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Dedication

To the ones who crowned our names with pride, who lifted us with hands unseen, who gave endlessly, teaching us that the world is a battlefield and knowledge our greatest sword our fathers, our shelter after God.

To the ones whose prayers paved the way beneath our feet, whose hearts cradled us before their arms did, the candles that burned through our darkest nights, the whispers of strength when all seemed lost. Our mothers, the light of our journey.

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And finally, to ourselves for the patience when the road twisted harshly, for the resilience when the nights grew long, for believing even when fear whispered louder than hope.

Here we are, closing one chapter with gratitude, opening the next with prayers that knowledge will forever be our light, and love, our enduring guide.

List of abbreviations

1,25(OH)2D: 1,25-dihydroxy vitamin D.

25OHD: 25-hydroxy vitamin D.

CAS: Cycloartenol synthase.

DBP: Vitamin D binding protein.

DMAPP: Dimethylallyl diphosphate.

FPP: Farnesyl pyrophosphate.

GC-MS: Gas chromatography- mass spectrometry.

HPLC: High performance liquid chromatography.

IPP: Isopentyl diphosphate.

LAS: Lanosterol synthase.

LC-ES-MS/MS: Liquid chromatography-electrospray mass spectrometry.

MAPK: Mitogen-activated protein kinase.

MS/MS: Mass spectrometry.

PTH: Parathyroid hormone.

RANKL: Receptor activator of nuclear factor-kB ligand.

RXR: Retinoid X receptor.

SMT: Sterol methyl transferase.

TLC: Thin layer chromatography.

UVB-radiation : Ultraviolet-B radiation.

VDR: Vitamin D receptor.

VDRE : Vitamin D response elements.

List of figures

Figure 1: Structures of vitamin D2 (ergocalciferol) and vitamin D3 (cholecalciferol) ……..... 4
Figure 2: Products of over irradiation of vitamin D ...…….. 6
Figure 3: Different mushroom species with vitamin D2 Potential ……. 15
Figure 4: First part of the biosynthetic pathway of sterols ….…… 16
Figure 5: Cyclization of 2,3-oxidosqualene forms either lanosterol or cycloartenol via a series of enzymatic cyclization leading to sterols in plants, fungi and animals ……..… 17
Figure 6: Simplified cholesterol biosynthesis. Lanosterol is converted to cholesterol in a series of enzyme reactions …….…..… 18
Figure 7: Last five steps of the ergosterol biosynthetic pathway in Saccharomyces *cerevisiae* .19
Figure 8: Simplified biosynthetic pathway for plant sterols …….…….. 21
Figure 9: Synthesis and activation of vitamin D …….…..……....….... 24
Figure 10: Systematic representation of vitamin D production through sun light and foods and its metabolism through vital organs such as liver kidney ……...…….……. 24
Figure 11: Role of vitamin D in calcium and phosphate homeostasis through various mechanistic regulatory pathways ...…….. 25
Figure 12: Molecular mechanism of vitamin D in regulation of calcium homeostasis and senescence due to oxidative and inflammatory stress…….. 27

List of tables

Table 1: Vitamin D classification …….……... 4
Table 2: Physical properties of provitamins and vitamins D2/D3 ……...……. 7
Table 3: Quantification of vitamin D3 and its metabolites in plants ……...…… 10
Table 4: Quantification of vitamin D2 and its metabolites in plants ……..……. 12
Table 5: Selected Dietary sources of vitamin D ……..…… 13

الملخص

يُعتَبَر هذا البحث دراسة شاملة لأهمية فيتامين د، خاصة مراحل اكتشافه، خصائصه ومصادره الطبيعية، مع التركيز على وجوده في الأطعمة الحيوانية، النباتية، الطحالب والفطريات. كما أُعطِيَت أهمية لتصنيعه ومساراته الأيضية في الكائنات الحية المختلفة، بما في ذلك مسارات الستيرول في الحيوانات والفطريات والنباتات. من الجدير بالذكر أن الأبحاث قد حددت تركيز فيتامين د3 ومستقبلاته في عدة أنواع نباتية، مما يتحدى الافتراض القديم بأن وجود فيتامين د3 كان حصريًا في الحيوانات. تُعتَبَر الأشعة فوق البنفسجية المحفز الطبيعي والرئيسي لتصنيع فيتامين د. غير أن بعض العوامل مثل الموقع الجغرافي والتغيرات الموسمية والتعرض المحدود لأشعة الشمس ساهمت في انتشار نقص مستواه عند الأشخاص في كل أنحاء العالم. يُعتَبَر فيتامين د عنصرًا غذائيًا حيويًا مسؤولًا عن الحفاظ على توازن الكالسيوم والفوسفور في الجسم، ويلعب دورًا أساسيًا في صحة الهيكل العظمي وتنظيم المناعة، خاصة أن له دورًا ضد الأكسدة والالتهاب، وبالتالي الوقاية من العديد من الأمراض المزمنة كارتفاع ضغط الدم والسكري، أمراض القلب، السمنة وبعض أنواع السرطان. نظرًا للأهمية الكبرى لفيتامين د اهتمت الدراسات بمعالجة نقصه وإيجاد بدائل طبيعية له، من خلال استهلاك المواد الغنية به، سواء كانت حيوانية أو نباتية اوالفطر المعرض للأشعة فوق البنفسجية، اوالطحالب، اوالأغذية المدعمة به.

الكلمات المفتاحية : كوليكالسيفيرول،7 -ديهيدروكوليستيرول، إرغوكالسيفيرول، إرغوستيرول، فيتامين د.

Abstract

This study provides a comprehensive review of the stages of vitamin D discovery, its properties, and natural sources, with a focus on its presence in animal, plant, algae, and fungal foods. It also emphasizes its synthesis and metabolic pathways in different organisms, including sterol pathways in animals, fungi, and plants. Notably, discoveries have identified the concentration of vitamin D3 and its receptors in several plant species, challenging the old assumption that vitamin D3 was exclusive to animals. Ultraviolet rays are the primary natural trigger of vitamin D synthesis. However, factors such as geographic location, seasonal changes, and limited sun exposure have contributed to the widespread deficiency of its levels among people worldwide. Vitamin D is a vital nutrient responsible for maintaining the balance of calcium and phosphorus in the body. It plays a crucial role in skeletal health and immune regulation, especially since it has a role against oxidation and inflammation, thereby preventing many chronic diseases such as hypertension, diabetes, heart diseases, obesity, and some types of cancer. Due to the great importance of vitamin D, studies have focused on treating its deficiency by finding natural alternatives, through the consumption of foods rich in it, whether animal or plant-based, UV-exposed mushrooms, microalgae, and fortified foods.

Key words: Cholecalciferol, 7-dehydrocholesterol, Ergocalciferol, Ergosterol, Vitamin D.

Résumé

Cette étude fournit une revue complète sur la vitamine D, en particulier les étapes de sa découverte, ses caractéristiques et ses sources naturelles, en concentrant sur sa disponibilité dans les aliments d'origine animale, végétale, algale et fongique. Elle accorde également une importance à sa synthèse et à ses voies métaboliques dans différents organismes vivants, y compris les voies des stérols chez les animaux, les champignons et les plantes. Il convient de noter que les recherches ont déterminé la concentration de la vitamine D3 et de ses récepteurs dans plusieurs espèces végétales, remettant en question l'ancienne hypothèse selon laquelle la vitamine D3 était exclusive aux animaux. Les rayons ultraviolets sont le principal facteur naturel induisant la synthèse de la vitamine D. Cependant, certains facteurs tels que la localisation géographique, les variations saisonnières et l'exposition limitée au soleil ont contribué à la propagation de sa carence dans le monde entier. La vitamine D est un élément nutritif vital responsable du maintien de l'équilibre du calcium et du phosphore dans le corps, et elle joue un rôle essentiel dans la santé du squelette et la régulation du système immunitaire, notamment en ayant un rôle contre l'oxydation et l'inflammation, et donc peut prévenir de nombreuses maladies chroniques telles que l'hypertension artérielle, le diabète, les maladies cardiaques, l'obésité et certains types de cancer. En raison de l'importance majeure de la vitamine D, les études se sont orientées vers le traitement de sa carence par des alternatives naturelles, à travers la consommation de substances riches en vitamine D, soient animales ou végétales, les champignons exposés aux rayons ultraviolets, les algues, et les aliments enrichis en vitamine D.

Mots-clés : Cholécalciférol, 7-déhydrocholestérol, Ergocalciférol, Ergostérol, Vitamine D.