

SHOULD NANOPARTICLES BE USED IN SUNSCREENS?

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Introduction

Metal oxide nanoparticles (ZnO, TiO₂) are commonly used in personal-care formulations as protective agents against exposure to ultraviolet radiation. Although previous research has concluded that nanoparticles do not penetrate healthy skin, it remains contentious whether this conclusion holds under normal conditions of sunscreen use.

Methods

Humans (n=20) were exposed to sunscreens containing zinc oxide (ZnO) particles to determine if Zn from the particles was absorbed through skin over 5 consecutive days under outdoor conditions. Two sunscreens were tested—“nano sunscreen” containing 19-nanometer (nm) nanoparticles and “bulk sunscreen” containing > 100-nm particles. Venous blood and urine samples were collected 8 days before exposure, twice daily during the trial, and 6 days post-exposure. As the first application in nanotechnology studies, stable isotope tracing was used where the ZnO, enriched to > 99% with the stable isotope ⁶⁸Zn, allowed dermally absorbed zinc to be distinguished from naturally occurring zinc.

Results and Conclusions

The overwhelming majority of applied ⁶⁸Zn was not absorbed, although blood and urine samples from all subjects exhibited small increases in levels of tracer ⁶⁸Zn. The amount of tracer detected in blood after the 5-day application period was ~1/1000th that of total Zn in the blood compartment. Tracer levels in blood continued to increase beyond the 5-day application phase in contrast to those in urine. Levels of ⁶⁸Zn in blood and urine from females receiving the nano sunscreen appeared to be higher than males receiving the same treatment and higher than all subjects receiving the bulk sunscreen. It is not known whether ⁶⁸Zn has been absorbed as ZnO particles or soluble Zn or both.

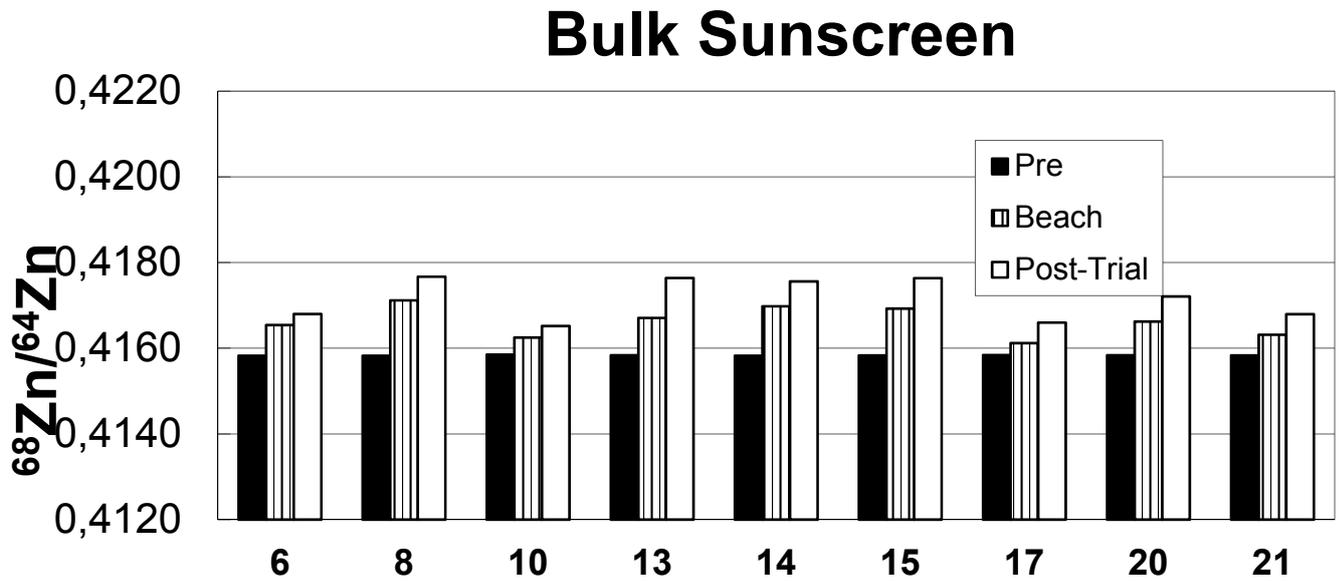


Figure 1. Changes in $^{68}\text{Zn}/^{64}\text{Zn}$ ratio for subjects (X axis) using sunscreen with bulk particles.

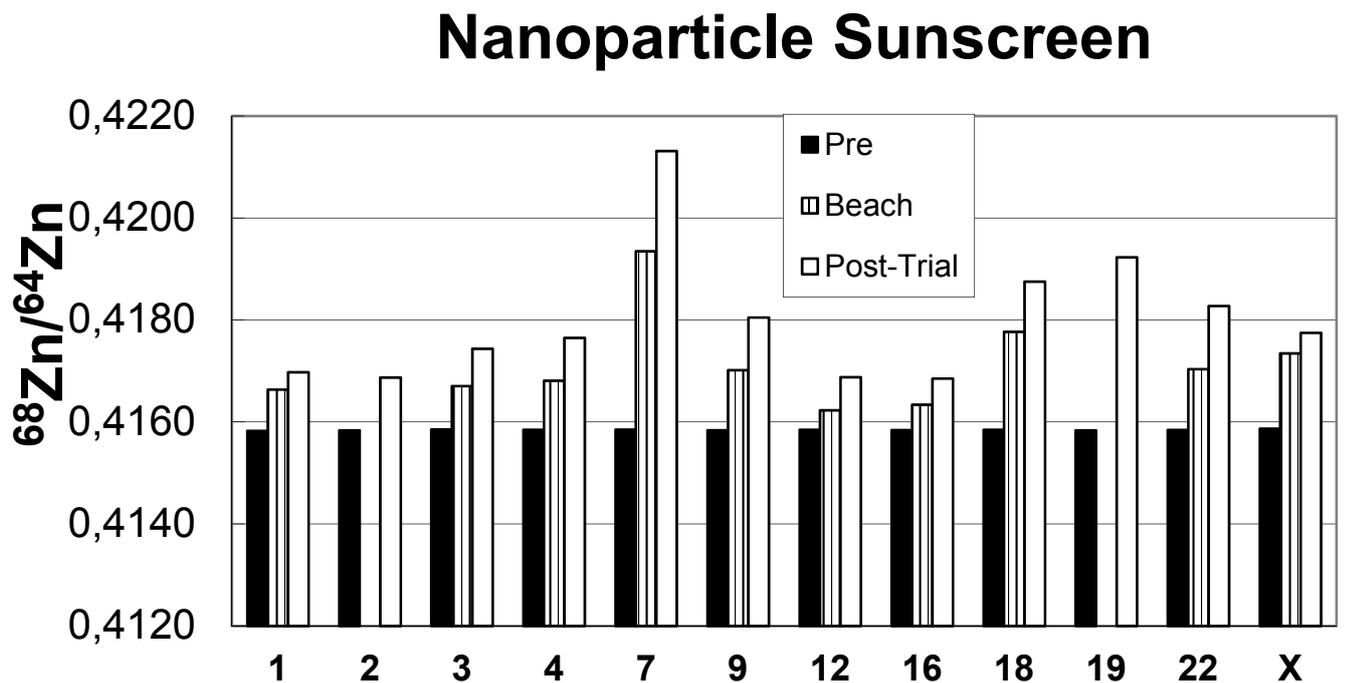


Figure 2. Changes in $^{68}\text{Zn}/^{64}\text{Zn}$ ratio for subjects (X axis) using sunscreen with nanoparticles

Reference Gulson, B., McCall, M., Korsch, M., Gomez, L., Casey, P., Oytam, Y., Taylor, A., McCulloch, M., Trotter, J., Kinsley, L., Greenoak, G. (2010). Small amounts of zinc from zinc oxide particles in sunscreens applied outdoors are absorbed through human skin. *Toxicol. Sci.*, 118, 140-149.