PriMera Scientific Surgical
Research and Practice
Volume 6 Issue 3 September 2025
ISSN: 2836-0028

PriMera Scientific Publications

Pomegranate: The Savier of Ovarian Cancer

Type: Review Article
Received: August 04, 2025
Published: August 29, 2025

Citation:
Adsul Samruddhi Subhash., et al. "Pomegranate: The Savier of Ovarian Cancer". PriMera Scientific Surgical Research and Practice 6.3 (2025): 14-23.

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Abstract

Ovarian cancer is the fifth most common cause of death for women overall and the leading cause of death for women diagnosed with gynaecological cancers. The majority of cases are diagnosed at an advanced stage, which results in poor outcomes for this disease. The key early detection strategies include transvaginal ultrasound, a laboratory marker such as the cancer antigen-125 assay, and a detailed gynaecological evaluation; however, anti-angio genic bevacizumab and Poly (ADP-ribose) polymerase (PARP) inhibitors have gained traction in the management of this gynaecological malignancy in the last ten years. After the initial treatment, a high rate of recurrence has been noted. The majority of these relapsed cases are known to have a higher rate of treatment failures and are less treatable. Therefore, there is an urgent need for innovative treatment methods based on a deeper understanding of the molecular characteristics of this malignancy as well as efficient preventive and detection strategies. In addition to reviewing the epidemiology and risk factors of ovarian cancer, this article discusses some recent ongoing studies and emphasizes the evaluation and multidisciplinary approach in the care of this condition.

Keywords: Ovarian cancer; Pomegranate; Menopause; Tumor

Objective

I. To aid in early diagnosis and treatment, distinguish the symptoms of ovarian cancer from those of other gynaecological disorders [1].
II. To Use the proper techniques, such as transvaginal ultrasonography, pelvic exams, and tumor marker tests, to screen patients for ovarian cancer [2].
III. To Use multimodal therapy, imaging scans, and biopsy as part of evidence-based ovarian cancer diagnosis and treatment methods [3].
IV. To Utilize inter professional team techniques to enhance ovarian cancer patients' care coordination and results [4].

Introduction

Both epithelial and non epithelial ovarian cancers are classified as ovarian cancers [5]. Over 95% of ovarian cancers are epithelial, whereas non epithelial ovarian cancers (such as germ cell, sex-cord stromal, and small cell ovarian cancers) make up about 5% of all ovarian cancers [6]. High-grade serous, low-grade serous, clear cell, endometrioid, and mucinous ovarian cancers are among the subtypes of epithelial ovarian cancers that are separated by histologic classification because the subtypes can affect patient outcomes, therapy, and diagnostic evaluation [7].

Ovarian cancer is the primary cause of mortality among women diagnosed with gynaecological cancers and the second most frequent gynaecologic malignancy in the United States, according to the Centers for Disease Control and Prevention. Ovarian cancer is the third most prevalent gynaecologic cancer in the world [8].

In the United States, ovarian cancer ranks fifth among all cancers that kill women, and it ranks eighth globally [9]. The vague clinical symptoms of ovarian cancer and the absence of preventative screening techniques undoubtedly contribute to the illness's high death rate by delaying diagnosis; the majority of patients are diagnosed with advanced-stage disease [10]. Advanced age is the biggest risk factor for ovarian cancer, which primarily affects postmenopausal women [11].

Clinical assessment, imaging examinations, and tumor markers are the main tools used to evaluate any ovarian mass in order to identify the mass's characteristics and determine the patient's risk factors for malignancy; an ovarian cancer diagnosis is confirmed by histology. Treatment strategies are determined on the stage and histology of the tumor as well as patient characteristics (such as comorbidities and prior treatments) [12]. At the moment, systemic chemotherapy and surgical debulking are usually advised, either in conjunction with or apart from targeted therapies [13]. Antiangiogenic bevacizumab, polyadenosine diphosphate (ADP)-ribose polymerase (PARP) inhibitors, and immunotherapy are examples of targeted therapy [14]. Furthermore, new approaches to the treatment of ovarian cancer include hot intra peritoneal chemotherapy, interval surgical debulking, and neo adjuvant therapy [15]. A high recurrence rate and mortality rate, however, persist despite advancements in ovarian cancer treatment, highlighting the need for inter professional management, effective prevention and detection strategies, and novel treatment modalities founded on a deeper comprehension of the molecular features of ovarian cancer.

Risk Factors for Ovarian Cancer

Although the exact cause of ovarian cancer is unknown, a number of factors have been found to raise the risk of developing the disease [16]. The following are risk factors for ovarian cancer:

i. Older age.
ii. Menarche at an early age.
iii. Menopause's late start.
iv. Family background.
v. The absence of nulliparity.
vi. Being overweight.
vii. Use of perineal talcSmoking.
viii. Endometriosis.
ix. Hormone replacement treatment.

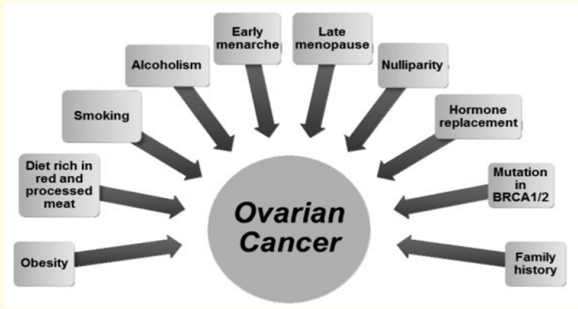


Figure 1: Risk Factor of Ovarian cancer.

A higher risk of ovarian cancer is linked to factors that enhance ovulation throughout one's lifespan, such as nulliparity, early menarche, or late menopause [17]. The precise etiologic process is unknown, though. Furthermore, it is believed that oxidative stress and deoxyribonucleic acid damage caused by inflammatory diseases (such as endometriosis and obesity) contribute to the development of ovarian cancer [18]. A substantial risk factor for ovarian cancer is a positive personal or family history of breast or ovarian cancer. One common underlying reason of a person's predisposition to cancer is germline mutations in the BRCA1 or BRCA2 genes [19]. Mismatch repair genes in Lynch syndrome, tumor protein p53 (TP53) in Li-Fraumeni syndrome, STK11 in Peutz-Jeghers syndrome, CHEK2, RAD51, BRIP1, and PALB2 are among the other hereditary cancer syndromes linked to gene mutations that also raise the risk of ovarian cancer [20]. Based on detected alterations in the distal epithelium in fallopian serous tubal intraepithelial carcinoma, an HGSC precursor, recent results indicate that high-grade serous ovarian cancer (HGSC) may have its genesis in the fallopian tube [21]. Although studies have not shown that suggested ovarian cancer screening procedures are helpful, several organizations have agreed that it is appropriate to offer these high-risk people a variety of screening options.

Epidemiology

According to study findings, a woman has a 1.1% chance of getting ovarian cancer during her lifetime up to age 95 [22]. Over 19,000 new cases of ovarian cancer were detected in the United States in 2022, and over 12,000 people were thought to have died from the disease [23]. Additionally, there are age-related differences in the incidence of ovarian cancer subtypes [24]. Women aged 45 to 50 years had the highest incidence of low-grade endometroid ovarian cancer, while those aged 60 to 65 years have the highest incidence of high-grade serous ovarian cancer [25]. Women between the ages of 55 and 60 are most likely to develop clear-cell ovarian cancer [26]. Non-Hispanic White women have the highest incidence of low-grade endometrioid and high-grade serous malignancies; Clear cell cancer is more common in Asian/Pacific Islander women, while non-Hispanic Black women have the lowest incidence of all ovarian cancer subtypes. The 5-year survival rate for early-stage ovarian cancer is 93.1%, while the 5-year survival rate for advanced-stage disease is 30.8%. The recurrence risk for stage I ovarian cancer is less than 10%, while 90% of women with stage IV ovarian cancer experience recurrence [27].

Symptoms

- Bloating or a swollen feeling in the stomach.
- Feeling full quickly after eating.
- Frequent or urgent Pelvic pain.
- abdominal pain or cramping.
- Unexplained weight loss.
- Fatigue [28].

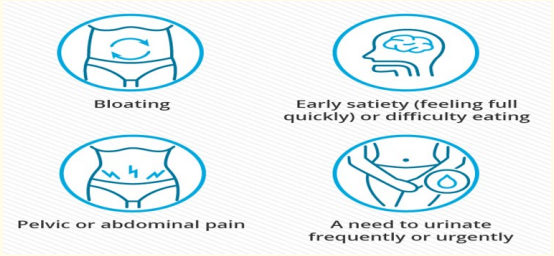


Figure 2: Symptoms of ovarian cancer.

Fruits with Potential Anti-Cancer Activity

Pomegranate

Image 1: Pomegranate.

The biological source of pomegranate is the plant *Punica granatum* L., which belongs to the family Lythraceae [29].

Pomegranate

Kingdom	Plantae
Division:	Magnoliophyta
Class:	Magnoliopsida
Subclass:	Rosidae
Order:	Myrtales
Family:	Lythraceae
Genus:	*Punica*
Species:	***P. granatum***

fruit

Image 2: Botanical profile of Pomegranate.

Chemical Constituents with Anti-Ovarian Cancer Potential

Polyphenols

- *Punicalagin and punicalin*: Hydrolyzable tannins with strong antioxidant and anti-inflammatory effects [30].
- *Ellagic acid and gallic acid*: Known to induce apoptosis and inhibit cancer cell proliferation [31].
- *Flavonoids*: Includes quercetin, kaempferol, catechin, epicatechin, and rutin—modulate cell signaling and oxidative stress [32].

Phenolic Acids

- *Caffeic acid, ferulic acid, p-coumaric acid*: Contribute to antioxidant and anti-proliferative activities [33].

Anthocyanins

- Provide antioxidant effects and may influence cancer cell cycle regulation [34].

Sterols and Alkaloids

- Present in smaller amounts but may support anti-cancer mechanisms [35].

Punicic Acid

- Found in pomegranate seed oil; a conjugated fatty acid with anti-inflammatory and anti-tumor properties [36].

Compound	*Class Specific Molecules*	*Role in Ovarian Cancer Treatment Class*
Phenolic Acids	Ellagic acid, gallic acid, caffeic acid, ferulic acid, p-coumaric acid	Antioxidant, anti-inflammatory, DNA damage protection
Hydrolyzable Tannins	Punicalagin, punicalin, ellagitannins	Induce apoptosis, inhibit proliferation, modulate cell cycle
Flavonoids	Catechin, epicatechin, quercetin, rutin, kaempferol	Suppress Tumor growth, Regulate signaling pathway
Anthocyanins	Delphinidin , Cyanidin ,pelargonidin derivatives	Antioxidant ,Modulate oxidative stress
Steroids & Phytoestrogens	Estrone, estradiol , testosterone	Influence hormone-related cancer pathways

Chart 1: Chemical Constituents with Anti-Ovarian Cancer Potential.

Mechanisms of Action Against Ovarian Cancer

- *Cell Cycle Arrest*: PPE increases levels of CDKN1A (p21), halting cancer cell proliferation.
- *Apoptosis Induction*: Promotes programmed cell death in ovarian cancer cells (e.g., OVCAR-3 line).
- *Oxidative Stress Modulation*: Acts as antioxidant in healthy cells and prooxidant in cancer cells, disrupting their survival.
- *Growth Factor Suppression*: Reduces TGF-β2 and EGF levels and their receptors (TGFBR2, EGFR) in cancer cells.
- *Steroidogenesis Influence*: Stimulates estradiol secretion in non-cancerous ovarian cells, potentially supporting hormonal balance [37].

1 phenolic acids

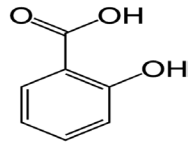
It act against ovarian cancer, with a focus on their molecular targets, mechanisms, and therapeutic relevance [38].

What Are Phenolic Acids?

Phenolic acids are a subclass of plant-derived polyphenols, mainly divided into:

- *Hydroxybenzoic acids*: e.g., gallic acid, protocatechuic acid, salicylic acid.
- *Hydroxycinnamic acids*: e.g., caffeic acid, ferulic acid, p-coumaric acid [39].

They're found in fruits like pomegranate, berries, and vegetables, and are known for their antioxidant, anti-inflammatory, and anticancer properties [40].



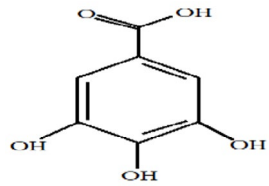
Structure 1: Phenolic acid.

Hydrolyzable tannins—especially gallotannins and ellagitannins—are a class of polyphenolic compounds found in plants like pomegranate, Terminalia chebula, and Phyllanthus niruri [41]. They've gained attention for their potent anti-ovarian cancer effects through multiple molecular mechanisms [42].

What Are Hydrolyzable Tannins?

These are tannins that can be hydrolyzed into sugars and phenolic acids (like gallic acid and ellagic acid) [43]. Two major types:

- *Gallotannins*: Esters of gallic acid with glucose (e.g., tannic acid, corilagin, chebulagic acid).
- *Ellagitannins*: Esters of hexahydroxydiphenic acid with glucose (e.g., punicalagin, pedunculagin) [44].



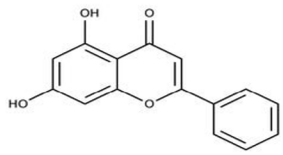
Structure 2: Hydrolyzable tannins.

Flavonoids

Flavonoids are a diverse group of plant-derived polyphenolic compounds that have shown significant anti-ovarian cancer potential through multiple biochemical and cellular mechanisms [45]. Let's unpack their types, molecular actions, and therapeutic relevance in detail [46].

What Are Flavonoids?

Flavonoids are secondary metabolites found in fruits, vegetables, tea, wine, and medicinal herbs [47].



Structure 3: Flavonoids.

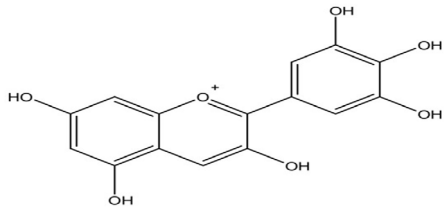
Anthocyanins

Anthocyanins are vibrant plant pigments responsible for the red, purple, and blue hues in many fruits and vegetables—and they're emerging as powerful allies in the fight against ovarian cancer [48].

What Are Anthocyanins?

Anthocyanins are a subclass of flavonoids found in the cell vacuoles of plants. They exist as glycosides of anthocyanidins [49].

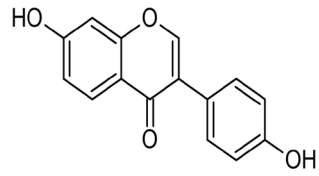
Their antioxidant capacity is influenced by the number and position of hydroxyl and methoxy groups on their B-ring [50].



Structure 4: Anthocyanins.

Steroids & Phytoestrogens

Steroids, particularly glucocorticoids and sex steroids, are used in ovarian cancer treatment for both therapeutic and supportive [51].



Structure 5: Steroids & Phytoestrogens.

Conclusion

Ovarian cancer remains one of the deadliest gynaecological malignancies due to late-stage diagnosis and high recurrence rates. Early detection through imaging and tumor markers is critical, but treatment remains challenging, especially in recurrent cases. Advances in targeted therapies—such as PARP inhibitors and bevacizumab—have shown promise. Understanding molecular pathology, implementing multimodal diagnostic strategies, and enhancing interprofessional care coordination are vital for improving outcomes. Additionally, emerging natural compounds like those found in pomegranate offer potential in adjunctive therapeutic strategies.

References

1. Hong MK and Ding DC. "Early diagnosis of ovarian cancer: A comprehensive review of the advances, challenges, and future directions". Diagnostics 15.4 (2025): 406.
2. Liberto JM., et al. "Current and emerging methods for ovarian cancer screening and diagnostics: a comprehensive review". Cancers 14.12 (2022): 2885
3. Sahu SA and Shrivastava D. "A comprehensive review of screening methods for ovarian masses: Towards earlier detection". Cureus 15.11 (2023).
4. Krankenberg DJ., et al. "Ovarian cancer management in an ESGO ovarian cancer center of excellence: a systematic case study of the interprofessional and interdisciplinary interaction". Archives of Gynecology and Obstetrics 309.6 (2024): 2821-8.
5. Webb PM and Jordan SJ. "Global epidemiology of epithelial ovarian cancer". Nature Reviews Clinical Oncology 21.5 (2024): 389-400.

6. Schoutrop E., et al. "Molecular, cellular and systemic aspects of epithelial ovarian cancer and its tumor microenvironment". In-Seminars in cancer biology. Academic Press 86 (2022): 207-223.
7. De Leo A., et al. "What is new on ovarian carcinoma: integrated morphologic and molecular analysis following the new 2020 World Health Organization classification of female genital tumors". Diagnostics 11.4 (2021): 697.
8. Huang J., et al. "Worldwide burden, risk factors, and temporal trends of ovarian cancer: a global study". Cancers 14.9 (2022): 2230.
9. Ali AT, Al-Ani O and Al-Ani F. "Epidemiology and risk factors for ovarian cancer". Menopause Review/Przegląd Menopauzalny 22.2 (2023): 93-104.
10. Vaiphei SD. "Understanding End-of-Life Care: Psychological Approaches to Cancer Care". Taylor & Francis (2025).
11. La Marca A and Diamanti M. "Factors affecting age at menopause and their relationship with ovarian reserve: A comprehensive review". The European Journal of Contraception & Reproductive Health Care 29.5 (2024): 245-55.
12. Bertozzi S., et al. "Breast cancer care for the aging population: a focus on age-related disparities in breast cancer treatment". BMC cancer 25.1 (2025): 492.
13. Mantovani G., et al. "Primary or Interval Debulking Surgery for Advanced Endometrial Cancer with Carcinosis: A Systematic Review and Individual Patient Data Meta-Analysis of Survival Outcomes". Cancers 17.6 (2025): 1026.
14. Wang ZB., et al. "Ovarian cancer targeted medication: PARP inhibitors, anti-angiogenic drugs, immunotherapy, and more, volume II". Frontiers in Pharmacology 16 (2025): 1552652
15. Tsolakidis D., et al. "Evaluating the Impact of Hyperthermic Intraperitoneal Chemotherapy (HIPEC) on Interval and Secondary Debulking in Ovarian Cancer: A Systematic Review". Cancers 17.5 (2025): 904.
16. Webb PM and Jordan SJ. "Global epidemiology of epithelial ovarian cancer". Nature Reviews Clinical Oncology 21.5 (2024): 389-400.
17. Fu Z, Taylor S and Modugno F. "Lifetime ovulations and epithelial ovarian cancer risk and survival: a systematic review and meta-analysis". Gynecologic oncology 165.3 (2022): 650-63.
18. Didziokaite G., et al. "Oxidative stress as a potential underlying cause of minimal and mild endometriosis-related infertility". International Journal of Molecular Sciences 24.4 (2023): 3809.
19. Barili V., et al. "Genetic basis of breast and ovarian cancer: approaches and lessons learnt from three decades of inherited predisposition Testing". Genes 15.2 (2024): 219.
20. Palleschi M. Exploring the role of rare germline variants in non-coding regions of cancer predisposition genes in triple-negative breast cancer patients (2024).
21. Otsuka I. "Mechanisms of high-grade serous carcinogenesis in the fallopian tube and ovary: current hypotheses, etiologic factors, and molecular alterations". International journal of molecular sciences 22.9 (2021): 4409.
22. Li Y., et al. "Global, regional, and National burden of breast, cervical, uterine, and ovarian cancer and their risk factors among women from 1990 to 2021, and projections to 2050: findings from the global burden of disease study 2021". BMC cancer 25.1 (2025): 330.
23. Rees A., et al. "Screening Methods to Discover the FDA-Approved Cancer Drug Encorafenib as Optimally Selective for Metallothionein Gene Loss Ovarian Cancer". Genes 16.1 (2025): 42.
24. Shen Y., et al. "Molecular characteristics of early-and late-onset ovarian cancer: insights from multidimensional evidence". Journal of Ovarian Research 18.1 (2025): 83.
25. Wei YF., et al. "Worldwide patterns and trends in ovarian cancer incidence by histological subtype: a population-based analysis from 1988 to 2017". EClinicalMedicine (2025).
26. Mongiovi JM., et al. "Associations between parity, history of breastfeeding, and T cell profile of ovarian tumors". Cancer Epidemiology, Biomarkers & Prevention (2025).
27. Zhang J, Wang M and Wu Y. "Risk Factors for Recurrence in Serous Borderline Ovarian Tumors and Early-Stage Low-Grade Serous Ovarian Carcinoma". Current Oncology 32.5 (2025): 263.

28. Haddadi R. Managing the Unseen: A Qualitative Study on Polycystic Ovary Syndrome-Related Pain and Symptom Management (Master's thesis, University of Twente).
29. Yan M and Yuan Z. "Chloroplast Genome of Pomegranate. In The Pomegranate Genome". CRC Press (2025): 70-75.
30. Huang Z, Foo SC and Choo WS. "A review on the extraction of polyphenols from pomegranate peel for punicalagin purification: techniques, applications, and future prospects". Sustainable Food Technology (2025).
31. Martínez-Méndez DD., et al. "Ballota hirsuta Benth Arrests the Cell Cycle, Induces Apoptosis and Inhibits the Invasion of MCF-7 and MDA-MB-231 Cell Lines in 2D and 3D Models". International Journal of Molecular Sciences 26.12 (2025): 5672.
32. Al Hoque A, Begum S and Dutta D. "Occurrence, Chemical Nature, and Medicinal Benefits of Flavonoids-Rutin, Kaempferol, Quercetin, Anthocyanidins, Catechins, and Flavones". In Dietary Supplements and Nutraceuticals. Singapore: Springer Nature Singapore (2025): 1-24.
33. Rauf A., et al. "Ferulic acid as a promising candidate for developing selective and effective anti-cancer therapies". Discover Oncology 16 (2025): 1214.
34. . Manmuan S., et al. "Phytochemical analysis, antioxidant activity, and cytotoxic effects of Caulerpa lentillifera extracts inducing cell apoptosis and sub-G/G0-G1 cell cycle arrest in KON oral cancer cells". BMC Complementary Medicine and Therapies 25.1 (2025): 101.
35. Namwan N., et al. "Synergistic Anti-Cancer Activities of Curcumin Derivative CU17 Combined with Gemcitabine Against A549 Non-Small-Cell Lung Cancer Cells". Pharmaceutics 17.2 (2025): 158.
36. Ashaolu TJ., et al. "Extraction and stabilization of pomegranate seed oil: a functional oil for the food industry". Journal of Food Measurement and Characterization 19.1 (2025): 167-84.
37. D'costa M., et al. "CDK regulators—Cell cycle progression or apoptosis—Scenarios in normal cells and cancerous cells". Advances in Protein Chemistry and Structural Biology 135 (2023): 125-77.
38. Palani B., et al. "Bioactive Compounds for Inhibiting Mutated Gene (BRCA1 and BRCA2) Signaling Pathway in Ovarian Cancer Treatment". Biomedical Materials & Devices (2025): 1-20.
39. Nunes AR., et al. "Phenolic Acids from Fruit By-Products as Therapeutic Agents for Metabolic Syndrome: A Review". International Journal of Molecular Sciences 26.8 (2025): 3834.
40. Mustafa YF. "Role of fruit-derived antioxidants in fighting cancer: a narrative review". Indian Journal of Clinical Biochemistry (2025): 1-8.
41. Nguyen TL., et al. "Innovative extraction technologies of bioactive compounds from plant by-products for textile colorants and antimicrobial agents". Biomass conversion and biorefinery 20 (2024): 24973-5002.
42. Xu C., et al. "The role of macrophage polarization in ovarian cancer: From molecular mechanism to therapeutic potentials". Frontiers in Immunology 16 (2025): 1543096.
43. Bayramoglu EE and Civi S. "Review of tannins currently used in the leather industry". Part 1: hydrolysable tannins. ICAMS 2024 (2024): 30.
44. Molnar M., et al. "A comprehensive analysis of diversity, structure, biosynthesis and extraction of biologically active tannins from various plant-based materials using deep eutectic solvents". Molecules 29.11 (2024): 2615.
45. Islam MR., et al. "The role of natural and semi-synthetic compounds in ovarian cancer: Updates on mechanisms of action, current trends and perspectives". Molecules 28.5 (2023): 2070.
46. Semeradtova A., et al. "Extracellular vesicles in cancer´ s communication: messages we can read and how to answer". Molecular Cancer 24.1 (2025): 86.
47. Amer A and Shahin A. "In Vitro Production of Flavonoids". Plant Specialized Metabolites: Phytochemistry, Ecology and Biotechnology (2025): 1-49.
48. Masyita A., et al. "Natural pigments: innovative extraction technologies and their potential application in health and food industries". Frontiers in Pharmacology 15 (2025): 1507108.
49. Lazić AM., et al. "Harnessing the potential of selected plant pigments in dye-sensitized solar cells: the current status". Hemijska

industrija 79.1 (2025): 47-65.

50. An J., et al. “Organic Functional Groups and Their Substitution Sites in Natural Flavonoids: A Review on Their Contributions to Antioxidant, Anti-Inflammatory, and Analgesic Capabilities”. Food Science & Nutrition 13.5 (2025): e70191.
51. Schwarzlmueller P., et al. “Steroid hormones as modulators of anti-tumoural immunity”. Nature Reviews Endocrinology (2025): 1-3.