

**This Reports the Results of the Presley SB107 CYA on Violence
Reduction after Nutritional Intervention
= 37% fewer level "B" offenses**

Nutrition and Institutional Rule Violations Schoenthaler

A CONTROLLED TRIAL OF THE EFFECT OF VITAMIN-MINERAL SUPPLEMENTATION ON THE INCIDENCE OF SERIOUS INSTITUTIONAL RULE VIOLATIONS

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Abstract

The effect of vitamin-mineral supplementation on serious institutional rule violations was studied in a triple-blind, randomized, controlled trial among 402 male prisoners aged 18 to 25 years in California. A 15 week pre-intervention period was compared with a 15 week experimental period in which 1 group received placebos and 2 groups received different strengths of vitamin-mineral supplements based on 100% and 300% of the USRDA. An ANCOVA indicated that change in serious rule violations among the 3 groups was statistically significant, ($F = 3.73$, $p = .025$). Using Tukey's method of multiple comparisons, only the difference between the placebo and 100% formula was statistically significant. Mean rule violations per subject rose slightly, (ie., 20%), among the placebo group and fell slightly, (ie., 16%), among the 300% group. In contrast, mean rule violations fell 38% among subjects who received the 100% formula, (95% confidence interval, 11 to 65%). The study suggests that the behavior of a substantial minority of offenders may be rapidly improved by combining nutritional intervention with existing therapies in controlled settings.

Acknowledgements

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Introduction

It has been found that about 6% of the male population are "chronic offenders" [1]. These men: (a) commit the majority of all homicides, rapes, robberies, and aggravated assaults; (b) are arrested a minimum of 5 times before their 18th birthday; (c) tend to be substance abusers; and (d) usually continue their criminal activities into adulthood [1]. Their recidivism suggests that they are not deterred by the rehabilitative or punitive measures commonly employed within the justice system. Since they do not respond to rehabilitation or punishment like "normal" people, their criminal behavior may be due partly to biological factors as well as societal, environmental, or other factors [2-5]. Thus, identifying possible biological abnormal-

ities or deficiencies in the chronic offender may be a fruitful avenue of research, especially if such deficits might be easily corrected. The present study examines the possibility that nutritional deficiencies may be a factor in the behavior of the chronic offender.

Literature Review

To date, most research on the possible role of nutrition in chronic criminal behavior has been conducted on prisoners and incarcerated juvenile delinquents. One would expect to find a concentration of persistent offenders in prison, and indeed, studies show that there is a substantial core of inmates, (about 20%), who fit the chronic offender profile, ie., males aged 18 to 25 years with a history of multiple arrests and substance abuse [6,7]. This group commits most of the breaches of prison discipline, (so-called "rule violations,") of which one-third involve threatened or actual violence.

In the 1970s, it was suggested that violent behavior might be due to dietary factors, in particular the over-ingestion of sugar [8]. Accordingly, a number of prisons experimented with the manipulation of prisoners' diets, specifically replacing high-sugar "manufactured" foods with fresh fruits, vegetables, and whole grain products. It was found that the number of serious rule violations fell an average of 42% in 14 institutions afterwards, but the improvements occurred among only 24% of the

delinquents [9-13]. It was also found that, although they were offered well-balanced prison diets, the worst-behaved delinquents chose to eat foods containing significantly fewer vitamins and minerals [14]. It was subsequently hypothesized that the improvement in behavior was not due to decreased sugar consumption, but to the increased intake of the vitamins and minerals contained in the fresh fruits, vegetables, and whole grain foods.

This hypothesis was tested in a randomized, double-blind trial in an Oklahoma juvenile correctional facility. Sixty-four delinquents aged 12 to 17 years were given either vitamin-mineral supplements or placebos for 13 weeks [15-16]. There were 16% fewer total rule violations ($p < .01$), 14% fewer non-violent rule violations ($p < .01$), and 21% fewer violent rule violations ($p < .05$) among the 35 juveniles receiving supplements than among the 29 who received placebos during the experimental period. Yet all differences between the groups could be accounted for by improvements in just 12 of the 35 juveniles, (ie., 34%). Blood assays confirmed that the juveniles whose violent behavior had decreased most markedly had low concentrations of vitamins in their blood before supplementation began, but this condition was corrected by the end of the study ($p < .001$).

Although the number of responders in this study was quite small, the results were considered sufficiently impressive to merit large-scale replication. Accordingly, the California

Legislature passed Welfare and Institution's Code section 1706 (b) which authorized a large-scale replication within the California Youth Authority under the supervision of a nine member "Research Oversight Committee" appointed by the Office of Senate Research. This paper is an account of the study sponsored by the California State Legislature to test the hypothesis that vitamin-mineral supplementation will improve the behavior of offenders with nutritional deficiencies.

Methods

Subjects and location. Four hundred forty-nine male "wards," (ie., prisoners), aged 18 to 25 years agreed to enter the trial and comprised 93% of the wards in this age range within two California Youth Authority institutions. A decision was reached a-priori to exclude any subject from the analysis who was paroled, released, or transferred out of these institutions within 6 weeks of the beginning of supplementation. Accordingly, 402 subjects participated for at least 42 days within Dewitt Nelson (n = 146) and the Preston School of Industry (n = 256). The former is a "typical" California correctional facility for young adult males while the latter holds offenders deemed to be too dangerous to be held in less secure facilities or transferred to Preston as a result of behavior problems in other facilities.

Design summary. First, subjects completed three written tests (of IQ, mood, and personality), gave blood samples, and

then received placebos for at least 2 weeks as a pre-intervention wash-out. A 15 week trial followed during which one group continued to receive placebos; another group received supplements based on 300% of the USRDA; and a third group received supplements based on 100% of the USRDA. The exact composition of the 300% [16] and 100% [17] formulas is published in other papers. At the end of the experimental period, further blood samples were drawn. The records of all serious rule violations were then obtained from the Youth Authority computers covering the 15 weeks of the experiment itself and the 15 weeks before.

During the 30 week experimental period, the prison staff had been asked not to make any changes to their normal routine. In particular, serious rule violations by the subjects were to continue being recorded by staff in the normal way. The most serious rule violations, called "B-level" reports, were selected to quantify serious violent and serious non-violent behaviors. Each B-level report results in formal charges, administrative hearings against the accused, and a "sentence" if the charges are found to be true.

Potential covariates. Before the experimental period began, each subject took the non-verbal half of the Wechsler Adult Intelligence Scale-Revised, (WAIS-R); the Profile of Mood States, (POMS); and the Eysenck Personality Questionnaire, (EPQ). Each subject was questioned about smoking habits and daily intake of caffeinated coffee and soft drinks. These data served as

potential covariates, along with age and race.

Triple-blind randomized trial. Subjects were randomly assigned to three groups without staff or subjects knowing any group assignment. Each subject's group assignment was given to the California Legislature's Research Oversight Committee before supplementation began. The authors and the research assistants were not informed of group assignments until after all data had been computerized and submitted for final analysis. That analysis was done by the Research Oversight Committee's biostatistician. This created a triple-blind design.

At the start of the trial, the groups were not significantly different in serious rule violations, race, age, smoking habits, caffeine intake, soft drink consumption, WAIS-R scores, the six POMS scales, nor the four EPQ scales. As expected, the pre-intervention rule violations were correlated with rule violations during the intervention period ($p < .001$, $r = .45$). Each of the above variables was also tested individually as additional potential covariates, but none were found to modify any of the subsequent conclusions. Thus, the final model had pre-intervention rule violations as the sole covariate.

Subject judgment of the pills. At the completion of the study, subjects were asked to guess whether they had received placebos, a weak supplement, or a strong supplement. No significant relationship was found. About 1/3 of each cohort thought they were receiving placebos.

Biochemical data. Baseline blood samples were collected from the 317 subjects who so consented. All samples were archived at Doctor's Data in West Chicago, Act Labs in Houston, and Medical Science Institute Laboratories in Los Angeles. The protocol called for this archived blood to be assayed at a later time if support was found for the primary hypothesis.

Statistical analyses. The primary hypothesis to be evaluated would use ANCOVA techniques with the experimental time period measurement as the dependent variable, the treatment group as the grouping variable of interest, and pre-intervention time period measurement acting as the covariate. If statistical significance was found, results were to be followed up using Tukey's [18] Studentized range test at a procedure-wise error rate of 5%.

Adjustments to the primary variable of interest. Because all subjects were not present for the entire baseline and experimental periods, subjects who were confined less than 6 weeks during either period were excluded from the analysis. As a control for variation in days "at-risk" that ranged from 42 to 104 days, each subject's total rule violations during the experimental period was divided by his days "at-risk." In addition, a weight factor proportional to the subject's days "at-risk" was incorporated into the analysis. The same procedure was used on the covariate: total pre-intervention B-level rule violations. Finally, since rule violation rates during the pre-

intervention and experimental periods have skewed distributions, statistical analyses were performed on the log transformed data.

Results

Main findings. The differences among the three groups for the change in "the mean number of serious rule violations per subject" was statistically significant ($F = 3.731$, $p = .025$). The follow-up test indicated that only the difference between the placebo and 100% supplement group was statistically significant.

A small, but statistically insignificant increase in mean rule violations was observed in the placebo group, (ie., 20%), and a small, but statistically insignificant decrease in mean rule violations was observed in the 300% group, (16%). In contrast, a 41% decrease in mean serious rule violations occurred in the 100% group. This became 38%, (with a 95% confidence interval of 11% to 65%), when the data was weighted as described above.

insert table one about here

The apparent different efficacy of the two supplements are counter-intuitive. One might have expected either: (1) a proportional dose response with the stronger formula producing better results or; (2) no dose response with both supplemented groups performing about the same. Neither occurred. Subjects given the stronger dose did not improve as much as subjects given

the weaker formula. However, it should be noted that the difference between the two supplement groups was not statistically significant.

insert table two about here

Secondary findings. One would expect no change in rule violations among most offenders, a few behaving worse, and a few behaving better due to chance. This is precisely what was found in the placebo group as illustrated in Table three. The percent who behaved worse (32%) was about the same as the percent that behaved better (27%). Thus, 5% more subjects on placebo behaved worse than behaved better. In contrast, there was a 16% net improvement in the 100% group and a 9% net improvement in the 300% group. The result of the corresponding chi-square test for independence did not quite reach statistical significance, ($p = .173$). However, this was primarily due to the fact that the chi-square test does not take into account the magnitude of change (which ANCOVA does). Thus, the apparent reason for the significant difference in serious rule violations appears to be due to both the number who improved and the magnitude of the improvements among the subjects who received the 100% formula.

insert table three about here

Discussion

The measurement of violent and non-violent rule violations in this study is more reliable than the previous nutrition and antisocial behavior research [9-14] because each alleged violation was adjudicated at a formal administrative hearing that is somewhat similar to a criminal trial. Accordingly, unsupported and minor violations were eliminated in this study.

The primary purpose of this study with two adult "prison" populations in California was to re-test an Oklahoma finding on juveniles, namely that the past improvements in offenders' behaviors might be caused by the increased intake of vitamins and minerals following either supplementation or dietary improvements. The use of vitamin-mineral supplements to test this hypothesis became essential from a research standpoint since one can not separate the psychological and biological effects of changing diet. A placebo controlled trial became essential.

These present California data suggest that this hypothesis is supported and replicated on young adults. The 38% mean improvement (with a 95% CI of 11% to 65%) for the 100% USRDA group, is very similar to the 14 previous trials which reported a mean improvement of 42% and a range of 21% to 54% [19]. Accordingly, the blood sample results will be published independently once funding is obtained for assays and analysis.

The supplements had no measurable impact on the majority of the subjects who received the supplements. Presumably this is

because these non-responders: (a) had no recorded incidents during the pre-intervention period, (b) were well-nourished; (c) were at least not sufficiently malnourished to promote rule violations, (d) failing to take the supplements, and/or (e) the supplements were not effective for these particular subjects.

Investigations are often concerned with placebo effects (improvements due to subject expectations from treatment) and maturation effects (improvements due to the passage of time). The results for the placebo group show there were no placebo and/or maturation effects. In a 1986 pilot study, 40 offenders aged 15 to 17 years were given the same formula and rule violations fell 37% ($p < .01$), but the study was hardly conclusive due to the absence of a control group and potential maturation effects [14]. The results here may lend some credence to the results found in this pilot study.

What implications might these findings have for criminal justice policy? It is clear that the antisocial behavior of most offenders must continue to be attributed to non-nutritional environmental factors and continue to require the full range of established correctional interventions. However, this study provides further evidence that low dose vitamin-mineral supplements might improve the conduct of a substantial minority of prisoners, (ie., primarily the chronic offenders who commit a disproportionate share of prison rule violations). One should also not lose sight of the fact that similar results have been

accomplished without supplements in 12 studies where the focus was on getting offenders to change their diets so they would eat about 4 servings each of fruits/vegetables and whole grain products each day [9].

The economic implications of giving supplements appear substantial. The cost associated with 129 offenders receiving supplements for 104 days was about \$500; there were 48 fewer serious rule violations among this group during the experimental phase which means the cost of deterrence was about 10 dollars per incident. That should be weighed against the cost of these incidents to correctional facilities which has been conservatively estimated to be about \$12,000 for the more serious rule violations based on longer sentences [19]. However, this estimate does not include the costs of formal adjudicatory hearings, lawsuits, property damage, physical/emotional injuries, or morale problems that are associated with rule violations.

Whether these findings can be extended to non-incarcerated offenders on probation or parole and whether nutritional markers can be isolated to identify potential responders must await further research.

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Table one

SERIOUS RULE VIOLATIONS BY GROUP AND TIME PERIOD
(Unadjusted and unweighted for days at-risk)

Serious violations	Baseline		Experimental		Change	Difference from placebo
	Period		Period			
	\bar{X}	SD	\bar{X}	SD		
All groups (n=402)	.868	(1.57)	.746	(1.25)	-12%	
Placebo (n=139)	.734	(0.98)	.878	(1.34)	+20%	
100% USRDA (n=129)	.907	(1.36)	.535	(0.88)	-41%	- 61%
300% USRDA (n=134)	.970	(2.14)	.813	(1.43)	-16%	- 36%

Table two

ANCOVA TABLE FOR SERIOUS RULE VIOLATIONS BY GROUP
(Adjusted and Weighted for days at-risk)

Source of Variation	Sum of Squares	DF	Mean Square	F	Sig of F
Baseline Covariate	12.341	1	12.341	47.835	.000
Main Effects: Group	1.925	2	.962	3.731	.025
Residual	102.678	398	.253		

Table three

NUMBER OF SUBJECTS SHOWING CHANGES IN RULE VIOLATIONS BY GROUP

	Worse	No Change	Better	Net Change
Placebo	45 (32%)	56 (40%)	38 (27%)	5% worse
100% USRDA	25 (19%)	59 (46%)	45 (35%)	16% better
300% USRDA	33 (25%)	56 (42%)	45 (34%)	9% better

Chi-square = 6.367, df = 4, p = .173