

Exploring Vitamin A: A Comparative Review of British and Pakistani Standards

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Abstract

Background: Vitamin A also known as retinol is an oil soluble vitamin which plays a critical role in physiological conditions for maintaining skin health and immune function. Its therapeutic interventions by regulatory standards vary across regions. This study is a comparison of Pakistani Pharmacopoeia with BP standards. With focus on disease which uses pure Vitamin A as primary treatment.

Objective: To conduct comprehensive literature based comparison to analyze the potency, quality and regulatory standards and to identify specific diseases where Vitamin A is a primary treatment.

Methodology: This article will develop into an overview of vitamin A and the associated BP standards, then explore the available vitamin A products available in Pakistan, facilitating a detailed comparison. Moreover, it will show a comparative analysis of products having vitamin A in both pharmacopoeias, spotlighting common and specific medicines which use vitamin A in its pure form without additional excipients for specific disease treatments. Through a clear layout of these topics, the article aims to offer a comprehensive understanding of the current landscape surrounding vitamin A treatment protocols and product accessibility in both the UK and Pakistan.

Sources: A systematic review of different articles and regulatory documents from reputable sources like official pharmacopoeia website, global health regulatory and clinical studies was conducted. Additionally, the study focuses on diseases like Xerophthalmia, night blindness and psoriasis.

Result: The BP definitely based on more rigorous requirements for Vitamin A quality, purity and dosage consistency as compared to Pakistan pharmacopoeia. Both has similar therapeutical regulations and disease treatment management. Drug manufacturing brands available in the US are more expensive and couldn't be prescribed to Pakistani patients dealing with Xerophthalmia, night blindness and psoriasis.

Conclusion: Strict enforcement of standards in Pakistan could rapidly improve health outcomes. Ensuring consistent quality, purity and standardized dosage and availability of pure Vitamin A is a requirement for effective treatment practice.

Keywords: Vitamin A; Pakistani standards; Pakistan Pharmacopoeia; Xerophthalmia; Night blindness; Psoriasis

Vitamin A, a crucial micronutrient for maintaining vision, promoting healthy skin, and supporting the immune system, significantly impacts public health across the globe. Despite its vital role, disparities exist in the availability and standards of vitamin A products, particularly when comparing developed and developing countries. A comparative review of the medicines' standards for vitamin A in the British pharmacopoeia versus those in Pakistan not only unveils these differences but also highlights the importance of harmonising health standards

worldwide. This analysis is imperative for understanding how variations in pharmacopoeial standards and product availability can influence the treatment and prevention of vitamin A-related diseases.

The article will delve into an overview of vitamin A and the associated British pharmacopoeia standards, then explore the available vitamin A products in Pakistan, providing a detailed comparison. Moreover, it will engage in a comparative analy-

Vitamin A Products Available in Great Britain

Product Name	Form	Manufacturer	Formula
Boots Retinol Night Cream	Serum	Boots UK Limited	Contains retinol, a form of vitamin A
Superdrug Optimum Retinol Serum	Serum	Superdrug Stores PLC	Contains retinol, a form of vitamin A
Holland & Barrett Vitamin A 5000 IU Capsules	Capsules	Holland & Barrett	Contains vitamin A (retinol)
The Ordinary Retinol 0.2% in Squalane	Serum	DECIEM UK	Contains retinol in squalane
SkinCeuticals Retinol 0.3	Serum	L'Oréal UK	Contains 0.3% retinol
Medik8 Retinol 3TR Serum	Serum	Pangaea Laboratories Ltd.	Contains 0.3% retinol
No7 Advanced Retinol 1.5% Complex Night Concentrate	Concentrate	Boots UK Limited	Contains 1.5% retinol complex
Pixi Retinol Tonic	Tonic	Pixi Beauty UK	Contains retinol
StriVectin Advanced Retinol Night Treatment	Treatment	StriVectin Operating Company UK Ltd.	Contains retinol
Omorovicza Miracle Facial Oil	Oil	Omorovicza UK	Contains retinol
Avene A-Oxitive Night Peeling Cream	Cream	Pierre Fabre UK	Contains retinaldehyde, a form of vitamin A
Allies of Skin 1A Retinal + Peptides Overnight Mask	Mask	Allies of Skin	Contains retinol, a form of vitamin A
Pestle & Mortar Superstar Retinoid Night Oil	Oil	Pestle & Mortar	Contains retinoid complex
Zelens Power A High Potency Vitamin A Treatment Drops	Drops	Zelens UK	Contains high potency vitamin A (retinol)

sis of products having vitamin A in both pharmacopoeias, spotlighting the medicines which use vitamin A in its pure form without additional compounds for specific disease treatments. Furthermore, the review will cover the dosage and treatment protocols for vitamin A deficiency, concluding with the critical assessment of how these standards and availability directly impact the effective management of vitamin A deficiency. Through a clear layout of these topics, the article aims to offer a comprehensive understanding of the current landscape surrounding vitamin A treatment protocols and product accessibility in both the UK and Pakistan.

Overview of Vitamin A and British Pharmacopoeia Standards

British Pharmacopoeia: An Overview

The British Pharmacopoeia (BP) is a critical document that provides official standards for pharmaceutical substances and medicinal products in the UK. Established in 1864, the BP includes comprehensive collections of authoritative standards, incorporating all texts and monographs of the European Pharmacopoeia, marked with a chaplet of stars, as well as national standards developed specifically for the UK [9]. It is developed by the BP team, a group of experts who ensure the pharmacopoeia meets the highest quality standards for medicine safety and efficacy. The BP is updated annually and becomes legally effective at the start of each year, ensuring that it remains a current and vital tool in the regulation of medicines [9].

Standards for Vitamin A in British Pharmacopoeia

The standards for Vitamin A and other pharmaceutical substances in the British Pharmacopoeia are defined through rigorous testing and quality control measures. British Pharmacopoeia Chemical Reference Substances (BPCRS) are primary standards used to perform these tests. These standards are established using absolute methods, and their declared content figures are determined without comparison to another substance [4][2]. The BPCRS are critical for ensuring the consistency and accuracy of pharmaceutical testing in the UK, making them an essential component of the BP's regulatory framework.

Moreover, the BP includes specific monographs for active pharmaceutical ingredients and excipients, which provide mandatory standards for substances like Vitamin A. These monographs detail the required purity, composition, and other critical parameters that must be adhered to, ensuring that all pharmaceutical products manufactured and sold in the UK meet stringent safety and efficacy guidelines [8]. The BP also contains appendices and supplementary chapters that support the monographs by providing additional guidance on methods of analysis and calibration requirements for analytical techniques [8].

These standards are not only a testament to the BP's commitment to public health but also reflect its role as a cornerstone of the Medicines and Healthcare products Regulatory Agency's strategy to safeguard public health in the UK [9].

Vitamin A Products Available in Pakistan

Forms of Vitamin A

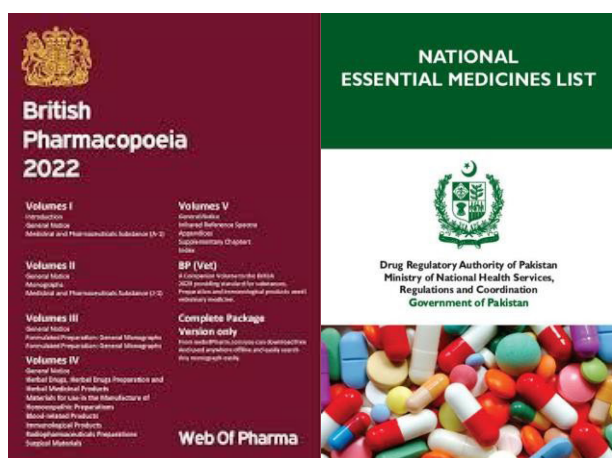
In Pakistan, Vitamin A is available in various forms to cater to different health needs and preferences. These include syrups, tablets, and capsules, each designed to provide specific dosages of Vitamin A. For instance, syrups are available in concentrations like 0.9 mg/5ml, 1.5 mg/5ml, and dosages extending up to 2800 IU/4ml [12]. Tablets offer a broader range of dosages, from as low as 300 IU to as high as 30,000 IU, allowing for tailored intake based on individual health requirements [12]. Capsules are also available, with dosages ranging from 500 IU to 25,000 IU, providing options for both maintenance and therapeutic uses [12].

Several brands in Pakistan offer Vitamin A products, ensuring accessibility and variety for consumers. Notable among these is the Nutrifactor brand, which offers supplements like Visionex and Icelandic Cod Liver Oil. Visionex is an advanced liquid formulation that not only contains Vitamin A but also includes vitamins C and E to enhance antioxidant support and protect against free radicals. It is designed to support healthy vision and long-term eye health [15]. Icelandic Cod Liver Oil, an-

Popular Vitamin A Products in Pakistan

Product Name	Form	Manufacturer	Formula
Scotmann Vitamin A Softgel	Softgel	Scotmann Pharmaceuticals	Vitamin A (as Retinyl Palmitate) 5000 IU
Getz Pharma Vitamin A Capsules	Capsules	Getz Pharma	Vitamin A (as Retinyl Palmitate) 5000 IU
ATCO Vitamin A Capsules	Capsules	ATCO Laboratories	Vitamin A (as Retinyl Palmitate) 5000 IU
Platinum Pharma Vitamin A Facial Oil	Facial Oil	Platinum Pharmaceuticals	Retinol (Vitamin A)
OBS Pharma Vitamin A Softgel	Softgel	OBS Pharma	Vitamin A (as Retinyl Palmitate) 5000 IU
Pharmevo Vitamin A Tablets	Tablets	Pharmevo	Vitamin A (as Retinyl Palmitate) 5000 IU
Brookes Vitamin A Softgel	Softgel	Brookes Pharma Pvt Ltd	Vitamin A (as Retinyl Palmitate) 5000 IU
Bosch Vitamin A Capsules	Capsules	Bosch Pharmaceuticals	Vitamin A (as Retinyl Palmitate) 5000 IU
Wilshire Vitamin A Softgel	Softgel	Wilshire Laboratories	Vitamin A (as Retinyl Palmitate) 5000 IU
Platinum Pharma Vitamin A Capsules	Capsules	Platinum Pharmaceuticals	Vitamin A (as Retinyl Palmitate) 5000 IU
Genix Pharma Vitamin A Softgel	Softgel	Genix Pharma Pvt Ltd	Vitamin A (as Retinyl Palmitate) 5000 IU
Efroze Vitamin A Capsules	Capsules	Efroze Chemical Industries	Vitamin A (as Retinyl Palmitate) 5000 IU
Barret Retinol Serum	Serum	Barrett Hodgson Pakistan	Retinol (Vitamin A)
Amson Vitamin A Eye Cream	Eye Cream	Amson Vaccines & Pharma	Retinol (Vitamin A)

Comparative Analysis: British Pharmacopoeia Standards vs. Pakistan Availability



other product from Nutrifactor, is rich in Vitamin A and D and includes omega-3 fatty acids, which support heart and brain health [15].

Moreover, products such as VI-DAYLIN are available in various formulations at different price points, making Vitamin A supplements accessible to a broader segment of the population. For example, VI-DAYLIN syrup is offered at a retail price ranging from PKR 25.00 to PKR 107.00, depending on the concentration and volume [12].

These products play a crucial role in addressing Vitamin A deficiency, which can lead to severe health issues such as night blindness and immune system impairments. By providing a range of Vitamin A supplements, Pakistan's healthcare market caters to the needs of its population, aiming to reduce the prevalence of Vitamin A deficiency and its associated health complications [15].

Assessment Criteria: Purity, Potency, and Safety:

Vitamin A's role as an "anti-infective" agent, underscored by studies highlighting its significance in immune responses to infection, forms the basis for its widespread therapeutic use. However, the potential adverse effects associated with synthetic vitamin A supplementation, particularly the risk of bulging fontanelle in infants, necessitate a careful evaluation of purity, potency, and safety standards. This is further complicated by the dose-dependent inhibition of Mycobacterium tuberculosis growth by vitamin A and its metabolites, indicating a narrow therapeutic window where efficacy must be balanced against safety.

Quality and Purity Standards

The British Pharmacopoeia (BP) establishes rigorous standards for Vitamin A, utilizing British Pharmacopoeia Chemical Reference Substances (BPCRS) to ensure high-quality testing and consistency. These primary standards are absolute, meaning their content figures are determined without comparison to another substance [20]. In contrast, Pakistan follows Codex guidelines for maximum residue limits of pesticides and other contaminants in foodstuffs, but does not have a system to enforce these limits in domestically produced foods [24]. This discrepancy highlights a significant difference in the enforcement and application of quality and purity standards between the two regions.

Packaging and Labeling

The BP mandates specific packaging and labeling requirements to maintain the integrity and information transparency of pharmaceutical products. Every package must clearly display critical information such as the name of the product, manufacturer, net contents, and expiration dates [19]. Meanwhile, in Pakistan, packaging requirements are less stringent, generally following Codex rules with no special requirements for environmental concerns such as waste disposal or recycling [24]. Additionally, while British standards require detailed labeling including potential allergens and storage conditions, Pakistani regulations focus more on basic labeling in Urdu and English and mandatory Halal certification without stringent requirements on environmental or health warnings [23].

Regulatory Compliance

The UK's regulatory framework is tightly controlled, with annual updates to the BP to reflect the latest scientific and health standards [9]. Conversely, Pakistan's approach to regulatory compliance in food safety and consumer education was only recently updated with the implementation of Statutory Regulatory Order (SRO) 237 on July 1, 2019 [23]. This order aims to improve food safety but still lacks the comprehensive and detailed approach seen in the BP. Furthermore, the UK's involvement in international development programs like the Food Fortification Programme indicates a proactive approach to addressing micronutrient deficiencies abroad, specifically in Pakistan, by providing technical and financial support to fortify foods like edible oils with Vitamin A [26].

The comparative analysis of the British and Pakistani standards reveals a broader commitment and rigorous approach

in the UK towards quality control, packaging, and regulatory compliance, which contrasts with the more flexible and evolving standards in Pakistan.

Dosage and Treatments for Vitamin A Deficiency

Vitamin A plays a pivotal role in maintaining vision, skin health, and immune function. When levels fall too low, supplementation becomes necessary to avoid serious health issues, including night blindness and immune deficiencies. The treatment for Vitamin A deficiency varies based on the severity of the deficiency, patient age, and the presence of any complicating health conditions.

Recommended Dosages

The recommended daily amount of vitamin A is 900 micrograms (mcg) for adult men and 700 mcg for adult women, with variations for pregnant and breastfeeding women, and children depending on their age [32][33]. For treating deficiency, healthcare providers might prescribe high doses of vitamin A supplements for several days, followed by lower doses until symptoms resolve [31][34]. In areas with high prevalence of Vitamin A deficiency, the World Health Organization recommends large oral doses for children to prevent morbidity and mortality, with specific doses outlined for different age groups [28]. It's crucial that dosing is based on the severity of deficiency and under healthcare provider discretion [35].

Common Treatments

Treatment begins with high doses of vitamin A supplements for a few days, transitioning to lower doses to allow for recovery from symptoms such as night blindness and dry eyes [31]. For infants and young children, where high doses can be toxic, the correct dosage must be carefully determined by a healthcare provider [31]. In specific cases, such as cystic fibrosis, lifelong treatment with vitamin A and other fat-soluble vitamins is standard care [28]. Intramuscular administration of vitamin A is

Grade of xerophthalmia	Age	Type of deficiency
XN: Night Blindness	2-6: adult women	Long Lasting, Not blinding
X1A: Conjunctival xerosis	6-Mar	Long Lasting, Not blinding
X1B: Bitots spots	6-Mar	Long Lasting, Not blinding
X2: Corneal xerosis	4-Jan	Acute deficiency can be blinding
X3A: Corneal ulcers < 1/3 cornea	4-Jan	Severe acute deficiency blinding
X3B: Corneal ulcer/keratomalacia 1/3 cornea or greater	4-Jan	Severe acute deficiency blinding
XS: Corneal scarring (from X3)	>2	Consequence of Corneal ulceration
XF: Xerophthalmous fundus	Adult	Long Lasting, Not blinding. Rare

recommended when oral administration is not feasible [30]. In regions with high prevalence of Vitamin A deficiency, universal supplementation of select populations is advocated by the World Health Organization [35].

Personalized treatments utilizing vitamin A Xerophthalmia:

It signifies a severity of VAD that can cause mortality from malnutrition and increased susceptible to infections it is mainly characterized by dry eyes, vision difficulty if left untreated re-

sults into night blindness and the lesions on the eye ball mucous membrane it is due to deficiency of vitamin A. Its treatment involves

Vitamin A Therapy: It can be through oral vitamin A supplements (Retinol, Vitamin A palmitate and Vitamin A propionate) Artificial Tears: It can be through eye drops(Systane Ultra, Restasis and Thera tears)

Psoriasis: It is a chronic skin disease that causes itchy, scaly patches on various parts of body its treatment depends on severity of condition and individual patient response its treatment involves:

Topical Retinoids: These are creams or gels applied to skin like Tazarotene, Tretionin and Adapalene. Oral Retinoids: It include Acitretin, Isotretinoin and Bexarotene.

Future Treatment:

Retinoic Acid: Derivatives of vitamin A play a crucial role in rregulating cell cell differentiation proliferation and apoptosis which are essential for cancer treatment.

Retinol binding proteins: Proteins like CRBP regulate the uptake and bioavalibility of retinol signalling during cancer progression.

Intracellular retinoid: The presence of specific cytoplasmic retinol and binding proteins (CRBP and CRABPs) regulate intracellular retinoid availability which is crucial for cancer treatment.

Risk and Side Effects:

Supplementation is essential in treating deficiency, it's important to be aware of the risks associated with excessive intake. Acute toxicity can occur from ingesting very high doses in a short period, leading to symptoms like severe headache, blurred vision, and nausea [28]. Chronic intake of high doses can result in dry skin, joint pain, and liver abnormalities [28]. The Food and Nutrition Board has established upper limits (ULs) for pre-formed vitamin A to mitigate risks associated with excessive intake [28]. Pregnant women need to exercise caution with vitamin A supplements due to the risk of birth defects from excessive use [33]. Possible interactions with medications such as anticoagulants, cancer drugs, and weight-loss drugs highlight the importance of consulting healthcare providers before taking vitamin A supplements [33].

In conclusion, the treatment of Vitamin A deficiency requires a nuanced approach, balancing the need for supplementation to address the deficiency with the potential risks of excessive intake. Healthcare providers play a crucial role in determining the appropriate dosage and form of vitamin A, considering individual health needs and potential interactions with other medications.

Conclusion

Through this comprehensive review, it has been established that Vitamin A is not only essential for maintaining vision, immune function, and skin health but also that disparities in availability and pharmacopoeial standards pose significant challenges to global health. In comparing the British and Pakistani contexts, it is clear that while the UK's rigorous pharmacopoeial standards and regulated market ensure high-quality Vitamin A products, Pakistan faces unique challenges in quality control and product availability. The discussion on specific Vitamin A treatments, including dosage and brands available in Pakistan versus abroad, illustrates the critical need for improved acces-

sibility and quality standards in developing countries to combat Vitamin A deficiency effectively.

Furthermore, these comparisons underscore the broader implications of pharmacopoeial standards on public health. While the UK serves as an example of strict regulatory enforcement ensuring product efficacy and safety, Pakistan's evolving standards represent a significant opportunity for international collaboration and support to enhance medicine quality and accessibility. As this article concludes, it reinforces the call for harmonizing health standards and suggests further research into innovative solutions for Vitamin A supplementation and deficiency prevention. Ensuring that individuals worldwide have access to safe, effective, and high-quality Vitamin A treatments is not only vital for addressing a global health issue but also for advancing towards more equitable health outcomes across countries.

Recommendations

In conclusion, treating Vitamin A deficiency requires a nuanced approach, balancing the need for supplementation to address the deficiency with the potential risks of excessive intake. Healthcare providers are crucial in determining the appropriate dosage and form of vitamin A, considering individual health needs and possible interactions with other medications.

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