- α (TNF- α), have been observed in patients with PCOS [5]. Inflammation is a defensive response to potentially harmful stimuli and typically requires the participation of various protein complexes known as inflammasomes. The NLRP3 inflammasome is one of the most extensively studied inflammasomes, capable of recognizing diverse pathogenic microorganisms and stress-related endogenous signaling molecules [6]. Activation of the NLRP3 inflammasome has been implicated in numerous immune and metabolic disorders, including atherosclerosis, obesity, type 2 diabetes mellitus, inflammatory bowel disease, endometriosis, and PCOS [7–10]. Given the close association between the pathogenesis of PCOS and chronic inflammation, the role of the NLRP3 inflammasome in PCOS has attracted widespread attention from researchers.

2. Structure and Activation of the NLRP3 Inflammasome

The NLRP3 inflammasome is a critical mediator of host immune responses and is composed of the cytoplasmic sensor NLRP3, the apoptosis-associated speck-like protein

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containing a CARD (ASC), and the inflammatory protease caspase-1 [11]. NLRP3 is the core component of this complex and consists of three domains: a carboxy-terminal leucine-rich repeat (LRR) domain with self-inhibitory and signal recognition functions; a central adenosine triphosphatase (ATPase) domain (termed NACHT) that exhibits ATPase activity and mediates self-oligomerization; and an amino-terminal pyrin domain (PYD) responsible for recruiting ASC [12–14]. The ASC protein contains both a PYD domain and a caspase recruitment domain (CARD). Through its PYD domain, ASC is recruited into the signaling complex via PYD–PYD interactions, while the CARD domain serves to recruit procaspase-1 monomers into the assembling complex, thereby activating caspase-1 [15].

The NLRP3 inflammasome can be activated through three pathways: the canonical pathway, the non-canonical pathway, and the alternative pathway [6]. In PCOS, activation of the NLRP3 inflammasome typically occurs through the canonical pathway, which requires both a priming signal and an activation signal for assembly. The priming signal is usually mediated by Toll-like receptors, NOD1 and NOD2, as well as cytokine receptors (e.g., tumor necrosis factor receptor), leading to activation of nuclear factor kappa-B (NF- κ B). NF- κ B then translocates to the nucleus and binds to DNA, ensuring adequate expression of NLRP3, pro-interleukin-1 β (pro-IL-1 β), and pro-interleukin-18 (pro-IL-18) genes/proteins [16,17]. The activation signal is delivered through a series of distinct stimuli, including pathogen-associated molecular patterns (PAMPs) and damage-associated molecular patterns (DAMPs), which are required for NLRP3 inflammasome complex assembly [18]. Activation of the NLRP3 inflammasome induces autoproteolytic cleavage of pro-caspase-1 to release caspase-1 and triggers caspase-1-dependent pyroptosis in various cell types [19]. NLRP3 activation through the canonical pathway leads to the release of IL-1 β and IL-18, which mediate inflammation and activate gasdermin-D (GSDMD), thereby inducing inflammatory cell death known as pyroptosis [19] (As shown in Figure 1).

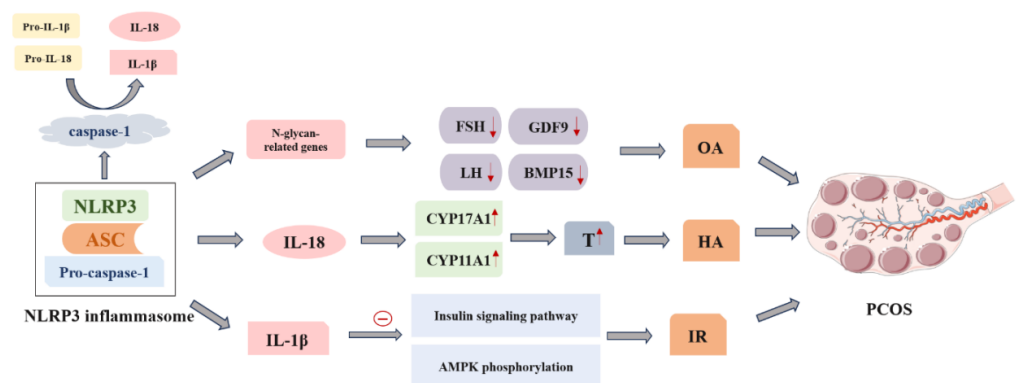


Figure 1. Role of the NLRP3 Inflammasome in the Development and Progression of PCOS. T: Androgen; FSH: Follicle-Stimulating Hormone; LH: Luteinizing Hormone; HA: Hyperandrogenism; IR: Insulin Resistance; OA: Oligo-Ovulation or Anovulation.

3. Relationship between the NLRP3 Inflammasome and PCOS

The NLRP3 inflammasome is activated in various inflammatory and metabolic diseases. It is expressed in ovarian granulosa cells (GCs) and can become abnormally activated under pathological conditions or various stimuli [20]. Recently, a meta-analysis revealed elevated levels of NLRP3 inflammasome components in both human subjects with PCOS and animal models, suggesting that this inflammasome may play a role in the development of PCOS [21]. Another study demonstrated that the NLRP3 inflammasome may promote the pathogenesis of PCOS by regulating steroid metabolism, N-glycan biosynthesis, post-translational modifications, oocyte maturation, autophagy, and apoptosis-related gene expression [22].

3.1. NLRP3 Inflammasome and Follicular Development and Ovulation

Chronic low-grade inflammation is closely associated with the pathogenesis of PCOS. An aberrant inflammatory state can disrupt ovarian tissue and normal folliculogenesis, leading to impaired oocyte quality, anovulation, and reduced female fertility [23]. Activation of the NLRP3 inflammasome leads to caspase-1 activation and the production of IL-1 β and IL-18. These cytokines play important roles in regulating ovarian steroidogenesis, ovarian follicle maturation, and other reproductive processes [24]. The NLRP3 inflammasome forms in ovarian GCs of patients with PCOS, inducing oxidative stress, affecting cellular metabolism, and impairing cell proliferation [25]. Activation of the NLRP3 inflammasome accelerates ovarian fibrosis in PCOS mouse models [26]. The NLRP3/caspase-1 signaling pathway is involved in oxidative stress-triggered apoptosis of ovarian GCs, and treatment with *Rubus chingii* Hu (a traditional Chinese medicine) can reverse NLRP3 overexpression-induced pathological changes in ovarian tissue [27,28]. Therefore, the NLRP3 inflammasome typically leads to ovarian dysfunction, thereby affecting follicular development and ovulation.

Furthermore, the NLRP3 inflammasome can upregulate N-glycan synthesis-related genes in the human ovarian granulosa cell tumor (KGN) cell line. N-glycosylation is a post-translational protein modification involving the covalent attachment of sugar chains to specific residues of proteins, such as asparagine, serine, or threonine [29]. Glycosylation defects can lead to numerous clinical disorders, including developmental delay, growth impairment, and immune system diseases [30]. During follicular development, dynamic changes in N-glycans in follicular fluid play a critical role; many hormones and growth factors important for oogenesis and follicular development (such as FSH, LH, and oocyte-secreted GDF9 and BMP15) are closely related to glycosylation. Moreover, major glycoproteins in follicular fluid, such as transferrin and macroglobulin, are closely associated with oocyte maturation [31]. Therefore, upregulation of NLRP3 may affect these glycosylation factors, thereby influencing normal follicular development and maturation. In summary, the NLRP3 inflammasome plays an important role in the pathogenesis of PCOS; its activation can cause chronic inflammation, oxidative stress, and ovarian fibrosis, impairing ovarian GC function and affecting follicular development.

3.2. NLRP3 Inflammasome and Hyperandrogenism

Hyperandrogenism has been demonstrated to be a major underlying cause of infertility in patients with PCOS [32]. In a preclinical study of PCOS, low-grade inflammation was shown to be associated with hyperandrogenism by stimulating the NLRP3 inflammasome and promoting excessive production of inflammatory mediators [26]. The NLRP3 inflammasome is a multiprotein complex that can be activated through various pathways (such as cellular damage, pathogen invasion, or metabolic disorders) [6]. Once activated, the released IL-18 increases androgen secretion by upregulating CYP17A1 and CYP11A1 expression, thereby exacerbating PCOS symptoms [33]. Previous studies have shown that TNF- α affects androgen secretion in KGN cells [34]. Li et al [35]. used exogenous TNF- α to induce KGN cells and found that DHEA and testosterone levels were significantly increased. TNF- α induced NLRP3 inflammasome activation, while upregulation of miR-1224-5p significantly reduced DHEA and testosterone levels and simultaneously inhibited NLRP3 inflammasome activation. Overall, the effect of miR-1224-5p upregulation in attenuating TNF- α -induced androgen production and inflammation in KGN cells may be achieved through inhibition of NLRP3 inflammasome activation.

Hyperandrogenism and inflammation interact in the pathology of PCOS [36]. Local inflammatory responses may promote ovarian androgen production, and circulating inflammatory biomarkers are closely influenced by circulating androgens. Molecular markers of circulating androgens and oxidative stress are highly correlated with inflammation. Some women with PCOS appear to have higher levels of androgens, oxidative stress, and free fatty acids (FFAs), which can serve as danger signals for activating the inflammasome pathway [37]. A mouse model study [38] further confirmed

this: in ovarian GCs of testosterone-induced PCOS mice, excessive androgens may induce inflammatory responses and further activate the NLRP3 inflammasome possibly through the TLR4 pathway. Hyperandrogenism stimulates chronic low-grade inflammation in the ovary to activate the NLRP3 inflammasome, further inducing a series of pathological changes, including pyroptotic death of ovarian GCs, follicular dysfunction, and ovarian interstitial cell fibrosis. In conclusion, the NLRP3 inflammasome and androgens interact and influence each other, and further research is needed to elucidate the specific mechanisms.

3.3. NLRP3 Inflammasome and Insulin Resistance

Insulin resistance or impaired insulin signaling is a core phenotype of PCOS and is associated with other metabolic disorders such as obesity, non-alcoholic fatty liver disease (NAFLD), type 2 diabetes (T2D), and ultimately cardiovascular disease (CVD), all of which are long-term consequences of PCOS [39]. Strong evidence indicates that the NLRP3 inflammasome plays a key role in insulin resistance (IR) [40]. In macrophages, activation of the NLRP3 inflammasome can induce IL-1 β and IL-18 production through caspase-1; these pathways lead to pancreatic β -cell death with chronic hyperglycemia and affect diabetes progression [41]. IL-1 β mediates the interaction between macrophages and adipocytes, contributing to obesity-related IR. Meanwhile, IL-1 β can reduce the responsiveness of adipose tissue to insulin by inhibiting the insulin signaling pathway, and inhibiting its production or activity may improve insulin signaling [42]. In obese subjects, NLRP3 expression in subcutaneous adipose tissue and visceral adipose tissue is positively correlated with BMI and IR [43,44]. Furthermore, NLRP3 inflammasome inhibition has been found to reduce obesity-related inflammation and enhance insulin sensitivity [45]. One study [46] using a dihydrotestosterone (DHT)-induced PCOS mouse model found that early postnatal overfeeding combined with DHT triggered hyperinsulinemia and systemic insulin resistance, which was associated with increased hepatic inflammation and impaired energy metabolism regulation. Their study also demonstrated that activation of hepatic c-Jun N-terminal kinase 1 (JNK1) and NLRP3, accompanied by increased IL-1 β expression, reduced AMP-activated protein kinase (AMPK) phosphorylation and its target protein activity, thereby impairing insulin signaling. Activating AMPK or inhibiting NLRP3 may represent a novel strategy for improving PCOS-related insulin resistance. In brief, the NLRP3 inflammasome plays a role in PCOS-related insulin resistance.

4. Therapeutic Potential of Targeting the NLRP3 Inflammasome in PCOS

PCOS is a complex disease, and current treatment approaches remain primarily symptomatic. Increasing evidence suggests that the NLRP3 inflammasome plays an important role in PCOS, and certain drugs have shown potential for treating PCOS by targeting the NLRP3 inflammasome and inhibiting inflammatory pathways.

4.1. NLRP3 Inflammasome Inhibitors

A clinical cohort study showed that serum levels of NLRP3, caspase-1, IL-1 β , ASC, and IL-18 were significantly elevated in patients with PCOS, and abnormal IL-18 and IL-1 β expression may be attributed to NALP3 inflammasome activation [47]. IL-18 and IL-1 β play important roles in the characteristic pathological processes of PCOS. INF39 is a novel acrylate compound capable of inhibiting NLRP3 ATPase activity [48]. When INF39 was used to treat GCs from PCOS mice, ovarian fibrosis indicators were suppressed, and ovarian interstitial fibrosis was significantly reduced [38]. During the development of PCOS, follicular dysfunction and anovulation are closely associated with ovarian fibrosis, and the NLRP3 inflammasome is considered a potential target for preventing ovarian fibrosis [49]. However, effective inflammasome inhibitors for clinical research remain in the early stages of development, and more studies are needed to evaluate their efficacy and safety for PCOS.

4.2. NLRP3 Inflammasome Protective Agents

Metformin is a biguanide drug that improves insulin sensitivity and reduces androgen levels [50]. Studies [51] have shown that metformin has a protective effect on the NLRP3 inflammasome. PCOS is associated with NLRP3 inflammasome activation; caspase-1 activity and IL-1 β production are significantly increased in PCOS ovaries, and both are reduced after metformin treatment. Metformin also inhibits pyroptosis in human KGN cells through the miR-670-3p/NOX2/ROS pathway. It reduces NLRP3 and ASC mRNA levels, as well as NLRP3, cleaved caspase-1, ASC, and GSDMD-NT protein levels, lactate dehydrogenase release, and caspase-1 activity in lipopolysaccharide-treated human KGN cells [52]. Pioglitazone-metformin complex (PM) has been reported for the treatment of PCOS. In a prospective clinical study [53], the therapeutic efficacy of PM was evaluated in PCOS patients with psychological distress. PM improved mood disorders, particularly anxiety and depression, and downregulated NLRP3 and caspase-1 in blood samples. Furthermore, PM demonstrated efficacy in regulating TNF- α , IL-6, IL-1 β , and total testosterone concentrations. Notably, PM was more effective than metformin alone in reducing testosterone levels.

4.3. IL-1 β Inhibitors

IL-1 β is a key mediator of inflammatory responses, involved in cell proliferation, differentiation, and apoptosis, and plays a critical role in the pathogenesis of PCOS [54]. Diacerein (DIA) is an IL-1 β inhibitor that acts as a key rate-limiting enzyme for IL-1 β secretion and blocks its receptor. DIA has been reported to possess broad anti-inflammatory, antioxidant, and anti-apoptotic effects and is commonly used in the treatment of osteoarthritis [55]. DIA has been reported to have beneficial effects in letrozole-induced PCOS rat models [55,56]. A preclinical study found that DIA treatment significantly reduced body weight, ovarian weight, and ovarian size in PCOS rats. It also regulated serum levels of sex hormones and metabolic factors in PCOS rats, including LH, testosterone, blood glucose, insulin, and lipid levels. Furthermore, DIA attenuated inflammation by inhibiting TNF- α , NF- κ B, caspase-1, NLRP3, IL-6, and IL-1 β [57]. In summary, DIA possesses anti-inflammatory properties and has shown significant efficacy in alleviating endocrine, metabolic, and ovarian structural alterations associated with PCOS.

5. Conclusion

In conclusion, the NLRP3 inflammasome plays a crucial role in the development and progression of PCOS. Activation of the NLRP3 inflammasome is involved in multiple pathophysiological processes of PCOS, including ovulatory dysfunction, hyperandrogenism, and insulin resistance. To effectively treat PCOS, in-depth investigation of the specific mechanisms of the NLRP3 inflammasome in the pathophysiology of this disease is essential. Current studies suggest that certain drugs can exert therapeutic effects by targeting the NLRP3 inflammasome; however, whether these drugs can be successfully applied in clinical practice still lacks extensive clinical research. Targeted therapy against the NLRP3 inflammasome and its downstream inflammatory factors may become an effective treatment for PCOS.

References

1. C. Vatieer and S. Christin-Maitre, "Epigenetic/circadian clocks and PCOS," *Human Reproduction (Oxford, England)*, vol. 39, no. 6, pp. 1167–1175, 2024.
2. C. Guan, S. Zahid, A. S. Minhas, et al., "Polycystic ovary syndrome: a 'risk-enhancing' factor for cardiovascular disease," *Fertility and Sterility*, vol. 117, no. 5, pp. 924–935, 2022.
3. A. T. Brinca, A. C. Ramalhinho, A. Sousa, et al., "Follicular fluid: a powerful tool for the understanding and diagnosis of polycystic ovary syndrome," *Biomedicines*, vol. 10, no. 6, p. 1254, 2022.
4. M. G. Da Broi, V. S. I. Giorgi, F. Wang, et al., "Influence of follicular fluid and cumulus cells on oocyte quality: clinical implications," *Journal of Assisted Reproduction and Genetics*, vol. 35, no. 5, pp. 735–751, 2018.
5. H. Deng, Y. Chen, J. Xing, et al., "Systematic low-grade chronic inflammation and intrinsic mechanisms in polycystic ovary syndrome," *Frontiers in Immunology*, vol. 15, p. 1470283, 2024.

6. M. Dadkhah and M. Sharifi, "The NLRP3 inflammasome: mechanisms of activation, regulation, and role in diseases," *International Reviews of Immunology*, pp. 1–14, 2024.
7. E. Irandoost, S. Najibi, S. Talebbeigi, et al., "Focus on the role of NLRP3 inflammasome in the pathology of endometriosis: a review on molecular mechanisms and possible medical applications," *Naunyn-Schmiedeberg's Archives of Pharmacology*, vol. 396, no. 4, pp. 621–631, 2023.
8. V. Lamantia, S. Bissonnette, M. Beaudry, et al., "EPA and DHA inhibit LDL-induced upregulation of human adipose tissue NLRP3 inflammasome/IL-1 β pathway and its association with diabetes risk factors," *Scientific Reports*, vol. 14, no. 1, p. 27146, 2024.
9. Y. Yang, Y. Qiao, G. Liu, et al., "A novel synbiotic protects against DSS-induced colitis in mice via anti-inflammatory and microbiota-balancing properties," *Probiotics and Antimicrobial Proteins*, 2024.
10. D. T. Meier, J. De Paula Souza, and M. Y. Donath, "Targeting the NLRP3 inflammasome-IL-1 β pathway in type 2 diabetes and obesity," *Diabetologia*, 2024.
11. Y. Kim, S. Lee, and Y. H. Park, "NLRP3 negative regulation mechanisms in the resting state and its implications for therapeutic development," *International Journal of Molecular Sciences*, vol. 25, no. 16, p. 9018, 2024.
12. L. Andreeva, L. David, S. Rawson, et al., "NLRP3 cages revealed by full-length mouse NLRP3 structure control pathway activation," *Cell*, vol. 184, no. 26, pp. 6299–6312.e22, 2021.
13. Q. Yuan, B. Tang, and C. Zhang, "Signaling pathways of chronic kidney diseases, implications for therapeutics," *Signal Transduction and Targeted Therapy*, vol. 7, no. 1, p. 182, 2022.
14. K. Shahzad, S. Fatima, H. Khawaja, et al., "Podocyte-specific NLRP3 inflammasome activation promotes diabetic kidney disease," *Kidney International*, vol. 102, no. 4, pp. 766–779, 2022.
15. R. C. Coll and K. Schroder, "Inflammasome components as new therapeutic targets in inflammatory disease," *Nature Reviews Immunology*, 2024.
16. H. Duez and B. Pourcet, "Nuclear receptors in the control of the NLRP3 inflammasome pathway," *Frontiers in Endocrinology*, vol. 12, p. 630536, 2021.
17. T. Mokhtari, M. Lu, and A. E.-M. El-Kenawy, "Potential anxiolytic and antidepressant-like effects of luteolin in a chronic constriction injury rat model of neuropathic pain: role of oxidative stress, neurotrophins, and inflammatory factors," *International Immunopharmacology*, vol. 122, p. 110520, 2023.
18. L. Xiao, M. Wang, Y. Shi, et al., "Neuroinflammation-mediated white matter injury in Parkinson's disease and potential therapeutic strategies targeting NLRP3 inflammasome," *International Immunopharmacology*, vol. 143, p. 113483, 2024.
19. Y. Huang, W. Xu, and R. Zhou, "NLRP3 inflammasome activation and cell death," *Cellular & Molecular Immunology*, vol. 18, no. 9, pp. 2114–2127, 2021, doi: 10.1038/s41423-021-00740-6.
20. J. M. Navarro-Pando, E. Alcocer-Gomez, B. Castejon-Vega, et al., "Inhibition of the NLRP3 inflammasome prevents ovarian aging," *Science Advances*, vol. 7, no. 1, p. eabc7409, 2021.
21. S. A. Alenezi, R. Khan, L. Snell, et al., "The role of NLRP3 inflammasome in obesity and PCOS—a systematic review and meta-analysis," *International Journal of Molecular Sciences*, vol. 24, no. 13, p. 10976, 2023.
22. B. Wang, M. Shi, C. Yu, et al., "NLRP3 inflammasome-dependent pathway is involved in the pathogenesis of polycystic ovary syndrome," *Reproductive Sciences (Thousand Oaks, Calif.)*, vol. 31, no. 4, pp. 1017–1027, 2024.
23. M. Orisaka, T. Mizutani, Y. Miyazaki, et al., "Chronic low-grade inflammation and ovarian dysfunction in women with polycystic ovarian syndrome, endometriosis, and aging," *Frontiers in Endocrinology*, vol. 14, p. 1324429, 2023.
24. A. Salmassi, A. Fattahi, M. Nouri, et al., "Expression of mRNA and protein of IL-18 and its receptor in human follicular granulosa cells," *Journal of Endocrinological Investigation*, vol. 40, no. 4, pp. 447–454, 2017.
25. Y. Liu, H. Liu, Z. Li, et al., "The release of peripheral immune inflammatory cytokines promote an inflammatory cascade in PCOS patients via altering the follicular microenvironment," *Frontiers in Immunology*, vol. 12, p. 685724, 2021.
26. D. Wang, Y. Weng, Y. Zhang, et al., "Exposure to hyperandrogen drives ovarian dysfunction and fibrosis by activating the NLRP3 inflammasome in mice," *The Science of the Total Environment*, vol. 745, p. 141049, 2020.
27. J. Hou, Z. Lei, L. Cui, et al., "Polystyrene microplastics lead to pyroptosis and apoptosis of ovarian granulosa cells via NLRP3/caspase-1 signaling pathway in rats," *Ecotoxicology and Environmental Safety*, vol. 212, p. 112012, 2021.
28. H. Li, Y. Li, Y. Zhang, et al., "Rubus chingii Hu relieved the polycystic ovary syndrome with enhanced insulin sensitivity through inhibiting TNIP/NLRP3 inflammasome signaling," **Gynecological Endocrinology: The Official Journal of the International Society of Gynecological Endocrinology**, vol. 39, no. 1, p. 2237116, 2023.
29. H. H. Freeze, J. X. Chong, M. J. Bamshad, et al., "Solving glycosylation disorders: fundamental approaches reveal complicated pathways," *American Journal of Human Genetics*, vol. 94, no. 2, pp. 161–175, 2014.
30. B. G. Ng and H. H. Freeze, "Perspectives on glycosylation and its congenital disorders," *Trends in Genetics: TIG*, vol. 34, no. 6, pp. 466–476, 2018.
31. K. S. Olaniyi and S. E. Arleogbe, "Alleviation of adipose-hepatic glycolipid dysregulation by acetate in experimental PCOS model is associated with NF- κ B/NLRP3 repression," *Canadian Journal of Physiology and Pharmacology*, vol. 101, no. 12, pp. 630–641, 2023.
32. L. Zhou, "Research on the pathogenesis and related progress of polycystic ovary syndrome," *Chronic Disease Journal*, vol. 25, no. 12, pp. 1798–1800, 2024.

33. J.-Y. Fan, T. Yi, C.-M. Sze-To, et al., "A systematic review of the botanical, phytochemical and pharmacological profile of *Dracaena cochinchinensis*, a plant source of the ethnomedicine 'dragon's blood'," *Molecules (Basel, Switzerland)*, vol. 19, no. 7, pp. 10650–10669, 2014.
34. Q. Lang, X. Yidong, Z. Xueguang, et al., "ETA-mediated anti-TNF- α therapy ameliorates the phenotype of PCOS model induced by letrozole," *PLoS One*, vol. 14, no. 6, p. e0217495, 2019.
35. Y. Li, N. Yao, Y. Gao, et al., "MiR-1224-5p attenuates polycystic ovary syndrome through inhibiting NOD-like receptor protein 3 inflammasome activation via targeting forkhead box O 1," *Bioengineered*, vol. 12, no. 1, pp. 8555–8569, 2021.
36. M.-C. Huang, P.-L. Chen, and C.-L. Hsu, "Transcriptome analysis of mesenchymal progenitor cells revealed molecular insights into metabolic dysfunction and inflammation in polycystic ovary syndrome," *International Journal of Molecular Sciences*, vol. 25, no. 14, p. 7948, 2024.
37. M. Rostamtabar, S. Esmaeilzadeh, A. Karkhah, et al., "Elevated expression of IL-18 but not IL-1 β gene is associated with NALP3 and AIM2 inflammasome in polycystic ovary syndrome," *Gene*, vol. 731, p. 144352, 2020.
38. D. Wang, Y. Weng, Y. Zhang, et al., "Exposure to hyperandrogen drives ovarian dysfunction and fibrosis by activating the NLRP3 inflammasome in mice," *The Science of the Total Environment*, vol. 745, p. 141049, 2020.
39. P. Moghetti and F. Tosi, "Insulin resistance and PCOS: chicken or egg?," *Journal of Endocrinological Investigation*, vol. 44, no. 2, pp. 233–244, 2021.
40. T. Viinikangas, E. Khosrowabadi, and S. Kellokumpu, "N-glycan biosynthesis: basic principles and factors affecting its outcome," *Experientia Supplementum (2012)*, vol. 112, pp. 237–257, 2021.
41. R. Zhou, A. Tardivel, B. Thorens, et al., "Thioredoxin-interacting protein links oxidative stress to inflammasome activation," *Nature Immunology*, vol. 11, no. 2, pp. 136–140, 2010.
42. D. Gao, M. Madi, C. Ding, et al., "Interleukin-1 β mediates macrophage-induced impairment of insulin signaling in human primary adipocytes," *American Journal of Physiology. Endocrinology and Metabolism*, vol. 307, no. 3, pp. E289–E304, 2014.
43. N. Esser, L. L'homme, A. De Roover, et al., "Obesity phenotype is related to NLRP3 inflammasome activity and immunological profile of visceral adipose tissue," *Diabetologia*, vol. 56, no. 11, pp. 2487–2497, 2013.
44. S. Bando, D. Fukuda, T. Soeki, et al., "Expression of NLRP3 in subcutaneous adipose tissue is associated with coronary atherosclerosis," *Atherosclerosis*, vol. 242, no. 2, pp. 407–414, 2015.
45. J. R. Lukens, V. D. Dixit, and T.-D. Kanneganti, "Inflammasome activation in obesity-related inflammatory diseases and autoimmunity," *Discovery Medicine*, vol. 12, no. 62, pp. 65–74, 2011.
46. N. Veličković, B. Mičić, A. Teofilović, et al., "Overfeeding in the early postnatal period aggravates inflammation and hepatic insulin sensitivity in the 5 α -dihydrotestosterone-induced animal model of PCOS," *Frontiers in Endocrinology*, vol. 15, p. 1402905, 2024.
47. M. Rostamtabar, S. Esmaeilzadeh, A. Karkhah, et al., "Elevated expression of IL-18 but not IL-1 β gene is associated with NALP3 and AIM2 inflammasome in polycystic ovary syndrome," *Gene*, vol. 731, p. 144352, 2020.
48. Y. Shi, Q. Lv, M. Zheng, et al., "NLRP3 inflammasome inhibitor INF39 attenuated NLRP3 assembly in macrophages," *International Immunopharmacology*, vol. 92, p. 107358, 2021.
49. Y. Chen, C. Miao, Y. Zhao, et al., "Inflammasomes in human reproductive diseases," *Molecular Human Reproduction*, vol. 29, no. 10, p. gaad035, 2023.
50. K.-J. Chang, J.-H. Chen, and K.-H. Chen, "The pathophysiological mechanism and clinical treatment of polycystic ovary syndrome: a molecular and cellular review of the literature," *International Journal of Molecular Sciences*, vol. 25, no. 16, p. 9037, 2024.
51. L.-H. Zhou, H. Zou, J.-Y. Hao, et al., "Metformin inhibits ovarian granular cell pyroptosis through the miR-670-3p/NOX2/ROS pathway," *Aging*, vol. 15, no. 10, pp. 4429–4443, 2023.
52. L.-H. Zhou, H. Zou, J.-Y. Hao, et al., "Metformin inhibits ovarian granular cell pyroptosis through the miR-670-3p/NOX2/ROS pathway," *Aging*, vol. 15, no. 10, pp. 4429–4443, 2023.
53. Q.-J. Guo, J. Shan, Y.-F. Xu, et al., "Pioglitazone metformin complex improves polycystic ovary syndrome comorbid psychological distress via inhibiting NLRP3 inflammasome activation: a prospective clinical study," *Mediators of Inflammation*, vol. 2020, p. 3050487, 2020.
54. Y. Xiang, S. Liu, S. Wan, et al., "Interleukin-1 increases SERPINE1 expression in human granulosa-lutein cell via p50/p52 signaling pathways," *Molecular and Cellular Endocrinology*, vol. 591, p. 112274, 2024.
55. S. A. Khodir, E. Sweed, S. M. Motawaa, et al., "Diacerein and myo-inositol alleviate letrozole-induced PCOS via modulation of HMGB1, SIRT1, and NF- κ B: a comparative study," *Naunyn-Schmiedeberg's Archives of Pharmacology*, 2024.
56. M. Z. U. H. Shah, V. K. Shrivastava, S. Muzamil, et al., "Diacerein mitigates endocrine and cardio-metabolic disruptions in experimental PCOS mice model by modulating AdipoR1/PON 1," *BMC Endocrine Disorders*, vol. 24, no. 1, p. 109, 2024.
57. Y. F. Ibrahim, M. Alorabi, W. Y. Abdelzaher, et al., "Diacerein ameliorates letrozole-induced polycystic ovarian syndrome in rats," *Biomedicine & Pharmacotherapy*, vol. 149, p. 112870, 2022.

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