



SYNTHETIC VITAMINS: CHEMICAL PROPERTIES, BIOLOGICAL ROLE, BENEFITS AND POTENTIAL RISKS

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ABSTRACT

This thesis examines the chemical nature, production methods, biological activity, and the beneficial as well as harmful effects of synthetic vitamins. Differences in bioavailability between natural and synthetic vitamins, risks of hypervitaminosis, and their clinical applications are analyzed based on modern biochemical and pharmacological perspectives.

Introduction

Vitamins are essential bioactive compounds that regulate enzymatic reactions in the human body. Their deficiency leads to various pathological conditions. Therefore, synthetic analogs of vitamins are widely produced in the pharmaceutical industry. Synthetic vitamins are chemically synthesized compounds with structures similar or identical to natural vitamins

Main Part

1. Chemical Nature and Classification of Synthetic Vitamins

Synthetic vitamins are organic compounds produced through chemical synthesis and possess biological activity.

Based on solubility, they are classified into:

Fat-soluble vitamins: A, D, E, K

Water-soluble vitamins: B-complex and vitamin C

According to chemical structure:

Isoprenoid compounds (vitamins A, E)

Steroid derivatives (vitamin D)

Heterocyclic compounds (B-group vitamins)

2. Production of Synthetic Vitamins

Modern technologies produce vitamins through:

Chemical synthesis

Biotechnological (enzymatic) methods

Microbial fermentation

Examples:

Vitamin C is synthesized from glucose

Vitamin B₁₂ is produced by bacteria

3. Pharmacokinetic Properties

The pharmacokinetics of synthetic vitamins includes:

Absorption

Distribution

Metabolism

Excretion

Fat-soluble vitamins accumulate in the liver and adipose tissue, increasing the risk of toxicity

4. Benefits of Synthetic Vitamins

1.Prevention and treatment of vitamin deficiencies

2.Important role in clinical medicine

Vitamin D: prevention of rickets

Vitamin B₁₂: treatment of megaloblastic anemia

1.Accurate dosage and standardization

2.Long shelf life and stability

5. Harmful Effects of Synthetic Vitamins

1.Hypervitaminosis

Vitamin A: hepatotoxicity

Vitamin D: hypercalcemia

1.Reduced bioavailability

Some synthetic forms may be less efficiently utilized

2.Allergic and toxic reactions

3.Metabolic imbalance

6. Comparison of Natural and Synthetic Vitamins

Parameter	Natural	Synthetic
Complexity	High	Simplified
Bioavailability	Higher	Sometimes lower
Stability	Low	High
Dosage control	Difficult	Precise

7. Modern Scientific Approaches

Recent studies indicate that:

Synthetic vitamins are effective for prevention

Excessive intake may be harmful

Personalized medicine approach is essential

Conclusion

Synthetic vitamins play an important role in modern medicine and pharmacology by preventing and treating vitamin deficiencies. However, their improper or excessive use may lead to hypervitaminosis and metabolic disturbances. Therefore, their use should be scientifically justified and supervised by healthcare professionals..

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