Review

Optimizing Skin Quality via AI-Enhanced Physical Activity

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Posted Date: 15 April 2025

doi: 10.20944/preprints202504.1234.v1

Keywords: skin quality; physical activity; artificial intelligence; personalized skincare; cosmetic dermatology

 doi:10.20944/preprints202504.1234.v1

Review

Optimizing Skin Quality via AI-Enhanced Physical Activity

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Abstract: Genetic predisposition, environmental factors, lifestyle choices, and physical activity influence skin quality. Regular exercise has well-documented benefits for skin physiology, including enhanced microcirculation, improved collagen synthesis, oxidative stress reduction, and modulation of inflammatory pathways. However, individual responses to physical activity vary significantly, depending on skin type, age, fitness level, and environmental exposures. Recent advances in artificial intelligence (AI) offer new opportunities for tailoring exercise programs to meet individual skin health needs. Wearable sensors and smart fitness devices provide real-time data on physiological responses (e.g., heart rate, sweat rate, oxidative stress) and environmental parameters (e.g., UV exposure, and pollution levels). AI algorithms process this data to create dynamic, adaptive exercise routines, designed to maximize skin benefits while minimizing potential harm (e.g., exercise-induced oxidative stress in sensitive skin types). This review synthesizes current evidence on the skin benefits of exercise, while exploring the emerging role of AI-driven personalized physical activity as a novel tool in cosmetic dermatology. Integrating AI into fitness planning, personalized, non-invasive skincare strategies may complement traditional topical and procedural approaches, representing a step forward in precision dermatology.

Keywords: skin quality; physical activity; artificial intelligence; personalized skincare; cosmetic dermatology

1. Introduction

Skin quality is influenced by a complex interplay of internal and external factors, including genetic predispositions, exposure to ultraviolet (UV) radiation, environmental conditions such as pollution and climate, and nutritional habits. Among these, the incorporation of regular physical activity into daily life is a lifestyle choice that significantly impacts overall skin health and appearance [1].

The wide-ranging benefits of physical activity on human health are extensively documented in scientific literature. Regular exercise has been linked to improved cardiovascular performance, enhanced mental well-being, and better metabolic control. More recently, research has begun to emphasize the positive influence of physical activity on skin physiology. These effects include improved circulation, which promotes the efficient delivery of oxygen and essential nutrients to skin cells, as well as the more effective removal of metabolic waste products from the skin [1]. Furthermore, physical activity triggers various biochemical and hormonal responses—such as increased collagen production, enhanced antioxidant activity, and overall improvements in skin structure—which together contribute to a delay in the visible signs of aging [2]. In addition to these anti-aging effects, recent studies suggest that regular exercise may also alleviate symptoms in individuals with chronic skin conditions like psoriasis and eczema by helping to reduce systemic inflammation. However, the extent of these benefits is not uniform across all individuals and can vary significantly based on factors such as skin type, age, environmental influences, and the intensity and duration of physical activity [1].

 doi:10.20944/preprints202504.1234.v1

Despite the clearly demonstrated advantages of exercise for skin wellness, the outcomes are highly individualized, largely due to the diverse nature of physical activity and personal physiological differences. As a result, personalized fitness plans that consider variables such as an individual's skin characteristics, physical condition, and age may lead to more effective and targeted improvements in skin health. In this context, artificial intelligence (AI) emerges as a powerful tool with transformative potential in the fields of wellness, fitness, and skincare. AI-powered skin analysis technologies are capable of assessing skin features such as texture, moisture content, elasticity, and pigmentation, enabling the delivery of customized solutions tailored to each person's unique needs [3]. Moreover, AI-driven fitness platforms can generate personalized workout plans by adjusting exercise intensity, frequency, and duration. These platforms can also track important metrics such as hydration status, environmental exposure (e.g., UV levels or humidity), and physical exertion, all of which have a direct impact on the skin's condition and resilience [4]. Real-time analysis of biometric data is another key capability of AI system, allowing for precise control of exercise load, personalized recovery recommendations, and maximization of health and skin-related outcomes [3–5].

When combined with wearable sensors and smart devices, AI facilitates continuous monitoring and interpretation of physical activity data [6]. The integration of sensor data and intelligent algorithms enables real-time feedback and adaptive adjustments, supporting more effective and personalized health interventions. In the context of skincare, AI-guided workouts can monitor changes in skin hydration and temperature during physical activity [2,7]. This information can be used to modify workout intensity or duration and adjust skincare routines accordingly, helping to preserve the skin barrier and maintain overall skin homeostasis [4,8]. AI also plays a pivotal role in managing oxidative stress caused by intense or prolonged physical activity, which is one of the leading contributors to premature aging. By fine-tuning exercise regimens to maintain a balance between enhanced blood circulation and controlled production of free radicals, AI helps mitigate the negative impacts of oxidative stress on the skin [1]. The use of artificial intelligence in personalized fitness and skincare programs represents an innovative and rapidly evolving field, with significant applications in both cosmetic treatment and clinical dermatology [3,9].

This study aims to explore the connection between physical activity and skin wellness in depth. It also seeks to assess the role of artificial intelligence in enhancing exercise planning and to evaluate how AI-assisted fitness technologies may offer a non-invasive, tech-enabled approach to improving skin health, appearance, and longevity. By integrating knowledge from the domains of sports science, dermatology, and digital health, this research examines the potential of AI-enhanced physical activity to promote healthier, more youthful skin and to delay the onset of age-related skin changes.

2. Materials and Methods

A comprehensive and structured methodology was implemented to thoroughly examine the impact of AI-enhanced physical activity on skin health. This approach combined a systematic literature review, comparative analysis of relevant studies, and a detailed evaluation of personalized artificial intelligence technologies. The findings of this research are grounded in current scientific literature, drawing from multiple disciplines including dermatology, exercise physiology, and artificial intelligence.

To gather relevant data, an extensive literature review was performed across several reputable electronic databases. These included IEEE Xplore, PubMed, Scopus, Google Scholar, and ResearchGate. The search aimed to identify and compile published studies from the period of 2010 to 2024, with a particular emphasis on more recent research conducted between 2019 and 2024. This ensured that the most up-to-date insights and technological advancements were included in the analysis.

The scope of this research encompasses three fundamental and interconnected thematic areas:

- The relationship between physical activity and skin wellness, including physiological mechanisms involved.
- The role of artificial intelligence in designing and managing personalized training programs.

 doi:10.20944/preprints202504.1234.v1

- The application of AI technologies in dermatology and skin health optimization.

To maintain the integrity, accuracy, and scientific relevance of the review, only high-quality sources were selected. These consisted of original research articles, systematic reviews, and meta-analyses published in peer-reviewed journals. The inclusion of studies was determined based on their direct relevance and significant contribution to the overarching research objectives.

Specific selection criteria were established to guide the study inclusion process. The criteria focused on the following key points:

This methodological framework allows for a well-rounded analysis of how AI can be leveraged not only to enhance physical performance but also to improve skin health through more targeted and personalized exercise routines. By synthesizing evidence from diverse yet interconnected scientific fields, this study aims to provide a robust understanding of the evolving intersection between technology, fitness, and dermatology.

3. Results

3.1. Effects of Exercise on Skin Health

The beneficial effects of regular physical activity on skin health are extensive, well-documented, and supported by a growing body of scientific evidence. These benefits arise from a complex interplay of cellular, metabolic, and physiological processes that are positively influenced by exercise. Physical activity contributes significantly to enhanced microcirculation, improved transport of oxygen and nutrients throughout the body, regulation of oxidative stress, reduction of chronic inflammation, and stimulation of collagen synthesis—all of which are essential for maintaining healthy, youthful-looking skin.

In particular, Kruk's research [10] emphasized the crucial role of exercise in mitigating oxidative stress and reducing inflammatory mediators, both of which are known contributors to premature skin aging. Additional studies have confirmed that consistent physical activity strengthens the body's antioxidant defense systems, thereby decreasing inflammatory processes and exerting a positive influence on overall skin health and resilience [11].

When examining the skin's structural integrity and functional performance, researchers such as McLoughlin et al. [12] and Oizumi et al. [13] demonstrated the positive impact of exercise on skin elasticity, collagen biosynthesis, and the function of the epidermal barrier. Moreover, the meta-analysis conducted by Lanting et al. [14] confirmed that regular physical activity significantly enhances microvascular reactivity and vasodilation, leading to improved delivery of oxygen and nutrients to skin cells, which are critical for repair and regeneration. These effects are further detailed in Table 1, which presents a summary of key studies and their respective findings.

Table 1. Effects of Exercise on Skin Health.

Authors	Study Focus	Key Findings
Kruk J. 2007 [10]	Exercise & chronic disease	Reduces oxidative stress and inflammation
Cho C, et al. 2004 [11]	Blood flow restriction aerobic exercise	Enhances antioxidant mechanisms and skin health
McLoughlin EC, et al. 2022 [12]	Exercise & skin function	Supports skin elasticity and vascular health

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Oizumi R et al. 2024 [13]	Epidermal barrier	Improves skin elasticity and epidermal barrier
Lanting MS et al. 2017 [14]	Exercise & microvascular reactivity	Confirms improved oxygen/nutrient delivery to skin
Palmer JA et al. 2022 [15]	Blood flow post-exercise	Indicates potential for improved skin circulation
Fuertes-Kenneally L, et al. 2023 [16]	HIIT & vascular function	Improves microcirculation and skin perfusion
McIntosh MC, et al. 2024 [17]	Resistance training & vascular function	Increases capillary permeability and skin vascularity
Lee J, et al. 2024 [18]	Collagen synthesis & resistance exercise	Boosts collagen with hydrolyzed collagen intake
Proksch E, et al. 2014 [19]	Collagen peptides & skin	Improves skin hydration and elasticity
Heinemeier KM, et al. 2007 [20]	Exercise & IGF-I	Stimulates regeneration via growth factors
Langton AK, et al. 2010 [21]	Elastic fibers & skin aging	Emphasizes importance of elastic fiber integrity
Tominaga K, et al. 2012 [22]	Astaxanthin & exercise	Combined benefits on skin quality
Yeh CJ, et al. 2022 [23]	Exercise & skin diseases	Improves psoriasis and alopecia via cytokine reduction
Conti P, et al. 2023 [24]	Exercise & immune response	Reduces oxidative stress in skin diseases
El Assar M, et al. 2022 [25]	Exercise & aging	Improves microcirculation and skin regeneration

The investigation conducted by Palmer et al. [15] provides insights into the rapid increase in cerebral blood flow following moderate-intensity exercise, which suggests a broader enhancement of peripheral circulation, including improved blood flow to the skin. Similarly, the study by Fuertes-Kenneally et al. [16] reveals that high-intensity interval training (HIIT) has a profound impact on vascular function, significantly boosting skin microcirculation and perfusion.

Furthermore, McIntosh et al. [17] found that resistance training contributes to increased capillary permeability, resulting in enhanced skin vascular function and nutrient exchange. This vascular

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enhancement is especially beneficial for skin cell regeneration and overall dermal health. In terms of skin composition, both the study by Lee et al. [18] and the clinical trial by Proksch et al. [19] confirm that physical activity promotes collagen synthesis. When combined with hydrolyzed collagen supplementation, exercise leads to measurable improvements in skin hydration, firmness, and elasticity.

Additionally, the role of exercise in stimulating the production of growth factors, such as insulin-like growth factor I (IGF-I), has been highlighted by Heinemeier et al. [20]. These growth factors promote tissue regeneration and support skin cell renewal. Langton et al. [21] emphasized the importance of preserving elastic fibers—structures essential for maintaining skin resilience and preventing sagging—which are indirectly protected and supported by regular physical activity.

The synergistic benefits of exercise and antioxidant supplementation were investigated by Tominaga et al. [22], who explored the combined effect of astaxanthin and physical activity on skin quality. Their findings underscore the potential of combining targeted nutrition with exercise for enhanced dermatological outcomes.

In addition to promoting skin health in healthy individuals, research has also demonstrated exercise's therapeutic potential in managing chronic skin disorders. Yeh et al. [23] reported improvements in inflammatory conditions such as psoriasis and androgenetic alopecia, attributed to reduced levels of pro-inflammatory cytokines. Likewise, Conti and Gallenga [24] found that physical activity can alleviate symptoms of various skin diseases by reducing oxidative stress and inflammation. Finally, El Assar et al. [25] confirmed that exercise enhances microcirculation and supports the skin's regenerative capacity—both critical factors in maintaining skin vitality during the aging process.

In conclusion, the collective findings from recent literature reinforce the notion that regular physical activity—whether in the form of aerobic training, resistance workouts, or high-intensity interval sessions—positively influences skin health on multiple levels. By enhancing blood flow, stimulating collagen production, regulating inflammation, and improving the delivery of nutrients to the skin, exercise serves as a highly effective and natural approach to skin rejuvenation. It offers a drug-free, preventive strategy for delaying the visible signs of skin aging and promoting overall dermatological well-being.

3.2. Exercise and Artificial Intelligence

The rapid advancement of artificial intelligence (AI) technologies has brought transformative changes to the fields of physical activity, sports performance, and rehabilitation. AI is increasingly being integrated into the design, monitoring, and implementation of exercise programs, offering new possibilities for personalization, precision, and safety. Through the use of data-driven algorithms and machine learning, AI systems are capable of analyzing complex physiological and environmental variables to optimize exercise outcomes for individuals across different age groups and fitness levels [26,27].

One of the most impactful applications of AI is its ability to prevent and predict physical injuries. This is achieved by analyzing biomechanical data, movement patterns, and historical health records, thereby allowing the creation of targeted exercise programs that not only enhance performance but also reduce the risk of injury. Personalized exercise regimens, tailored to an individual's needs and conditions, promote safer and more effective training experiences. These programs can also dynamically adapt to real-time data, offering ongoing adjustments that account for fatigue, recovery status, and external factors [26].

In their study, Canzone et al. [5] emphasized the critical role of artificial intelligence in creating highly individualized training programs, highlighting the importance of real-time data acquisition in making informed decisions throughout the training process. The integration of biometric and contextual data allows AI to personalize fitness plans, ensuring that each recommendation aligns with the user's physical capabilities and goals. Similarly, Xu et al. [27] explored how conversational AI platforms such as ChatGPT-4.0 can be linked with specialized information systems to design

 doi:10.20944/preprints202504.1234.v1

personalized training programs. Their findings showed that AI could develop safe and reliable exercise routines by accurately assessing users' physical condition, performance metrics, and personal preferences. These findings are summarized in Table 2.

Table 2. Exercise and Artificial Intelligence.

Authors	Study Focus	Key Findings
Nitish N, et al. 2029 [26]	AI guidance in health	Navigation-based personalized health and quality of life improvement
Xu Y, et al. 2024 [27]	ChatGPT & personalized exercise	AI systems can create tailored exercise plans based on user profiles
Canzone A, et al. 2025 [5]	AI in exercise program design	Real-time data enables personalization and decision-making
Fang J, et al. 2024 [28]	Digital health & goal setting	ML improves personalized exercise goal setting
Schoeppe S, et al. 2016 [29]	Apps for physical activity	AI-supported apps improve diet and activity tracking
Zhan C. 2024 [30]	AI in injury rehabilitation	AI creates adaptive rehab plans using video/sensor data
Zou R. 2025 [31]	Injury prevention & rehab	AI predicts injury risk and supports safe return to sport
Kakavas G, et al. 2020 [32]	Sports trauma prediction	AI predicts injuries using athlete history and condition
Bartlett R. 2006 [33]	Biomechanics & AI	AI enhances diagnosis and rehab monitoring
Reis FJJ, et al. 2024 [34]	AI in sports medicine	AI uses data from diagnostic tools

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Desa V, et al. 2024 [35]	AI & return to play	AI supports decision-making in rehabilitation
Smaranda AM, et al. 2024 [36]	AI in ECG analysis	AI reshapes ECG analysis for athlete safety
Pareek A, et al. 2025 [37]	AI in Sports	Outlines AI's current and future roles in sports injury management

Artificial intelligence enables continuous feedback and real-time monitoring of exercise sessions, ensuring the user receives timely and accurate insights to enhance performance and reduce risk [28,29]. Mobile applications equipped with AI functionality are capable of tracking every aspect of an athlete's physical activity, from heart rate and sleep quality to hydration levels and stress markers. These metrics allow the system to adapt exercise plans accordingly, providing a highly personalized approach that can be followed and adjusted day-to-day. The result is a dynamic program that evolves with the user, supporting continuous improvement and injury prevention [29].

Equally significant is the growing role of AI in the rehabilitation of sports-related injuries. The study conducted by Zhan [30] demonstrated that artificial intelligence can create fully customized rehabilitation protocols by processing data from motion sensors, video analysis, and patient history. These adaptive programs are capable of identifying delays in recovery or irregularities in progress, allowing healthcare providers or users to make timely interventions and modifications.

The research by Zou [31] adds further support to the preventive capabilities of AI by showcasing its ability to detect early signs of overtraining or biomechanical inefficiencies that could lead to injury. AI-driven systems not only forecast potential risks but also provide guidelines for a safe return to physical activity. Kakavas et al. [32] underscore this point by illustrating how AI tools assess an athlete's medical and performance history to accurately predict susceptibility to injuries. These capabilities play a vital role in modern sports science, where the goal is not only to optimize performance but also to ensure longevity in athletic careers.

The study by Bartlett [33] further highlights the revolutionary impact of AI in diagnosing movement-related disorders and monitoring rehabilitation progression. Through motion capture and biomechanical analysis, AI can detect subtle changes in performance that may indicate inefficiencies or potential complications.

In the realm of sports medicine, researchers like Reis et al. [34] and Desa [35] explored how AI incorporates data from diagnostic technologies such as electrocardiograms (ECG) and force measurement tools (dynamometers) to inform clinical decision-making. These tools help clinicians assess readiness for return to sport with greater accuracy and confidence.

Smaranda et al. [36] and Pareek et al. [37] focused on AI's potential to redefine ECG analysis and detect musculoskeletal vulnerabilities, which is crucial for managing athletes' health and minimizing the risk of sudden injury. Their findings emphasize the importance of integrating AI in health surveillance and performance optimization.

In summary, the collective findings across numerous studies suggest that artificial intelligence plays an increasingly vital role in the development of effective and safe exercise programs. With its capacity to process large volumes of data, adjust plans in real time, and predict potential risks, AI is poised to become a foundational element in the future of personalized fitness, athletic rehabilitation, and injury prevention. As AI continues to evolve, its contributions to sports science and digital health are expected to grow, offering more precise, data-informed strategies for enhancing both performance and long-term well-being.

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3.3. Artificial Intelligence and Dermatology

A comprehensive evaluation of 21 recent studies was conducted to explore the evolving role and growing significance of artificial intelligence (AI) in the field of dermatology. These studies collectively demonstrate how AI technologies are transforming skin diagnostics, treatment planning, and patient care. One of the most notable applications involves the use of image-based machine learning algorithms to detect and classify various skin conditions—including lesions, melanomas, and different types of skin cancer—with remarkable precision. The accuracy of these AI models has been shown to be comparable to, and in some cases even surpass, that of experienced dermatologists, as demonstrated in the influential studies by Esteva et al. and Brinker et al. [38,39]. These findings are summarized in Table 3.

Table 3. Artificial intelligence and Dermatology.

Authors	Study Focus	Key Findings
Esteva A, et al. 2017 [38]	Skin cancer classification	AI matches dermatologist-level accuracy
Brinker TJ, et al. 2029 [39]	Melanoma classification	AI outperforms dermatologists in image classification
Janda M, et al. 2017 [40]	Melanoma diagnosis automation	High sensitivity useful in low-access settings
Han SS, et al. 2028 [41]	Onychomycosis diagnosis	Deep learning matches expert diagnosis
Liu Y, et al. 2020 [42]	Differential diagnosis of skin diseases	AI diagnoses 26 conditions with expert-level accuracy
Tschandl P, et al. 2020 [43]	Human-AI collaboration	Physician + AI improves diagnostic performance
Mohan J, et al. 2025 [44]	Transformer models in dermatology	Enhances accuracy and explainability
Omiye JA, et al. 2023 [45]	Explainable AI	Improves trust and clarity in diagnosis
Malalur Rajegowda G, et al. 2024 [46]	AI skincare in XR	93% accuracy in skincare recommendation
Zhou J, et al. 2023 [47]	SkinGPT-4	Visual LLMs for dermatological diagnostics
Panagoulias DP, et al. 2024 [48]	Tele-dermatology	AI supports decision-making via multi-modal data

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Cortes J, et al. 2024 [49]	Physician attitudes on AI	Interest in AI chatbots despite ethical concerns
Liopyris K, et al. 2022 [50]	Challenges in dermatology AI	Discusses biases and regulation needs
Gomolin A, et al. 2020 [51]	AI in dermatology Overview	Evaluates current AI applications
Hogarty DT, et al. 2020 [52]	Future of AI in dermatology	Reviews applications and prospects
De A, et al. 2020 [53]	AI use in Indian dermatology	Highlights AI's expanding role
Busik V. et al. 2024 [54]	AI and LLMs in dermatology	Reviews current LLM applications
Alwahaibi N, et al. 2025 [55]	Skin biopsy techniques	Discusses AI's impact on diagnostics
Hirani R, et al. 2024 [56]	AI in healthcare evolution	Historical and futuristic view on AI in care
Li Z, et al. 2022 [57]	Dermatology image analysis	Overview of AI trends and developments

The diagnostic accuracy of AI in dermatology has been especially promising in settings with limited access to specialists. For instance, in underserved or rural areas where dermatological expertise may not be readily available, AI can provide high-sensitivity diagnostic tools that support early detection and intervention [38,40]. In the specific case of onychomycosis, Han et al. [41] demonstrated that deep learning networks were able to diagnose nail infections with a level of accuracy comparable to that of expert dermatologists.

Moreover, AI has been employed in differential diagnosis, enabling the accurate classification of 26 distinct dermatological conditions. These AI-driven systems not only match specialist performance but often outperform general practitioners in diagnostic comprehensiveness and precision [42]. Such developments underscore the potential of AI to bridge gaps in expertise, reduce diagnostic delays, and improve patient outcomes.

Importantly, AI is not intended to replace clinical judgment but rather to augment and support it. A pivotal study by Tschandl et al. [43] showed that when AI was used in conjunction with physicians, diagnostic accuracy significantly improved compared to the performance of either party working alone. This synergy reflects a future model of care in which AI acts as a collaborative assistant rather than a substitute.

Advancements in explainable AI (XAI) and transformer models, as reported by Mohan et al. [44] and Omiye et al. [45], further enhance the interpretability of AI outputs. These technologies increase clinician trust by providing transparent reasoning for decisions, thereby making AI not only more accurate but also more acceptable in clinical environments.

The application of AI in personalized skincare has also gained attention. Malalur Rajegowda et al. [46] reported that AI models used in extended reality (XR) environments can deliver skincare recommendations with up to 93% accuracy. This high degree of precision affirms AI's potential to guide customized skincare regimens, improving efficacy and user satisfaction.

Simultaneously, the emergence of large language models (LLMs), such as SkinGPT-4 [47], has enabled more complex integrations between AI systems and clinical workflows, particularly in

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teledermatology. These tools enhance remote consultations by synthesizing visual and textual data, enabling better patient follow-up and diagnostic support across digital platforms [48].

The increasing interest in AI among healthcare professionals, especially dermatologists, has also been well-documented. Cortes et al. [49] found that many practitioners are optimistic about the use of AI-based chatbots to enhance patient communication and engagement, although concerns remain regarding algorithmic transparency, ethical use, and data security.

Despite these encouraging developments, challenges still persist. Studies by Liopyris et al. [50] and others [51–57] have highlighted significant issues related to heterogeneous datasets, algorithmic biases, and the urgent need for ethical guidelines and regulatory oversight. These challenges underscore the importance of standardized training datasets, inclusive algorithm development, and robust clinical validation to ensure equitable outcomes for all patient populations.

In conclusion, artificial intelligence is rapidly becoming a powerful tool in dermatology, revolutionizing how skin conditions are diagnosed, monitored, and managed. While AI shows exceptional promise in terms of accuracy, personalization, and accessibility, its full integration into clinical practice requires ongoing evaluation, transparency, and a commitment to ethical standards. The future of AI in dermatology lies in harmonizing technological innovation with human expertise to provide safer, faster, and more inclusive skin care.

4. Discussion

Artificial intelligence (AI) has emerged as a transformative force within the healthcare sector in recent years. Through the integration of machine learning algorithms and large language models (LLMs), AI has significantly enhanced diagnostic accuracy, prognosis prediction, and the personalization of medical treatments. In dermatology specifically, AI applications have demonstrated remarkable capabilities—particularly in the classification of dermatological images and in the continuous monitoring of skin disease progression. These innovations offer great potential for early intervention, targeted therapies, and more efficient patient care.

However, despite extensive research into AI's applications in dermatological diagnostics, comparatively less attention has been paid to its synergistic role in enhancing the dermatological benefits of physical exercise. This represents an exciting and relatively underexplored frontier in the development of innovative, non-invasive therapeutic strategies aimed at improving skin health.

The positive effects of physical activity on skin are well-established. Exercise activates a range of physiological mechanisms, such as improving microcirculation, stimulating collagen synthesis, reducing inflammation, and enhancing antioxidant defenses. It is also associated with increased skin hydration and elasticity, and plays a valuable role in managing chronic skin conditions like psoriasis, atopic dermatitis, and acne [10–12,58]. These findings are summarized in Table 4.

Table 4. Exercise, Artificial Intelligence, and Skin Health.

Topic	Information
Effects of Exercise on Skin	-Improved microcirculation -Enhanced collagen synthesis -Reduced inflammation -Antioxidant activity -Improved skin elasticity and hydration -Beneficial for chronic skin conditions (psoriasis, atopic dermatitis, acne)

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Use of AI in Dermatolo-gy	-Image analysis for diagnosis and disease monitoring - Detection of early lesions and signs of aging -Personalized treatment recommendations via systems like Skin GPT-4 and Dermacen Analytica -Use of Explainable AI (XAI) for transparent and trustworthy decision-making
Combining Exercise & AI for Skin Health	-Biometric and physiological data analysis through wearable devices - Customized workout plans based on real-time data (e.g., hydration, skin temperature) - Prevention of irritation and dryness by regulating exer cise intensity/duration - Predictive models identifying exercise-related flare-ups (e.g., acne) - Regulation of cortisol (stress hormone) levels through exercise
Collaboration & Future Directions	- Collaboration between doctors, developers, and re searchers - Skin quality as an indicator of overall health - Development of new therapeutic protocols combining AI and exercise - Integration with biosensors and advanced wearable technologies

The integration of AI into physical activity programs enhances these skin benefits by enabling continuous and individualized monitoring. AI-powered platforms—often supported by wearable technology—collect and analyze real-time physiological and biometric data such as hydration levels, skin temperature, and heart rate. These data points are used to adapt exercise intensity and duration, thereby preventing adverse effects like skin dryness or irritation, while optimizing skin-supportive outcomes [27,59].

By providing instant feedback, AI enhances user awareness of how physical activity directly affects skin health. This allows for more informed and timely adjustments to routines, offering improved therapeutic results, particularly for individuals with chronic skin conditions.

Moreover, AI is not limited to reactive diagnostics; it plays an active role in prevention. It supports the management of inflammation and stress-related flare-ups by recommending exercises that support the immune and endocrine systems. As noted in the work by Conti and Gallenga [24], exercise contributes to lowering cortisol levels—a stress hormone associated with flare-ups in skin conditions like acne and eczema. AI, through pattern recognition and machine learning, can identify and predict these flare-up triggers based on behavioral and physiological patterns [10,12,60].

AI-driven monitoring also supports long-term adherence to treatment protocols by providing continuous progress tracking. Studies by Liopyris et al. [50] and Alowais et al. [61] emphasized the importance of consistent monitoring and feedback in maintaining patient compliance and optimizing therapeutic results.

Further, AI systems like Skin GPT-4 and Dermacen Analytica integrate visual image analysis with physiological markers to detect early signs of aging or dermatological deterioration. These

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systems provide recommendations not only for medical treatment but also for lifestyle modifications—including exercise regimens aimed at enhancing skin regeneration. Through explainable AI (XAI) frameworks, such systems offer transparent rationale behind each recommendation, increasing trust and acceptance among healthcare providers and patients alike [44].

For AI and exercise to be fully integrated into dermatological care, interdisciplinary collaboration is essential. Physicians, software developers, data scientists, and biomedical engineers must work together to refine algorithms and ensure their safe, effective, and ethical use. Skin quality is increasingly viewed as a reflection of broader systemic health, and when addressed through both AI and tailored physical activity, it has the potential to significantly enhance patients' physical and psychological well-being.

As AI continues to evolve, its integration with biosensors and advanced wearable technologies will open new possibilities for continuous, real-time assessment of skin health. The findings of this study serve as a foundational step toward developing future therapeutic protocols that combine physical activity with AI-based support systems, paving the way for smarter, safer, and more personalized skincare.

5. Conclusions

The convergence of artificial intelligence and physical exercise represents a promising new frontier in dermatological care—one that extends well beyond traditional treatment paradigms. While the skin-enhancing benefits of exercise are already well-established, the integration of AI transforms this into a smarter, more dynamic, and highly personalized intervention. Through AI's capacity to adapt and optimize in real time based on individual needs, exercise evolves from a general health recommendation into a precise therapeutic tool.

This study emphasizes the significance of this intersection—not merely as a theoretical concept, but as a tangible direction for the present and future of medicine. From early detection of skin changes to personalized prevention strategies, AI-guided exercise programs empower individuals to actively participate in their own care while enhancing clinical outcomes.

By enabling targeted interventions, continuous monitoring, and personalized feedback, AI introduces a new era of dermatological practice—one characterized by prevention, proactivity, and precision. These developments not only improve the quality of skin but also contribute to broader health outcomes, psychological well-being, and quality of life. As research advances and technology continues to mature, AI-enhanced exercise programs have the potential to become an integral part of individualized dermatological treatment and overall health management.

Author Contributions: Conceptualization, E.R.; methodology, N.T.; software, N.T. and E.R.; validation, N.T., and E.S.; formal analysis, N.T.; investigation, N. T. and V.S.G.; resources, V.K.; data curation, E.S.; writing—original draft preparation, N.T.; writing—review and editing, N.T.; visualization, E.R. and N.T.; supervision, E.R.; project administration, N.T. and V.K.; funding acquisition, N.T. All authors have read and agreed to the published version of the manuscript."

Funding: This research received no external funding.

Informed Consent Statement: Not applicable.

Data Availability Statement: No new data were created or analyzed in this study.

Conflicts of Interest: The authors declare no conflict of interest.

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