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A Molecular Docking Approach of the Compound Beta-eudesmol as Potential Mitogen-Activated Protein Kinase 14 (MAPK 14) Inhibitor for Anti-inflammatory

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ABSTRACT

The docking molecular study of Beta-eudesmol with MAPK14 for anti-inflammatory activity investigates the potential of Beta-eudesmol in inhibiting the activity of mitogen-activated protein kinase 14 (MAPK14), which is involved in inflammatory responses. Our investigation was conducted using MOE software. Following docking, the ligands were ranked by binding energy, and the molecule with the lowest binding energy was chosen as the best lead. The results revealed the presence of a hydrogen bond between the carbonyl functionalities of the residues (Met 109 and His 107), which compose the active site of MAPK14, and the Beta-eudesmol hydroxyl group. This research aims to explore the molecular interactions between Beta-eudesmol and MAPK14, and assess their potential role in alleviating inflammation.

Keywords: Molecular docking, Beta-eudesmol, Anti- inflammatory, MAPK14

1. Introduction

Inflammation is a complex biological response that plays a crucial role in protecting the body against harmful stimuli. However, chronic inflammation can lead to various diseases, including arthritis, asthma, and cancer. Consequently, there is a growing interest in identifying novel anti-inflammatory agents to treat these conditions. MAPK14 (Figure 1), also known as p38α, is a key enzyme involved in the regulation of inflammation. Inhibition of MAPK14 has been shown to reduce inflammation in various experimental models [1]. Beta-eudesmol (Figure 2), a sesquiterpenes compound [2,3], has been traditionally used for its analgesic, antispasmodic, and anti-inflammatory properties. Recent studies have demonstrated that Beta-eudesmol possesses anti-inflammatory effects, which could be attributed to its ability to modulate the activity of MAPK14 [4,5].Molecular docking is a prominent method for modeling the binding interactions of tiny molecules and potential therapeutic candidates with protein targets, revealing critical information about their affinity and activity [6-8]. In this context, molecular docking studies can provide valuable insights into the molecular interactions between Beta-eudesmo and MAPK14, and help in understanding the potential mechanism of action of Beta-eudesmol in anti-inflammatory activity.

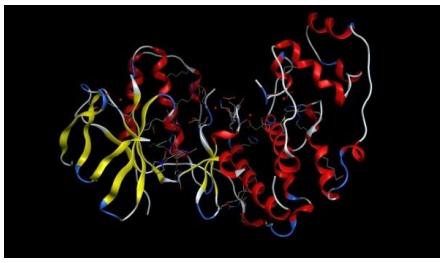

Figure 1: Crystal structure of MAPK 14

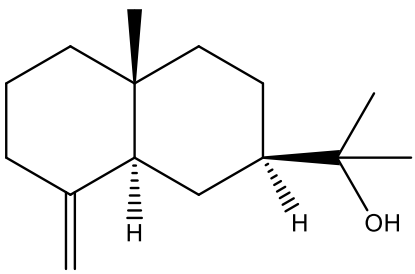

Figure 2: Chemical Structure of β-eudesmol

2. Experimental

The initial stage in molecular docking is to construct the ligand; β-eudesmol and receptor; MAPK14 structure. This includes translating chemical structures into software-readable formats, adding hydrogen

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atoms, assigning suitable charges, and optimizing geometry. The docking procedure involves putting the ligand in the receptor's active site and then looking for the ideal orientation and conformation resulting in the highest binding affinity. This is accomplished by utilizing a combination of geometric and empirical scoring functions.

3. Results and Discussion

The molecular docking study revealed that Beta-eudesmol can effectively dock into the binding pocket of MAPK14, forming a stable complex (Figure 3). The binding energy of the Beta-eudesmol-MAPK14 complex was found to be -5.88 kcal/mol, suggesting a strong binding affinity. The interaction analysis revealed that Beta-eudesmol formed backbone acceptor/donor contacts with critical MAPK14 residues (Met 109 and His 107) (Figure 4), inhibiting its activity.

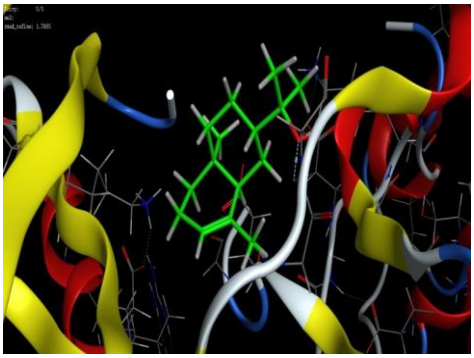

Figure3: Molecular docking model of Beta-eudesmol therapeutic target and MAPK 14 active compound.

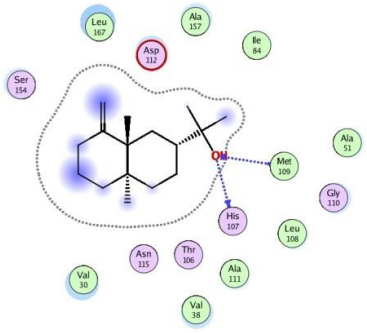

Figure4: Binding interactions of compound Beta-eudesmol with MAPK 14 crystal structure.

4. Conclusion

The molecular docking study of Beta-eudesmol with MAPK14 provides evidence for the potential of Beta-eudesmol in inhibiting MAPK14 mediated inflammation. Further experimental validation, such as in vitro and in vivo studies, is necessary to confirm the anti-inflammatory effects of Beta-eudesmol and its potential use as a therapeutic agent for inflammatory diseases.

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