

# Confusion, Lethargy and Leukonychia

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## Abstract

*Leukonychia, a medical term for white spots on the fingernails, has been associated with zinc deficiency, and zinc deficiency has been associated with a variety of psychological symptoms, including confusion and lethargy. A sample of 494 university students, were divided into a group with leukonychia and a group without leukonychia. Sixty-five percent of the subjects reported leukonychia on at least one fingernail, with males more likely to report leukonychia. Subjects responded to questions concerning right-left confusion, drowsiness, and number of hours of sleep. It was found that subjects with leukonychia were significantly more likely than those without it to report right-left confusion, drowsiness, and longer sleep time. Factors related to marginal zinc deficiency in the group, and the effects of marginal zinc deficiency on behaviour are discussed.*

## Introduction

The existence of white spots on the fingernails is quite common, and in folk wisdom has been associated either with trauma to the fingernails, or with deposits of calcium. In medicine these white spots are referred to as leukonychia. Muerhcke (1956) found a relationship between leukonychia and low serum albumin levels. Since about 70% of serum zinc is bound to albumin, Pfeiffer (1978, p. 18-23) suggested that the white spots are primarily the result of zinc deficiency, and has found that leukonychia is responsive to zinc therapy.

Zinc as a trace metal is an important component of many important enzyme systems. As recently as 1962 it was reported that zinc deficiency had never been observed in man. But since then, an increasing number of pathological conditions have

been associated with zinc deficiency, and corrected by zinc supplementation. Among these are growth retardation, disorders of sexual functioning and development, skin disorders, delayed healing, pregnancy complications, birth defects, poor appetite, abnormal dark adaptation, taste and smell disorders, and immunological deficiency (Pfeiffer, 1978; Prasad, 1983; Werbach, 1987).

Zinc deficiency appears to be a factor in a number of psychological processes due to its important role in the functioning of the central nervous system (Dreosti, 1984). All neural tissue contains zinc, but the hippocampus, an area important for memory and other integrative functions, is especially rich in zinc. The zinc is concentrated in the hippocampal mossy fiber pathway. Zinc also has high concentration in the pineal gland and in the retina, which is an outgrowth of the brain. Zinc has an important role in the formation of key enzymes involved in uptake or release of neurotransmitters (Prasad, 1983). Zinc is importantly involved in synaptic transmission (Hesse, 1979), and zinc deficiency is known to increase brain norepinephrine (Wallwork et al, 1984).

In view of these basic functions of zinc in the central nervous system, it is not surprising that zinc deficiency results in behavioural and neuropsychological abnormalities. Behavioural changes related to zinc nutrition status have been demonstrated in a number of controlled experimental studies (Halas, 1983). Diminished zinc status is associated with depression, schizophrenia (Pfeiffer, 1987; Pfeiffer and Braverman, 1982), dementia, mental retardation, learning disabilities (Prasad, 1983), and possibly anorexia nervosa (Bakan, 1979; Safai Kutti, 1984). A variety of neuropsychiatric signs have been associated with zinc deficiency. These include irritability, dysperception, emotional changes, cognitive changes, confusion and lethargy (Ohlsson, 1981; Pfeiffer, 1978; Prasad, 1983;

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Prasad and Braverman, 1982; Prasad, Halsted and Nadimi, 1961; Walravens et al, 1978).

If leukonychia is associated with zinc deficiency, then it should be possible to show that individuals with leukonychia also show other symptoms of zinc deficiency. In this study the relationship between leukonychia and two symptoms of zinc deficiency was explored, namely confusion and lethargy. More specifically, questionnaire items were used to indicate presence of right-left confusion, sleep time, and drowsiness as they relate to presence or absence of leukonychia. The purpose of this study is to compare university students with and without leukonychia on three behavioural variables, namely, right-left confusion, drowsiness, and amount of sleep.

### Method

A questionnaire was completed by 494 students, 204 males and 290 females, in an introductory psychology course. The following item was included to elicit self-reports of leukonychia.

"Some people have white spots in the pink part of one or more fingernails. Look at the fingernails of each of your hands. Do you see any white spots?": a) yes, b) no, c) I don't know, d) I can't tell because of nail polish.

Subjects also responded to the following item which provides information about a common aspect of mental confusion, namely right-left confusion.

"How often do you confuse right and left when giving directions?": a) very often, b) quite often, c) occasionally, d) very rarely, e) never.

Two items related to sleep/drowsiness were included to evaluate the relation between zinc deficiency and lethargy. These are:

"How many hours do you usually sleep per night?": a) less than 5 hours, b) 5-6 hours, c) 7-8 hours, d) 9-10 hours, e) more than 10 hours.

"How often do you feel drowsy?": a) very often, b) quite often, c) occasionally, d) very rarely, e) never.

### Results

#### Prevalence of Leukonychia

The presence of leukonychia was reported by 65% of the 459 subjects who replied "yes" or "no" to the white spot question. Males were more likely to report white spots than females. Of the 195 males, 138 or 71% reported the spots; of the 264 females, 159 or 60% reported the spots. The difference between males and females in frequency of reporting white spots is significant at the .05 level (Chi-Square of 4.99 with one degree of freedom).

#### Right/Left Confusion

The results showing the relationship between presence/absence of leukonychia and right-left confusion are shown in Table 1.

Of the 494 subjects there were 459 who provided positive information on both the white spot item and the right-left confusion item. It is clear from Table 1 that subjects who report white spots are more likely to report right-left confusion. Thus, of the 27 subjects who report being very often confused, 23 or 85% have leukonychia, whereas, of the 80 subjects who report never having right-left confusion, 46 or only 58% have leukonychia.

A 2 x 2 contingency table was produced by combining the "very often" and "quite often" categories and the "occasionally", "very rarely" and "never" categories. The relationship between high/low confusion and presence/absence of white spots produced a Chi-Square value of 5.00, which, with one degree of freedom is significant at the .025 level. Right-left confusion is more characteristic of those with leukonychia.

The trend toward greater likelihood of right-left confusion in subjects with leukonychia was present for both males and females. Separate analyses for each sex yielded Chi-Square values of 3.15 for males and 3.48 for females, each significant at the .10 level.

#### Sleep Time

Lethargy has been reported as part of the syndrome of zinc deficiency. Sleep time was used as an indicator. Table 2 shows the relationship between leukonychia and report of number of hours usually slept per night.

Of the 494 Ss there were 459 who provided positive information on both the white spot item and the hours of sleep item. Table 2 shows that there are proportionately fewer short sleepers and more long sleepers in subjects with leukonychia. The subjects with leukonychia spend more time sleeping. Whereas 52 percent of the subjects who sleep 6 hours or less per night report leukonychia, there are 67 percent with leukonychia among those who sleep 7 or more hours per night.

A 2 x 2 contingency table was produced by combining the "less than 5 hour" category and the "5-6 hour" category against the "7-8 hour", "9-10 hour", and "more than 10 hour" categories. The relationship between short sleep/longer sleep and presence/absence of leukonychia yielded a Chi-Square value of 6.03, significant at the .02 level. Subjects with leukonychia report typically longer sleep times.

The trend toward longer sleep time being associated with leukonychia is in the same direction for both males and females, but is more marked for males than for females. Separate Chi-Square analyses for males and females yield a Chi-Square of 6.0 for males, significant at the .02 level, and a statistically insignificant Chi-Square of 0.56 for females.

### **Drowsiness**

Self reports of drowsiness were used as another indicator of lethargy, and an analysis was carried out to determine the relationship between leukonychia and reported drowsiness. The results of this study are shown in Table 3.

Subjects who report leukonychia are more likely to report drowsiness than those who do not report it. Twenty-one of the 28 subjects (75%) who report themselves "very often" drowsy, have white spots in contrast to 5 of 11 (45.5%) who report themselves "never drowsy". In general the percentage of subjects with leukonychia decreases as responses go from "very often" drowsy to "never" drowsy.

A 2 x 2 contingency table was produced by combining the "very often" and "quite often" categories and the "occasionally", "very rarely" and "never" categories. The relationship between

more drowsy/less drowsy and presence/absence of leukonychia yields a Chi-Square value of 2.91, significant at the .10 level. High levels of drowsiness are more frequently reported by subjects who report white spots.

The trends for males and females are in the same direction. The relationship appears stronger for females than for males since the female Chi-Square value is 3.08, significant at the .10 level, and the male Chi-Square of 0.78 does not approach significance.

### **Discussion**

The main findings of this study are a high frequency of occurrence of leukonychia or fingernail white spots in a sample of university students, a greater likelihood of right-left confusion for subjects with leukonychia, longer sleep times for subjects with leukonychia, and a trend toward more reporting of drowsiness among those reporting leukonychia. If leukonychia is a manifestation of zinc deficiency as has been suggested (Pfeiffer, 1978), then the finding of a 65% frequency of occurrence of leukonychia suggests a rather high incidence of at least marginal zinc deficiency in a normal group of young adults of relatively high socio-economic status. The higher frequency of leukonychia among males may be related to need for more zinc in males, since there is a high concentration of zinc in the male sexual apparatus. According to Pfeiffer (1978, p. 17) more zinc may be required in the pubertal development of the male than in the pubertal development of the female.

Attention should be directed to some of the factors that might decrease intake or availability of zinc for this group. One such factor might be attempts at weight reduction which involve reduced consumption of meat and other sources of zinc. Other factors include high consumption of processed foods where processing reduces zinc, high intake of cereal foods containing phytates which reduce zinc absorption, consumption of alcohol, stress, fitness activities such as jogging which result in loss of zinc through sweating and, for females, the use of oral contraceptives which reduce the availability of zinc. It has also been suggested that masturbation

in males is a possible cause of loss of zinc, since semen and prostatic fluid are rich in zinc (Pfeiffer, 1978, p. 45).

The psychological variables chosen for examination, confusion and lethargy or drowsiness, have been reported as symptoms of zinc deficiency. They were chosen because of the possible association between leukonychia and zinc deficiency. It was hypothesized that subjects with leukonychia would show greater evidence of confusion and lethargy than those without leukonychia. The results are consistent with the hypothesis, since the subjects with leukonychia were more likely to report right-left confusion, longer sleep, and more drowsiness. These behavioural results support the suggested relationship between leukonychia and marginal zinc deficiency.

Of special interest is the fact that evidence of less than optimal psychological functioning related to leukonychia and zinc deficiency is found in a group of relatively healthy, well-functioning young people, i.e. university students. The psychological efficiency of these students may be at risk because of marginal zinc deficiency.

These findings need to be considered preliminary in that the measures used to evaluate confusion and lethargy were limited to simple questionnaire items. Further research should pursue a wider range of psychological variables with more sensitive instruments to elucidate the relationship between leukonychia, associated zinc deficiency, and psychological functioning. Also, in light of sex differences in the frequency of occurrence of leukonychia and in the relationships between leukonychia and behavioural variables, the relationship between leukonychia and other variables should be examined separately for males and females.

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**Table 1**  
**Leukonychia and Right-Left Confusion**

<b>R/L Confusion</b>	<b>Leukonychia/yes</b>	<b>Leukonychia/no</b>	<b>% With Leukonychia</b>
Very often	23	4	85.2
Quite often	39	16	70.9
Occasionally	70	51	57.9
Very rarely	120	56	68.2
Never	46	34	57.5

**Table 2**  
**Leukonychia and Hours of Sleep**

<b>Sleep Time</b>	<b>Leukonychia/yes</b>	<b>Leukonychia/no</b>	<b>% With Leukonychia</b>
Less than 5 hours	2	2	50.0
5-6 hours	36	33	52.2
7-8 hours	204	109	65.2
9-10 hours	53	17	75.7
More than 10 hours	2	1	66.7

**Table 3**  
**Leukonychia and Drowsiness**

<b>Drowsiness</b>	<b>Leukonychia/yes</b>	<b>Leukonychia/no</b>	<b>% With Leukonychia</b>
Very often	21	7	75.0
Quite often	67	29	69.8
Occasionally	160	96	62.5
Very rarely	45	24	65.2
Never	5	6	45.5