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REPORT

ELEVATED SERUM NICKEL CONCENTRATION IN PSORIASIS VULGARIS

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Abstract

Background. Psoriasis vulgaris is a common skin disease afflicting 1–3% of the American population. Its pathogenesis remains unknown despite concerted research efforts. Our purpose was to study baseline serum nickel concentrations in psoriasis vulgaris subjects and in healthy control subjects.

Methods. Sixteen psoriasis vulgaris subjects with active disease (in 14 of moderate to marked severity), and 11 age- and sex-matched healthy control subjects were studied. Serum nickel determinations were performed using electrothermal atomic absorption spectrophotometry (ETAAS).

Results. Despite the relatively small sample size, significant elevation of mean serum nickel concentration was found in the psoriasis group compared to the control group ($P = 0.019$).

Conclusions. Recognition of abnormal nickel homeostasis could point the way to greater understanding of the primary biochemical defect in the psoriatic process. Alternatively, this finding may mark an association without pathogenic significance. Further investigation is needed.

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Psoriasis is a chronic intractable skin disease affecting 1–3% of the American population; its pathogenesis remains unexplained.[1] A simple biochemical explanation of this ancient disease has been clouded by complex modern immunologic theories.

Considerable interest in trace and ultratrace minerals and their relationship to psoriasis has been shown for some time. Most thoroughly investigated have been zinc, copper, and selenium.[2–5] The search for a simple biochemical understanding of this disease continues to be elusive.

Certain mineral deficiency states that cause psoriasiform findings have stimulated considerable interest. For example, hereditary (acrodermatitis enteropathica) and acquired (associated with total parenteral nutrition (TPN), chronic liver disease, etc.) zinc deficiency states can cause psoriasiform abnormalities.[6,7]

Nickel is a transition element, similar to zinc, copper, cobalt, and iron. Since scaly, crusty, rough skin has been experimentally induced in nickel-deprived goats and minipigs,[8] we chose to measure serum nickel concentrations in subjects with psoriasis vulgaris comparing them to healthy control subjects.

Methods

Serum nickel concentrations were determined for 16 psoriasis vulgaris subjects with active disease of varying severity (in 14 moderately to markedly severe), and 11 age- and sex-matched healthy controls. Student's t-test was used to determine if there were statistically significant differences between these groups. Since ultratrace nickel concentrations were being studied in serum (less than 1 µg/L), modern methods to avoid external nickel contamination were followed meticulously, including all stages of specimen collection, handling, storage, transport, and analysis.[9,10] Specimens were analyzed in batches, using electrothermal atomic absorption spectrophotometry (ETAAS), at the University of Virginia Health Sciences Center, Clinical Laboratories, Charlottesville, Virginia.

RESULTS

Figure 1 shows all data points for serum nickel determinations in psoriasis and control subjects. Table 1 shows statistical results of these data, using Student's t-test to compare mean serum nickel concentrations for these two groups.

Despite the relatively small sample size, a significantly higher mean serum nickel level was found in the psoriasis group compared to the control group ($P = 0.019$). This contradicted our initial hypothesis, that a nickel deficiency state might be found in psoriatic individuals. Considerable overlap was seen in serum nickel levels in the two groups (0.2–0.7 µg/L for the psoriasis group and 0.2–0.6 µg/L for controls).

DISCUSSION

An extensive literature search identified only two previous studies addressing serum nickel concentrations and psoriasis.[11,12] The results of these studies were

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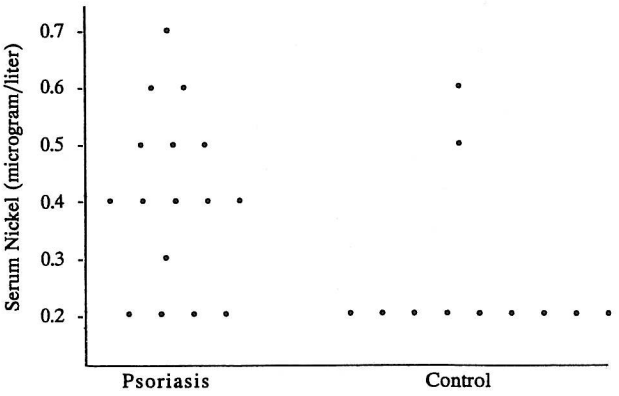

Figure 1. Data points for serum nickel concentrations.

contradictory and both were marred by serious methodologic errors and/or serious analytic inaccuracies. Since these studies were done, analytic methods have advanced that now allow order(s) of magnitude greater precision (10–100 times) in measuring serum nickel concentrations.[9] Furthermore, much greater accuracy is possible today with greater awareness of the importance of avoiding specimen contamination.[10]

To our knowledge, the present study reflects a fresh insight into psoriatic nickel homeostasis that could play a role in understanding better the possible underlying biochemical/genetic defect. Many factors may affect nickel levels in the body. Day to day factors such as stress, strain, or physical effort have been only briefly addressed in the literature.[13] Seasonal serum nickel variations are not known. Certain occupational and environmental exposures have been well studied and are the most significant factors in elevating serum nickel levels.[13] Simply living in a major nickel mining area can significantly raise serum nickel concentrations.[14]

Nickel absorption in the gastrointestinal tract is enhanced by a number of factors including iron deficiency, pregnancy, and lactation.[15] It is markedly inhibited by simultaneous ingestion of most foods and drinks.[16]

Certain chelating agents such as disulfiram have been shown to elevate serum nickel levels.[17] Foods and food processing techniques can also lead to a high dietary intake of nickel and restriction of these has been shown to reduce significantly renal nickel excretion.[18]

Serum nickel levels may rise significantly with some acute illnesses such as burns, stroke, and myocardial infarction.[19] In contrast, psoriasis is the only chronic disease in which elevated serum nickel levels have been reliably demonstrated (by the present study). Santucci reported elevated serum nickel levels in nickel-sensitive patients,[20] but his data are marred by serious analytical inaccuracies.[9,10] When better analytical methods are used, his findings are disputed.[13]

That nickel is physiologically important in the body is supported by many findings. Nickel is regulated homeostatically and does not accumulate in the body such as some other toxic elements.[15] The demonstration of nickel as an essential trace element in several animal species has led to a strong suspicion of an essential role in man.[8,21] The specific biologic functions of nickel are poorly understood at this time, although circumstantial evidence points to a potential metalloenzyme(s) cofactor function.[22] Multiple biologic interactions with other closely related transition elements, such as iron, copper, and zinc, lend further credibility to a possible biochemical or therapeutic role for nickel.[23–26]

Nickel is an element that possesses both nutritional and potentially toxic or carcinogenic properties. In the past, it was used therapeutically for a wide variety of chronic ailments, including epilepsy, headache, neuralgia, amenorrhea, and diarrhea.[27–30] Nickel is currently being incorporated into some multivitamin and mineral supplements.

Many studies on nickel have focused on the negative aspects of various nickel compounds (e.g., their toxic, carcinogenic, and allergic potential). These studies are widely published and are beyond the scope of this paper.[31–33] Reports of health risks have centered largely around the acute toxicity of exposure to nickel carbonyl[34] and the epidemiologic and laboratory evidence implicating certain inhaled or injected nickel compounds as potential carcinogens.[32] Topical nickel exposures are frequently associated with allergic contact dermatitis, especially from costume jewelry and other metal objects.[33]

Table 1. Statistical Results of Serum Nickel Values

	N	*Mean*	*Standard Deviation*
Psoriatics	16	0.405	0.157
Controls	11	0.264	0.143
Results of Student's t-test		t = 2.435	P* = 0.019

*two-tailed test.

CONCLUSIONS

In the present study, there is a statistically significant difference between the mean serum nickel concentrations in patients with psoriasis and in control subjects (P = 0.019). These higher nickel concentrations in the psoriatic group could point to a defective cellular transport mechanism or a defective nickel-dependent metalloenzyme that may result in a compensatory increase in nickel absorption/retention. This suggests that a biochemical defect in the psoriatic process could be related to nickel homeostasis or function in the body. These findings point the way to further studies that are ongoing at present.

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