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EFFECTS OF PYRIDOXINE ON DREAMING: A PRELIMINARY STUDY[1,2]

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Summary.—The effect of pyridoxine (Vitamin B-6) on dreaming was investigated in a placebo, double-blind study to examine various claims that Vitamin B-6 increases dream vividness or the ability to recall dreams. 12 college students participated in all three treatment conditions, each of which involved ingesting either 100 mg B-6, 250 mg B-6, or a placebo prior to bedtime for a period of five consecutive days. The treatment conditions were completely counterbalanced and a two-day wash-out period occurred between the three five-day treatment blocks. Morning self-reports indicated a significant difference in dream-salience scores (this is a composite score containing measures on vividness, bizarreness, emotionality, and color) between the 250-mg condition and placebo over the first three days of each treatment. The data for dream salience suggests that Vitamin B-6 may act by increasing cortical arousal during periods of rapid eye movement (REM) sleep. An hypothesis is presented involving the role of B-6 in the conversion of tryptophan to serotonin. However, this first study needs to be replicated using the same procedures and also demonstrated in a sleep laboratory before the results can be considered certain.

Pyridoxine (B-6) is a naturally occurring vitamin found in foods such as liver, kidney, whole-grain cereals, wheat germ, and soybeans (Goodman & Gilman, 1980). In the brain, pyridoxine is used as a coenzyme in the synthesis of certain neurotransmitters such as serotonin (Wyatt, Engelman, Kupfer, Fram, Sjoerdsma, & Snyder, 1970; Pfeiffer, 1975).

Anecdotal reports suggest that Vitamin B-6 supplements increase one's capacity for dream recall and lead to a perceived enhancement of the dream experience. For example, moderate to high dosages of Vitamin B-6 above the U.S. Recommended Daily Allowance (RDA) have been reported to improve dream recall (Pfeiffer, 1975; Fredericks, 1983). Conversely, a lack of dream recall has been implicated as an alleged sign of Vitamin B-6 deficiency (Pfeiffer, 1975). Stimulation of dream activity or enhancement of the actual dream experience has also been linked to consumption of pyridoxine through anecdotal reports. In linking these effects on intensity and recall of dreams, the concept of dream salience may be useful as a single construct of interest which can describe the overall effect of pyridoxine on the subjective experience of dreaming. The goal of this study was to investigate what role, if any,

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Vitamin B-6 plays in subjective sleep reports. We were particularly interested in the acute effect of this vitamin supplement on dream salience.

Dream salience refers to the subjective intensity of the dream, which has often been shown to be a psychological correlate of high cortical arousal during rapid eye movement (REM) sleep. It is often characterized by the vividness, emotionality, bizarreness, and activity of the dream which is likely to be accompanied by changes in physiology indicative of increased activation of the central nervous system. The Dream Salience Hypothesis, discussed extensively by Cohen (1974), implicated dream salience as a factor which may account for variations in ability to recall dreams. Simply put, more salient dreams are easier to remember possibly because their psychological and physiological importance for the dreamer are greater. This hypothesis was empirically confirmed by Cohen and MacNeilage (1974) in a laboratory investigation of sleep.

Based on findings from a factor analytic study by Hauri, Sawyer, and Rechtschaffen (1967) who examined variables associated with REM sleep, activity was excluded from the Dream Salience Scale used in the present study. Instead, the dimension of color was based on the various claims that Vitamin B-6 can make dreams more colorful [A. C. Hastings (1997) Response to Cevallos' description of dream potentiation by *Valeriana officinalis*, melatonin, and Vitamin B-6. Comment posted on the World Wide Web, retrieved December 18, 1997 from http://www.erowid.com/smarts/melatonin/melatonin_exp.shtml].

METHOD

Subjects

Twelve women and six men participated in a within-subjects design with each subject acting as his own control. For inclusion age was no younger than 18 and no older than 40 years, although the participating subjects were all under 30, ranging in age from 18 to 28 years old. Subjects were solicited by flyers and college bulletin postings in the New York City area. Subjects were also solicited from introductory psychology classes at The City College of New York. All subjects were required to be subjectively healthy with no significant medical problems.

Materials

An 18-question sleep log was given to each prospective subject to ensure the subject had normal sleep habits. This sleep log was a 2-page questionnaire containing questions regarding the amount of time in bed before attempting to fall asleep, lights out time, sleep latency, nighttime arousals, number of times out of the bed during the night, time of last awaking, time out of bed, an estimate of total sleep time, and difficulty awaking (rated on

a 10-point scale with 1 representing not difficult and 10 representing very difficult), use of medication, time outdoors in the morning, number of naps during the day, total amount of sleep during the naps, number of caffeinated beverages during the day, amount of alcohol drunk during the day, exercise (yes or no), and daytime alertness and fatigue (both on a 7-point scale). Subject filled out the sleep log for one week as a screening measure. The questionnaire was then reviewed by investigators to assess whether the subjects should be included in the study according to certain guidelines that are described below in the procedure. A postsleep questionnaire was used to monitor each subject's response to the treatments given. It consisted of several fill-in questions regarding sleep latency, number and duration of night time arousals, total sleep time, and dream recall. In the second portion of the questionnaire, subjects were asked to respond to a number of questions using an 11-point rating scale with anchors of 0: not at all and 10: extremely. These questions inquired about general sleep quality and morning alertness as well as dream recall and other various dream characteristics from the previous night.

The Dream Salience Scale consisted of four items embedded in this portion of the morning questionnaire. Subjects were asked to rate their dreams from the previous night in terms of their vividness, bizarreness, emotionality, and color. The scores for these four items were summed to obtain a Dream Salience Score for each treatment night. Over the five nights of the placebo treatment the reliability of the Dream Salience Scale, using Cronbach alpha, ranged from .91 to .95 with a mean of .93, suggesting acceptable internal consistency. Test-retest reliability was a bit more difficult to assess since dream recall has been shown to be affected by the attention people devote to remembering their dreams (Belicki, 1986). It was expected that the subjects' ratings on items related to dreams would increase over the first few days due to increased attention focused on dreaming. Therefore, it would make little sense to assess consistency of subjects' responses while their dream recall was expected to increase. With this in mind, the final three days of the placebo condition were analyzed for test-retest reliability with the assumption that recall of dreams over time exhibits a ceiling effect. The scale yielded acceptable reliability coefficients for Days 3 and 4 ($r = .76$, $p = .01$) and for Days 4 and 5 ($r = .73$, $p = .01$).

Procedure

Each subject's sleep was monitored by the subjective sleep logs described earlier for one week preceding the study to ensure that no subject's bedtime or wake time varied on average more than one hour during the monitoring week. The sleep logs were also used to detect and eliminate subjects who drank more than seven alcoholic beverages per week. Each subject

participated in three conditions under a double-blind paradigm to minimize both investigator's and subject's bias. In each treatment condition the subject was to ingest a capsule 5 min. prior to bedtime containing either 100 mg Pyridoxine, 250 mg Pyridoxine, or a placebo. Based on a previous report suggesting that enhancement of dreams through Vitamin B supplements may be a rather temporary phenomenon with a diminishing effect over a period of consecutive nights of vitamin intake, an acute effect of pyridoxine on dreaming was expected (Pearson & Shaw, 1987). To ensure that any acute effect was captured, the first three days of each treatment were analyzed. Each treatment condition, however, was given for five days with a two-day wash-out period between conditions. Data from Days 4 and 5 were collected for possible later use in a separate, exploratory analysis. All three-treatment weeks were counterbalanced for order among subjects such that all possible combinations of the three conditions were exhausted. There were six possible combinations.

Due to attrition and noncompliance, the number of subjects per order of treatment conditions ended up being unequal. To ensure complete counterbalancing, subjects were eliminated at random until each of the six possible combinations of conditions had an equal number of subjects. The only exception to random removal of subjects for data analysis was that an attempt was made to keep equal numbers of men and women to control for possible effects of sex. The final pool of 12 subjects included 6 men and 6 women.

Upon awaking each morning, the subjects completed the postsleep questionnaire from which a Dream Salience Score was obtained for the analysis. The City College of New York Institutional Review Board approved the research protocol.

Results

Each subjects' Dream Salience Scores were averaged over the initial three nights of each treatment condition to ensure that any acute effects were captured. The internal consistency as Cronbach alpha of the composite score, Dream Salience Score, over three days was .93. As was expected, the Composite Dream Salience Score increased in the Placebo condition ($M = 10.69$, $SD = 8.28$) to the 100-mg condition ($M = 13.90$, $SD = 8.77$) to the 250-mg condition where it was highest ($M = 16.03$, $SD = 10.96$).

To test for statistical significance the Composite Dream Salience Scores for each subject were entered into a single-factor, repeated-measures analysis of variance with three levels. This indicated a significant main effect of Vitamin B-6 dosage on reported dream salience ($F_{2,22} = 3.34$, $p = .05$, $\omega^2 = .115$). Two planned comparisons were then used to compare each pyridoxine dosage effect with the placebo condition. The Composite Dream Salience Score

was different in the placebo and the 250-mg condition ($F_{1,11} = 12.08$, $p = .005$, $\omega^2 = .335$).

Discussion

The present investigation showed a significant increase in Composite Dream Salience Scores in the 250-mg pyridoxine condition compared to placebo. The scores in the 100-mg pyridoxine condition, though they were not significant, fell between those for the 250-mg and placebo conditions. One possible explanation for the observed effect of Vitamin B-6 on Dream Salience Scores is that the pyridoxine treatment simply improved recall of dreams, giving an enhanced and seemingly vivid memory. There is evidence to support the claim that Vitamin B-6 improves memory (Deijen, van der Beek, Orlebeke, & van den Berg, 1992; Riggs, Spiro, Tucker, & Rush, 1996; La Rue, Koehler, Wayne, Chiulli, Haaland, & Garry, 1997).

Although memory itself may have been improved by pyridoxine, neurochemical evidence supports a mode of action which may better explain the observed increase in Dream Salience Scores. Pyridoxine's action as a coenzyme in tryptophan metabolism suggests an increase in brain serotonin levels which has been known to suppress REM sleep (Wyatt, *et al.*, 1970; Pfeiffer, 1975). After an initial inhibition of REM during the first portion of the night, it is possible that a subsequent rebound effect characterized by frequent awakenings out of highly dense periods of REM toward the morning hours may account for the increase in Dream Salience Scores in the pyridoxine conditions (Berger & Oswald, 1962; Goodenough, Lewis, Shapiro, & Sleser, 1965; Foulkes, 1966; Webb & Kersey, 1967; Aserinsky, 1969, 1973; Firth & Oswald, 1975; Goodenough, 1991; Barbato, Barker, Bender, Giesen, & Wehr, 1994; Antrobus, Kondo, & Reinsel, 1995). This interpretation requires empirical testing as detailed.

Several steps must be taken before these results can be taken as certain and used with confidence as a basis for theorizing. First, the present study should be replicated using the same procedures. Second, the results should be replicated in the context of awakenings from REM sleep and late-night stage II NREM sleep. Then studies would be needed to clarify the mechanism by which pyridoxine affects dream salience. Sleep laboratory studies with polysomnograph recordings may clarify the effect of Vitamin B-6 on sleep architecture in terms of the distribution of REM periods. Other studies in which dream reports and ratings are gathered throughout the night after both REM and NREM awakenings may help sort out whether the effect of pyridoxine on dreaming is specific to mentation in REM.

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