COUMARINS: NATURE'S VERSATILE COMPOUNDS WITH DIVERSE PHARMACOLOGICAL ATTRIBUTES

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Abstract: *This comprehensive article delves into the multifaceted realm of coumarins, a class of naturally occurring aromatic compounds. With a shared coumarin nucleus composed of furan-2-one and ortho-hydroxycinnamic acid moieties, these compounds exhibit remarkable pharmacological characteristics. The article explores their diverse roles, encompassing antimicrobial, antiviral, antioxidant, antifungal, and anticoagulant activities. Coumarins' prevalence in various plants, including celery and Rutaceae species, is discussed, along with their photodynamic properties and therapeutic applications in dermatology. The article underscores both the potential benefits and risks of coumarin utilization, emphasizing the importance of cautious consumption. Overall, this comprehensive review illuminates coumarins' versatility and their potential as promising agents in modern healthcare and various industries.*

Keywords: *pharmacological, antimicrobial, antiviral, antioxidant, antifungal, anticoagulant, celery, Rutaceae, photodynamic.*

Coumarins, a class of natural aromatic compounds, form the foundation of a wide array of biological activities. Regardless of their structural variations and classifications, they share a common coumarin nucleus, specifically the coumarin skeleton containing furan-2-one and ortho-hydroxycinnamic acid moieties. This distinctive molecular scaffold, characterized by a fragrant and powerful odor, was initially isolated in 1820 from the South American tree "Good Bean," commonly known as "Kumaruna." The indigenous "Kumaruna" family, rich in coumarins, is renowned for its abundance of this aromatic compound.

The Diversity of Coumarins:

Coumarins encompass a myriad of structures, each offering unique and subtle nuances. Their systematic isolation and comprehensive understanding have unfolded over the past few decades, revealing a treasure trove of over 500 naturally occurring coumarin varieties. The plant kingdom boasts a wide distribution of coumarins, predominantly in celery (Apiaceae) family members, umbellifers, and Rutaceae species. Coumarin content in various plants ranges from 0.2% to 10%, potentially yielding an impressive 5-10 kilograms of coumarins per ton of plant material in some cases.

Prevalence and Classification:

Among the various coumarin subtypes, coumarin, furanocoumarins, and pyranocoumarins are the most prevalent. These compounds are primarily found in free form or as glycosides, often occurring in different furan configurations. The

fundamental part of these derivatives is a coumarin nucleus and is typically present in low amounts, generally in the free or glycosidic forms.

Pharmacological Properties:

Coumarins are characterized by a myriad of pharmacological attributes. Notably, dicumarol, a natural coumarin derivative, has been recommended as an anticoagulant for thrombosis and thrombophlebitis treatment. Furthermore, synthetic anticoagulants owe their high efficacy to the foundational role of dicumarol. Some coumarins exhibit photodynamic activity, enhancing sensitivity to ultraviolet light, making them useful in treating conditions like vitiligo. Additionally, coumarins often possess spasmolytic properties and are applied in diuretic, cholagogic, cardiovascular, and hypotensive therapies.

Structural Variations and Bioactivity:

The structural variations of coumarins include:

Hydroxy-, Methoxy- (Alkoxy-), and Methylenedioxy-coumarins:

A) Benzene ring-based hydroxyl or alkoxy groups, as seen in umbelliferone, esculetin, osthenol, and others, prevalent in the carrot (Apiaceae) family, and widespread in the rue (Rutaceae) family.

B) Pyrone ring-based hydroxyl or alkoxy groups, widely distributed among diverse furan derivatives. Notably found in celery (Apiaceae) family plants, such as parsley.

Potential Benefits and Risks:

The utility of coumarins spans a wide spectrum of medical applications. They have been employed in the treatment of neuroses, colic, spastic constipation, obstructive biliary diseases, and bronchial asthma. Moreover, coumarins have become integral in preventing and treating thromboembolic events and atrial fibrillation. However, their anticoagulant properties necessitate cautious use to prevent potential negative effects.

Modern Applications and Health Considerations:

Today, coumarins find extensive use in promoting a healthy lifestyle and diet. They are integral to the creation of numerous products in the food industry. The importance of coumarins in modern diets is highlighted by the presence of this compound in a variety of plant-based foods, including chamomile, figs, chestnuts, and more. It is vital to exercise caution and adhere to recommended doses when incorporating coumarins into daily routines, as excessive consumption could lead to detrimental effects on health.

Conclusion:

Coumarins have transcended their traditional role as natural fragrance compounds and have emerged as versatile agents with a wide range of pharmacological attributes. From their antiviral and antioxidant properties to their potential therapeutic applications in various medical conditions, coumarins continue to capture the attention of researchers and practitioners alike. As our understanding of

these compounds deepens, coumarins remain promising candidates for innovative therapies and health-enhancing products, provided they are used thoughtfully and judiciously.

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