MedNEXT
Journal of Medical an Health Sciences

REVIEW ARTICLE

DOI: 10.54448/mdnt23406

Major clinical evidence of calorie restriction and intermittent fasting on skin health: a systematic review

Michelle Silva Rocha[1*], Fabiana Negreli da Silva Koslinski[2], Lorenna Lemos de Aquino[3], Laís Lyrio Barbosa[4], Isabela Lyrio de Souza[5], Edinaldo Marinho de Carvalho[6], Luís Eduardo Ocáriz Brítez[7], Gabriela de Oliveira Gonçalves[7], Vinícius Bezerra Lopes[8]

[1] UnB- University of Brasília. Escs- Higher school in health sciences. Asa Norte Regional Hospital. Address: Setor Médico Hospitalar Norte Q 2 - Asa Norte, Brasília - DF, Brazil.
[2] UFMS-Federal University of Mato Grosso do Sul Origin: UPAP - Polytechnic and Artistic University of Paraguay Address: José Paniago, 152 - Terenos/MS de Secretaria Municipal. Municipality of Terenos Doctor Family Health Strategy, Brazil.
[3] Secretariat of State of the State of Goiás, Brazil.
[4] UNIDERP-Anhanguera University. Rua Ceará, 333, Miguel Couto neighborhood - Campo Grande, Mato Grosso do Sul, Brazil.
[5] Municipal Health Department of Campo Grande/MS. Rua Bahia, 280, Centro, Campo Grande/MS, Brazil.
[6] UFF-Universidade Federal Fluminense.Origin: UPAP - Polytechnic and Artistic University of Paraguay. Rua Boa Esperança, 911, Turu, São Luís/MA, Brazil.
[7] Municipal Health Department of Campo Grande/MS. Street Bahia, 280, Centro, Campo Grande/MS, Brazil.
[8] On duty as Emergency Doctor at Asa Norte Regional Hospital – HRAN. Hospital Medical Sector Norte Q 2 - Asa Norte, Brazil.

*Corresponding author: Michelle Silva Rocha.
UnB- University of Brasília. Escs-Higher school in health sciences. Asa Norte Regional Hospital.
Address: Setor Médico Hospitalar Norte Q 2 - Asa Norte, Brasília - DF, Brazil.
E-mail: mileangelxi@outlook.com

DOI: https://doi.org/10.54448/mdnt23406
Received: 08-26-2023; Revised: 10-30-2023; Accepted: 11-07-2023; Published: 11-10-2023; MedNEXT-id: e23406

Abstract

Introduction: Combined skin diseases represent the fourth leading cause of non-fatal disability worldwide. In 2013, it was estimated that skin diseases represented almost 2.0% of the total global burden of disease. Different fasting models have been studied in an attempt to understand the effect of fasting on skin structure and function. **Objective:** It was to present the main scientific evidence of the effects of calorie restrictions and intermittent fasting on skin health. **Methods:** The PRISMA Platform systematic review rules were followed. The search was carried out from July to September 2023 in the Scopus, PubMed, Science Direct, Scielo, and Google Scholar databases. The quality of the studies was based on the GRADE instrument and the risk of bias was analyzed according to the Cochrane instrument. **Results and Conclusion:** A total of 119 articles were found, and 26 articles were evaluated in full, and 23 were included and developed in the present systematic review study. Considering the Cochrane tool for risk of bias, the overall assessment resulted in 22 studies with a high risk of bias and 26 studies that did not meet GRADE and AMSTAR-2. Most studies showed homogeneity in their results, with X^2=64.7%>50%. It was concluded that although calorie restriction is the most effective intervention to prolong the life of organisms and prevent age-related diseases, its effects on aging and skin diseases can be significant. Dietary lifestyles can affect epithelial lineages such as the skin and intestine. The impact of Ramadan fasting on skin health can be compared with the effect of other types of fasting, including periodic dieting, calorie restriction, dietary restriction, dietary manipulation, and intermittent, short-term, and

prolonged fasting. However, despite the scarcity of studies on the topic, no serious health risks have been reported and, therefore, patients who wish to fast should be warned about the importance of continuing their treatment and the administration of transdermal/topical medications.

Keywords: Skin. Skin health. Calorie restriction. Intermittent fasting.

Introduction

Combined skin diseases represent the fourth leading cause of non-fatal disability worldwide [1]. In 2013, it was estimated that skin diseases accounted for almost 2.0% of the total global burden of disease [1,2]. It is known that skin problems result from the interaction between several factors, including genetic components, internal diseases, immunological susceptibility, and factors such as infections, stress, lifestyle, diet, or exposure to ultraviolet radiation [3-7].

In this context, different fasting models have been studied in an attempt to understand the effect of fasting on skin structure and function, including modified alternate-day fasting regimens, periodic fasting-mimicking diets, short-term fasting, food restriction, caloric restriction or caloric or energetic or energy balance, or prolonged fasting, among others [8-13].

One of the skin's main functions is to provide a permeability barrier to protect against excessive water loss. Extracellular lipids formed mainly by ceramides, cholesterol, and fatty acids are the fundamental components of this barrier. The synthesis of cholesterol necessary for barrier formation occurs in the epidermis [14-16].

In this sense, a study that evaluated the impact of calorie restriction on side effects associated with topical treatment with retinoids observed that there was a significant reduction in retinoid-induced skin irritation without interfering with the beneficial effects of the medication. The resulting mitigation of adverse events associated with fasting has been attributed to two factors, the positive effect of caloric restriction on local antioxidant levels and its inhibitory effect on the transcription of matrix metalloproteinase genes involved in tissue destruction [16].

Therefore, the present study developed a systematic review to present the main scientific evidence on the effects of calorie restrictions and intermittent fasting on skin health.

Methods

Study Design

The present study followed the international systematic review model, following the rules of PRISMA (preferred reporting items for systematic reviews and meta-analysis). Available at: http://www.prisma-statement.org/?AspxAutoDetectCookieSupport=1. Accessed on: 09/10/2023. The methodological quality standards of AMSTAR-2 (Assessing the methodological quality of systematic reviews) were also followed. Available at: https://amstar.ca/. Accessed on: 09/10/2023.

Data Sources and Research Strategy

The literary search process was carried out from July to September 2023 and was developed based on Scopus, PubMed, Lilacs, Ebsco, Scielo, and Google Scholar, covering scientific articles from various eras to the present. The descriptors (MeSH Terms) were used: "Skin. Skin health. Calorie restriction. Intermittent fasting", and using the Boolean "and" between MeSH terms and "or" between historical discoveries.

Study Quality and Risk of Bias

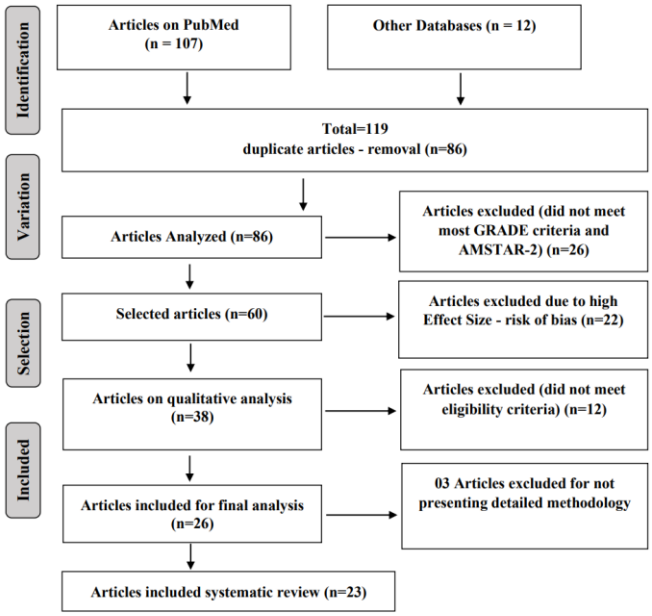
Quality was classified as high, moderate, low, or very low in terms of risk of bias, clarity of comparisons, precision, and consistency of analyses. The most evident emphasis was on systematic review articles or meta-analyses of randomized clinical trials, followed by randomized clinical trials. The low quality of evidence was attributed to case reports, editorials, and brief communications, according to the GRADE instrument. The risk of bias was analyzed according to the Cochrane instrument by analyzing the Funnel Plot graph (Sample size versus Effect size), using the Cohen test (d).

Results and discussion

Summary of Findings

A total of 119 articles were found that were subjected to eligibility analysis, with 23 final studies being selected to compose the results of this systematic review. The studies listed were of medium to high quality (Figure 1), considering the level of scientific evidence of studies such as meta-analysis, consensus, randomized clinical, prospective, and observational. The biases did not compromise the scientific basis of the studies. According to the GRADE instrument, most studies showed homogeneity in their results, with X^2=64.7%>50%. Considering the Cochrane tool for risk of bias, the overall assessment resulted in 22 studies with a high risk of bias and 26 studies that did not meet GRADE and AMSTAR-2.

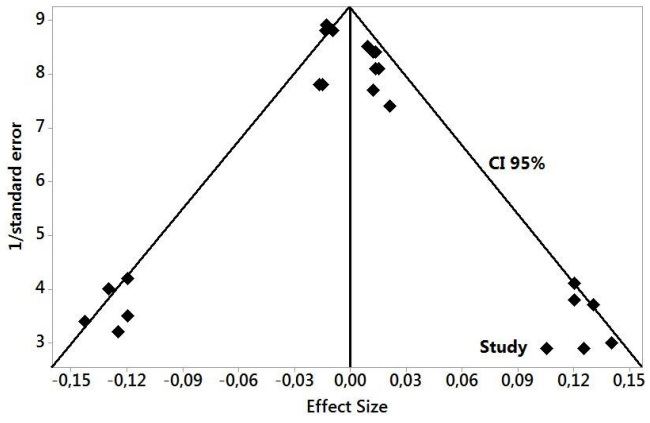
Figure 1. Flowchart showing the article selection process.



Source: Own authorship.

Figure 2 presents the results of the risk of bias of the studies using the Funnel Plot, showing the calculation of the Effect Size (Magnitude of the difference) using the Cohen Test (d). Precision (sample size) was determined indirectly by the inverse of the standard error (1/Standard Error). This graph had a symmetrical behavior, not suggesting a significant risk of bias, both between studies with a small sample size (lower precision) that are shown at the bottom of the graph and in studies with a large sample size that are presented at the top.

Figure 2. The symmetric funnel plot suggests no risk of bias among the small sample size studies that are shown at the bottom of the graph. High confidence and high recommendation studies are shown above the graph (n=23 studies).



Source: Own authorship.

Major Clinical Results

As we age, skin becomes more fragile and vulnerable to damage, which can contribute to age-related illnesses and even death. Although calorie restriction is the most effective intervention to prolong the life of organisms and prevent age-related diseases, its effects on aging and skin diseases can be significant. Calorie restriction can structurally and functionally affect most of the skin. The anti-inflammatory, antioxidant, stem cell maintenance, and metabolic activities of calorie restriction contribute to its beneficial effects on the skin. Calorie restriction mimetics, including resveratrol, metformin, rapamycin, and peroxisome proliferator-activated receptor agonists, show similar prevention to calorie restriction against skin aging [17].

The authors Grine et al. (2022) [18] analyzed the effects of intermittent fasting on the skin, gut, and metabolic health in patients with psoriasis. A 2-arm open-label randomized controlled pilot study was performed on 24 patients with psoriasis. The evolution of different markers, such as psoriasis severity, permeability, and inflammation, was mapped in response to intermittent fasting compared to a regular diet. Dietary lifestyles can affect epithelial lineages such as the skin and intestine [18].

Furthermore, the authors Bragazzi et al. (2021) [19] evaluated the effect of circadian intermittent fasting (CIF) on the daily management of dermatological diseases through a multicenter prospective observational study. A total of 72 patients with different dermatoses volunteered to participate in the study. They had a mean age of 40.38 ± 12.46 years (median 41.0 years), and 25 subjects were male (34.7% of the entire sample). The average weight change was 0 kg. The overall CIF effect size was -0.58 ([95% CI -0.83 to -0.33], p< 0.0001, medium effect size). As no weight loss occurred in the present investigation, it can be deduced that the impact of fasting in terms of improvements in clinical symptoms could be due to disruption of the human biological clock.

One study investigated the effect of Ramadan fasting on arousal and sustained attention. The skin conductance level of the fasting group was not different from the nonfasting group. In the non-fasting group, the amplitude of the skin conductance response to an auditory stimulus was greater and the onset latency of the skin conductance response was shorter than in the fasting group. The fasting group had a lower total number of marked targets, but a greater total number of missed targets and time for the subject to complete the test than the non-fasting group. Ramadan fasting did not change arousal, but reaction time to an auditory stimulus increased during Ramadan intermittent fasting. Both reaction amplitude and sustained attention also decreased in the fasting condition [20].

Furthermore, the authors Couto et al. (2018) [21] observed the transcriptional response to fasting in a

large cross-sectional study of adipose and skin tissue from healthy volunteers (N=625). It was identified 367 genes in adipose tissue and 79 in skin whose expression levels were associated with fasting hours conditionally independent of time of day and season, with 19 genes common to both tissues. Among these genes, 38 were replicated in humans. Fasting-responsive genes were enriched for regulation and response to circadian rhythm. It was identified 99 genes in adipose tissue and 54 genes in the skin whose expression was associated with the time of day. These genes were also enriched for circadian rhythm processes. In genes associated with both exposures, the effect of time of day was stronger and in the opposite direction to that of fasting hours. Therefore, it was identified shared and tissue-specific differences in the transcriptional response to fasting in a large sample of healthy volunteers.

Furthermore, the circadian rhythm and diet have been recognized as potential modulators of the minimum erythematous dose (MED), but their mutual interaction remains poorly studied. Thus, a study evaluated the potential modulation of diet on circadian oscillations in MED. In the first phase, only omnivores were included, specifically 54 patients with PsO and 54 healthy individuals. MED before and after NBUVB therapy changed significantly between the three different time points (morning, afternoon, and evening) ($p < 0.001$). The effect of time was statistically significant in both groups before and after phototherapy. In the second phase, we recruited 144 patients with PsO (vegan, vegetarian, paleo, ketogenic, circadian intermittent fasting, and omnivorous). The circadian oscillations of MED preserved a significant difference also after depuration and were influenced by the type of diet and time of day ($p < 0.001$). In particular, vegans had the lowest MED values, while Ramadan fasting had the highest values in the morning, afternoon, and evening. Therefore, the diet, as well as other ongoing therapies, should be reported in the records of patients with psoriasis undergoing NB-UVB and patients with lower MED should be treated preferably in the morning, when MED is highest [22].

Finally, scientific evidence has been accumulating on how skin cells are altered in response to calorie-restricted diets. One of the best-known calorie restriction diets is Ramadan intermittent fasting, which is a radical change in practitioners' eating plans during one lunar month. Patients with various health problems, including those with different skin diseases, can choose to share this event with their peers and family. However, there are no standardized protocols or guidelines to advise doctors on the appropriate management of their patients' condition during fasting [23].

Conclusion

It was concluded that although calorie restriction is the most effective intervention to prolong the life of organisms and prevent age-related diseases, its effects on aging and skin diseases can be significant. Dietary lifestyles can affect epithelial lineages such as the skin and intestine. The impact of Ramadan fasting on skin health can be compared with the effect of other types of fasting, including periodic dieting, calorie restriction, dietary restriction, dietary manipulation, and intermittent, short-term, and prolonged fasting. However, despite the scarcity of studies on the topic, no serious health risks have been reported and, therefore, patients who wish to fast should be warned about the importance of continuing their treatment and the administration of transdermal/topical medications.

Acknowledgement

Not applicable.

Ethical Approval

Not applicable.

Informed consent

Not applicable.

Funding

Not applicable.

Data sharing statement

No additional data are available.

Conflict of interest

The authors declare no conflict of interest.

Similarity check

It was applied by Ithenticate@.

Peer Review Process

It was applied.

References

1. Mansilla-Polo M, Piquero-Casals J, Morgado-Carrasco D. Popular Diets and Skin Effects: A Narrative Review. Actas Dermosifiliogr. 2023 Oct 24:S00017310(23)00846-3. English, Spanish. doi: 10.1016/j.ad.2023.10.015.

2. Hay RJ, Johns NE, Williams HC, Bolliger IW, Dellavalle RP, Margolis DJ, Marks R, Naldi L, Weinstock MA, Wulf SK, et al. The global burden of skin disease in 2010: An analysis of the prevalence and impact of skin conditions. J. Investig. Dermatol. 2014;134:1527–1534. doi: 10.1038/jid.2013.446.
3. Hollestein LM, Nijsten T. An insight into the global burden of skin diseases. J. Investig. Dermatol. 2014;134:1499–1501. doi: 10.1038/jid.2013.513.
4. Vos T, Flaxman AD, Naghavi M, Lozano R, Michaud C, Ezzati M, Shibuya K, Salomon JA, Abdalla S, Aboyans V, et al. Years lived with disability (YLDs) for 1160 sequelae of 289 diseases and injuries 1990–2010: A systematic analysis for the Global Burden of Disease Study 2010. Lancet. 2012;380:2163–2196. doi: 10.1016/S0140-6736(12)61729-2.
5. Seth D, Cheldize K, Brown D, Freeman EF. Global Burden of Skin Disease: Inequities and Innovations. Curr. Dermatol. Rep. 2017; 6:204-210. doi: 10.1007/s13671-017-0192-7.
6. Lewis V, Finlay AY. 10 years experience of the Dermatology Life Quality Index (DLQI) J. Investig. Dermatol. Symp. Proc. 2004;9:169–180. doi: 10.1111/j.10870024.2004.09113.x.
7. Cecchi L, D'Amato G, Annesi-Maesano I. External exposome and allergic respiratory and skin diseases. J. Allergy Clin. Immunol. 2018;141:846–857. doi: 10.1016/j.jaci.2018.01.016.
8. Brandhorst S., Choi I.Y., Wei M., Cheng C.W., Sedrakyan S., Navarrete G., Dubeau L., Yap L.P., Park R., Vinciguerra M., et al. A Periodic Diet that Mimics Fasting Promotes Multi-System Regeneration, Enhanced Cognitive Performance, and Healthspan. Cell MeTable. 2015;22:86–99. doi: 10.1016/j.cmet.2015.05.012.
9. Nieto R, Palmer RM, Fernández-Fígares I, Pérez L, Prieto C. Effect of dietary protein quality, feed restriction and short-term fasting on protein synthesis and turnover in tissues of the growing chicken. Br. J. Nutr. 1994;72:499–507. doi: 10.1079/BJN19940054.
10. Tomiyama A.J. Beyond interventions: Caloric restriction as a scientific model. Psychosom. Med. 2012;74:665–666. doi: 10.1097/PSY.0b013e31825fe211.
11. Alverez LC, Peters DJ, Murad H, Wright Et, McGhee G, Drenick EJ. Changes in the epidermis during prolonged fasting. Am. J. Clin. Nutr. 1975;28:866–871. doi: 10.1093/ajcn/28.8.866.
12. Forni MF, Peloggia J, Braga TT, Chinchilla JEO, Shinohara J, Navas CA, Camara NOS, Kowaltowski AJ. Caloric Restriction Promotes Structural and Metabolic Changes in the Skin. Cell Rep. 2017;20:2678–2692. doi: 10.1016/j.celrep.2017.08.052.
13. Giannetti A, Rabbiosi G. Aspects of carbohydrate metabolism in rat skin in various experimental conditions. II. Changes induced by fasting. Boll. Soc. Ital. Biol. Sper. 1967;43:337–338.
14. MacDonald I. Dietary carbohydrates and skin lipids. Br. J. Dermatol. 1967;79:119–121.
15. Wu-Pong S, Elias PM, Feingold KR. Influence of altered serum cholesterol levels and fasting on cutaneous cholesterol synthesis. J. Investig. Dermatol. 1994;102:799–802. doi: 10.1111/1523-1747.ep12378556.
16. Varani J, Bhagavathula N, Aslam MN, Fay K, Warner RL, Hanosh A, Barron AG, Miller RA. Inhibition of retinoic acid-induced skin irritation in calorie-restricted mice. Arch. Dermatol. Res. 2008;300:27–35. doi: 10.1007/s00403-007-0797-y.
17. Choi YJ. Shedding Light on the Effects of Calorie Restriction and its Mimetics on Skin Biology. Nutrients. 2020 May 24;12(5):1529. doi: 10.3390/nu12051529.
18. Grine L, Hilhorst N, Michels N, Abbeddou S, De Henauw S, Lambert J. The Effects of Modified Intermittent Fasting in Psoriasis (MANGO): Protocol for a Two-Arm Pilot Randomized Controlled Open Cross-over Study. JMIR Res Protoc. 2022 Feb 23;11(2):e26405. doi: 10.2196/26405.
19. Bragazzi NL, Trabelsi K, Garbarino S, Ammar A, Chtourou H, Pacifico A, Malagoli P, Kocic H, Conic RRZ; Young Dermatologists Italian Network; Kridin K, Pigatto PDM, Damiani G. Can intermittent, time-restricted circadian fasting modulate cutaneous severity of dermatological disorders? Insights from a multicenter, observational, prospective study. Dermatol Ther. 2021 May;34(3):e14912. doi: 10.1111/dth.14912.
20. Dolu N, Yüksek A, Sizer A, Alay M. Arousal and continuous attention during Ramadan intermittent fasting. J Basic Clin Physiol Pharmacol. 2007;18(4):31522. doi: 10.1515/jbcpp.2007.18.4.315.
21. Couto Alves A, Glastonbury CA, El-Sayed Moustafa JS, Small KS. Fasting and time of day independently modulate circadian rhythm relevant gene expression in adipose and skin tissue. BMC Genomics. 2018 Sep 7;19(1):659. doi: 10.1186/s12864-018-4997-y.

22. Damiani G, Pacifico A, Scoditti E, di Gregorio S, Del Fabbro M, Cozzolino C, Buja A, Mercuri SR, Bianchi VG, Grada A, Garbarino S, Bunick CG. Circadian Oscillations of Minimal Erythema Dose (MED) are Also Influenced by Diet in Patients with Psoriasis: A Chronomedical Study. Dermatol Ther (Heidelb). 2023 Oct;13(10):2229-2246. doi: 10.1007/s13555-023-00987-z.
23. Bragazzi NL, Sellami M, Salem I, Conic R, Kimak M, Pigatto PDM, Damiani G. Fasting and Its Impact on Skin Anatomy, Physiology, and Physiopathology: A Comprehensive Review of the Literature. Nutrients. 2019 Jan 23;11(2):249. doi: 10.3390/nu11020249.