NMN or NR for topical use

For topical use in skin applications, both NMN (Nicotinamide Mononucleotide) and NR (Nicotinamide Riboside) are NAD precursors with demonstrated benefits, but each has distinct properties and supporting data that can affect their suitability for formulation and expected biological results.[1][2][3]

Efficacy and Mechanistic Differences

- NMN is closer to NAD+ biosynthesis and can directly support cellular energy, repair functions, and anti-aging pathways in the skin. Studies show topical NMN increases cellular replicative lifespan, decreases senescence, and may upregulate NAD+ more efficiently in cutaneous cells. NMN also appears to reduce melanin production in aged skin models, suggesting it can improve skin tone and address pigmentary aging.[4][2][5][6][3][7]
- NR must be converted into NMN before it becomes NAD+ but is smaller and may penetrate skin more readily. Topical NR has been shown to boost NAD+ levels, enhance firmness, support the skin barrier, and improve repair processes, which helps reduce lines and wrinkles. NR's excellent cellular permeability suggests it may be optimal for superficial effects in skin layers.[8][1]

Comparative Human and Animal Data

Property	NMN	NR
Pathway to NAD+	Direct precursor (one step closer) [5][6]	Requires conversion to NMN [8][5]
Penetration & Stability	Larger molecule, conversion to NAM possible in skin, can degrade if exposed to high temperature[2][3]	Smaller molecule, higher skin permeability[1][8]
Skin Benefits	Anti-aging, increased cellular lifetime, pigment reduction, decreased senescence[4][3][2]	Improved texture, firmness, enhanced skin barrier, reduced fine lines[1]
Safety/Regulatory Status	Generally recognized as safe, supported in patent and clinical models[7][3][6]	Good safety record, widely used in commercial cosmetics[1][8]
Human Clinical Data (Topical)	Limited, but rodent and in vitro skin studies are promising[4][3][2]	More human topical data available for barrier and cosmetic effects[1][8]

Formulation Notes

- NMN should be formulated to avoid high temperatures and oxidation, as it degrades to nicotinamide (NAM) over time. It synergizes well with antioxidants, peptides, and hydrating agents.[2][3][7]
- NR readily combines with peptides and ceramides, and commercial products exist with proven topical efficacy.[6][1]

Conclusion

NMN offers promising anti-aging and pigment modulation benefits but may pose formulation stability challenges unless properly protected. NR is more widely proven for topical skin vitality and barrier support, with additional formulation ease due to its smaller molecular size. Combining both precursors with bioactive peptides and antioxidants may provide synergistic effects, but current evidence marginally favors NR for mainstream cosmetic topical application due to better skin penetration and safety data.[5][3][1][8][2]

Investigate potential anti-aging effects of NMN vs NR in cosmetics

Both NMN (Nicotinamide Mononucleotide) and NR (Nicotinamide Riboside) show promising anti-aging effects in cosmetic applications, primarily by boosting NAD+ levels, facilitating cellular repair, and protecting skin from environmental stressors.[21][22][23][24][25]

NMN Anti-Aging Effects in Cosmetics

- NMN elevates NAD+ within skin cells, resulting in enhanced cellular energy, improved repair mechanisms, and increased collagen production for firmer and more youthful skin.[26][23][24]
- Clinical and in vitro studies show NMN protects against oxidative stress, reduces wrinkle formation, boosts elastin synthesis, and helps recover skin from sun or pollution-induced damage.[27][24][28][29][21]
- NMN can upregulate sirtuin enzymes (especially SIRT1), supporting DNA repair and cellular longevity, and may also prevent pigmentary aging by inhibiting melanin transfer and reducing inflammation.[23][24][29]
- Application in engineered skin models demonstrates NMN can permeate the dermis and stimulate collagen type I production in fibroblasts, important for skin elasticity and resilience.[27][23]

- NMN's protective effects against particulate matter, UV exposure, and other environmental insults further solidify its role in preventative age-related skincare.[24][28]

NR Anti-Aging Effects in Cosmetics

- NR penetrates skin efficiently due to its small size and acts as an NAD+ precursor, enhancing skin cell repair, regeneration, and metabolic vitality.[22][30][31]
- Clinical formulations with NR have shown increased collagen content (up to 72%) and improved firmness, resulting in noticeable reductions in fine lines and wrinkles.[25][22]
- NR fortifies the skin barrier, improves hydration, and mitigates free radical damage from pollution and UV radiation, helping combat multiple signs of premature aging.[30][31][22]
- Synergistic pairing of NR with peptides, ceramides, hyaluronic acid, and retinoids in commercial products can further enhance anti-aging efficacy—boosting collagen, hydration, texture, and radiance.[22][25]
- NR's mechanism of elevating NAD+ also supports DNA repair and skin cell longevity.[31][30][22]

Direct Comparison Table

Feature	NMN	NR
NAD+ Elevation	Yes, direct precursor, rapid boost in skin cells[23][23]	Yes, precursor, efficiently absorbed, penetrates barrier[22][30]
Collagen Synthesis	Upregulated in dermal fibroblasts, improved elasticity[23][27]	Increased up to 72% in clinical products[25][22]
Wrinkle Reduction	Improves firmness, reduces lines via enhanced repair[21][27][24]	Decreases fine lines/wrinkles, supports cellular renewal[22][25]
Skin Barrier Support	Supports barrier via sirtuin activation, DNA repair[24][23]	Strong barrier, hydration, antioxidant synergy[22][30]
Pigment/Inflammation	Reduces pigment transfer and inflammation[23][29][24]	Antioxidant effects, reduces oxidative stress[22][30]
Penetration/Absorption	Larger, permeation demonstrated in dermal models[23]	Smaller, superior skin absorption, well-studied[22][30]
Commercial Formulation	Emerging, stability considerations[23][32]	Widely used in anti-aging formulations[22][25]

Summary

NMN and NR both provide measurable anti-aging benefits in cosmetic formulations by elevating NAD+, stimulating collagen production, reducing oxidative stress, and supporting repair. NMN excels in direct sirtuin and collagen activation, while NR is highly permeable, strengthens the skin barrier, and pairs synergistically with other bioactives. Current data suggest both are effective, but NR may be favored in commercial cosmetics due to easier absorption and robust clinical usage, while NMN has strong emerging evidence for deep repair, pigment modulation, and fibroblast rejuvenation.[21][23][25][30][22]

**

1. https://synergieskin.com/blogs/all/the-power-of-nicotinamide-riboside-nr-in-skincare
2. https://pmc.ncbi.nlm.nih.gov/articles/PMC12048825/
3. https://rescence.com/the-use-of-topical-nmn/
4. https://www.sciencedirect.com/science/article/abs/pii/S0923181122001220
5. https://www.innerbody.com/nmn-vs-nr
6. https://pmc.ncbi.nlm.nih.gov/articles/PMC10721522/
7. https://patents.google.com/patent/WO2016210232A1/en
8. https://www.lifeextension.com/wellness/supplements/nmn-vs-nr
9. https://pmc.ncbi.nlm.nih.gov/articles/PMC7238909/
10. https://www.nmn.com/precursors/nmn-vs-nr
11. https://peterattiamd.com/nmn-and-exercise-performance/
12. https://www.insidetracker.com/a/articles/nr-supplement-and-nmn-effectiveness-do-these-compounds-work-for-human-longevity
13. https://pmc.ncbi.nlm.nih.gov/articles/PMC9039735/
14. https://pubmed.ncbi.nlm.nih.gov/38333051/
15. https://www.rupahealth.com/post/using-nicotinamide-for-skin-conditions
16. https://pmc.ncbi.nlm.nih.gov/articles/PMC11857428/

17. https://decodeage.com/blogs/supplements/nicotinamide-vs-niacin-vs-nicotinamide-riboside-vs-nmn-whats-the-difference

18. https://pmc.ncbi.nlm.nih.gov/articles/PMC8389214/

19. https://aramoreskincare.com/blogs/news/why-nmn-and-our-synergistic-nad-complex-cofactors-will-help-kick-it-to-the-next-level

20. https://www.elysiumhealth.com/blogs/aging101/nmn-and-nr

21. https://vivahealthskincare.com/blogs/news/what-is-nmn-the-new-trend-in-anti-aging-skincare

22. https://synergieskin.com/blogs/all/the-power-of-nicotinamide-riboside-nr-in-skincare

23. https://pmc.ncbi.nlm.nih.gov/articles/PMC12048825/

24. https://www.nmn.com/news/nmn-protects-against-skin-aging

25. https://nrlab.shop

26. https://www.frontiersin.org/journals/pharmacology/articles/10.3389/fphar.2024.1436597/full

27. https://www.landyschemist.com/nmn-supplement-uk

28. https://vitagreen.online/en-ca/blogs/healthblogs/unlocking-the-potential-of-nmn-a-promising-anti-aging-supplement

29. https://pmc.ncbi.nlm.nih.gov/articles/PMC11422796/

30. https://www.jinfiniti.com/nad-benefits-for-skin/

31. https://www.healthline.com/nutrition/nicotinamide-riboside

32. https://rescence.com/the-use-of-topical-nmn/

33. https://pmc.ncbi.nlm.nih.gov/articles/PMC7238909/

34. https://www.sciencedirect.com/science/article/pii/S2161831323013595

35. https://www.nad.com/news/nmn-and-nr-formulations-exert-similar-metabolic-health-effects-latest-international-study

36. https://pmc.ncbi.nlm.nih.gov/articles/PMC10240123/

37. https://www.verywellhealth.com/the-benefits-of-nicotinamide-riboside-7866970

38. https://iadns.onlinelibrary.wiley.com/doi/10.1002/fft2.511

39. https://bskinenvie.ca/blogs/news/trending-anti-aging-powerhouse-nmn-is-it-worth-the-hype

40. https://pmc.ncbi.nlm.nih.gov/articles/PMC11857428/

41. https://www.nmn.com/precursors/nmn-vs-nr