Orthomolecular Predictors of Psychological Maladjustment

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The concept that mental health and physical health are intimately linked is not a new idea. Quite the contrary, the union has been in existence for quite some time. In fact, Cohen (1978) traced this relationship to Plato:

In Charmides, Plato took the physicians of Greece to task for failing to realize (or recall) that "if the head and the body are to be well, you must begin by curing the soul", (p. 616) Plato considered the impact of the spirit on the mind and the body. This was the beginning of the resemblance to the notion that mental health is influenced by physical health and vice versa. Cohen also traced the linkage between the two concepts to the Romans who believed that a "healthy mind could survive only in a healthy body" (p. 616). The importance of the healthy body in mutual existence with the mind was important in the past and is still important in the present.

PURPOSES OF THE STUDY
Nutrition and Mental Health

One aspect which is important in the maintenance of a healthy body is nutrition. Yet, despite the previous awareness of the connection between the mind and body, nutrition has only recently been recognized in its own right by the helping professions as an important factor in mental health. This has not been true of all professions. According to Schmitz (1985), for example, the "medical profession has known for years the relationship between nutritional deficiencies and mental illness" (p. 181). Cheraskin and Ringsdorf (Pearson & Long, 1982) believed that proper food nutrients are essential to emotional and mental health. Mental health problems such as schizophrenia, alcoholism,

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depression, anxiety, etc., may be heightened as a result of poor nutrition. Miller (1980) noted that poor nutritional habits are present in clients who are depressed, who experienced a loss of motivation, and who displayed learning disorders. Nutrition is an undeniable factor in mental health.

More specifically, Stiteler (1984) explained that scientists now realize that vitamins, nutrients, and minerals directly affect brain chemistry, and consequently behavior. Pearson and Long (1980) cited specific examples: lack of vitamin B results in anemia, depression and fatigue; thiamine deficiencies result in depression, irritability, confusion, insomnia, loss of memory, and an inability to concentrate; calcium aids nerve impulses, is a relaxant and analgesic; hypoglycemia results in depression, irritability and anxiety.

It is apparent that various mental illnesses are related to and may result from deficiencies in minerals and vitamins in the body and the brain. These concepts are the basis for the specifics of Orthomolecular theory (literally translated as "the right molecules") proposed by Pauling (1974). The definition as proposed by Dr. Linus Pauling is:

Orthomolecular Psychiatry is the achievement and preservation of mental health by varying the concentrations in the human body of substances that are normally present, such as vitamins. It is part of the broader subject, Orthomolecular medicine, an important part because the functioning of the brain is probably more sensitively dependent on its molecular composition and structure than is the functioning of other organs, (p. 1251) Pauling linked the physical and psychological realms, emphasized the importance between the two, as well as illustrated the importance of the proper functioning of the brain. Hoffer (1974) also has written extensively on psycho/nutrition and Orthomolecular theory and his works are to be noted for the contribution which they have made to the field. In the field of psychology, Fredericks

(1976) traced the beginnings of Orthomolecular theory to Freud. Fredericks stated, "It reflects a concept in psychology which is not new — Freud himself thought that the chemistry of the brain is disturbed in 'mental' disorders — but one which only recently has been accepted and applied effectively by a growing number of practitioners" (p. 13). Fredericks believed that the Orthomolecular approach accounted for "one aspect of his (man's) environment which has received un-healthful neglect: *The Influence of Body on Mind"* (p. 20). As Fredericks stated, the belief of the influence of body on mind is not a new idea, but is only slowly gaining popularity. Orthomolecular theory is one theory taking the aspect of "body on mind" into account.

In addition to the like terms of Ortho-molecular medicine and Orthomolecular psychiatry, the term psycho/nutrition is gaining popularity. Psycho/nutrition proposes that a "host of emotional problems, presently mislabeled 'mental', are actually rooted in improper diet and nutrition" (Cheraskin, Ringsdorf, & Brecher, 1974, p.11). In addition, Schmitz (1985) referred to psycho/ nutrition as "...how an individual's nutritional and corollary habits affect his/her state of mental health" (p. 181). Corollary habits included those of exercise, relaxation, and sleep. The author was aware of the similarity of the terms, i.e. Orthomolecular and psycho/nutrition, and thus chose to use these terms interchangeably.

Nutrition, Mental Health, and College Students

Of particular interest to this researcher was the relationship between the mental health of college students and their nutrition. Only a few studies were found regarding this relationship. Bagley (1981) found a strong relationship between the diet of college women and their emotional complaints and behavioral problems. Bennett (1965) also found that a typical student's diet might consist of starchy foods and coffee, with few foods that would supply the proper amount of basic nutrients, and thus affect behavior. A recent study, conducted by Schmitz (1985) found a strong relationship between the college students' degree of adjustment and their mental health as defined by psycho/nutrition. The evidence strongly suggested that

nutrition does impact the mental health of college students.

In a review of the literature, it was found that Schmitz's study was the only direct attempt to scientifically investigate college students and the relationship between adjustment and psycho/nutrition. In an exploratory attempt to determine the relationship between mental health and nutrition as defined by Orthomolecular theory, Schmitz (1985) administered the Psycho/Nutrition Inventory (PNI) and another instrument, the Index of College Student Adjustment (ICSA), to 74 students in the fall of 1984. Given knowledge of a student's score on the ICSA (whether the student's score was above or below the mean), Schmitz found that he could predict 83.8% of the time where the same student's score would fall on the PNI. For example, if a student's score was above the mean on the ICSA, Schmitz predicted correctly approximately four out of five times that the student's score was above the mean on the PNI. "Hits" or correct sortings were determined as those subjects who scored above the means on both inventories, or below the means on both inventories. Thus, the results of his study indicated "a high degree of correlation exists between a college student's degree of mental health as predicted by Orthomolecular theory and the degree to which he/she is adjusted or maladjusted as predicted by Kleinmuntz' findings (1960)" (p. 184). Because Schmitz performed an exploratory study on the relationship, much more research was needed to demonstrate and validate this relationship in the literature. Consequently, one purpose of this study was a replication of Schmitz's study to determine and validate the relationship between adjustment of college students and their mental health as defined by ortho-molecular theory.

Nutrition and Counseling

Based on his findings, Schmitz (1985) em-phasized the importance of professional practitioners paying heed to the increasing body of Orthomolecular research and theory. In support of Orthomolecular theory, Schmitz stated that, "Counselors and psychologists surely must have learned by now, that traditional psychotherapy is ineffective in a large number of cases" (p. 185). Ewing (1977) claimed that although all the

different psychotherapies are somewhat successful, most are not when the large-scale application is taken into account. She took into account the variety of problems that the clients brought into therapy, and the demands of the individuals as a possible reason for the lack of success. In further support of the theory, Martin and Martin (1982) believed that the counselors have become disillusioned with their present psychotherapy techniques as well as their attempts at helping others reach their full potential. One reason was that traditional psychotherapy often did not incorporate many of the specific components of an individual's well-being. Components that were being overlooked included those of nutrition, diet, sleep, exercise and relaxation. These important aspects, therefore, remained unrecognized, but were highlighted in Orthomolecular theory.

One system, for example, which did not incorporate the aspects was the Experiential-Phenomenological therapy. Specifically, in the non-directive, client-centered therapy, treatment was best described by the counselor as avoiding suggestion or giving direction to the client. It was characterized as a "non-medical method of therapy" developed by Carl Rogers (p. 332). This theory did not routinely, if ever, investigate the patterns of diet, sleep, exercise and relaxation.

In general, however, counselors are becoming more aware of an expanding horizon of "wellness" within their field (Allen, 1977). Counselors, it appeared, needed to take into consideration all of the aspects of adjustment of an individual to achieve a "wellness" approach for counselling. Because of the deficits in some theories, several theorists developed more thorough models that incorporated the "wellness" approach. For example, Lazarus' (1976) multi-modal counseling model incorporated into psychotherapy several previously overlooked aspects of a client's health. The components of the multi-modal model were identified by the use of the acronym BASIC ID. The areas of the BASIC ID were behavior, affect, sensation, imagery, cognition, interpersonal relations, and drugs. All of these areas were involved in the assessment and treatment of the client (Gerler, 1979).

Gerler's article, *The Evolving 'D' in*

'BASIC ID', focused on the expanding role of the "D" mode. The article focused not only on its role of drugs, but also on a role which included diet. Lazarus first conceptualized the "D" mode in regard to the fact that some clients in therapy, in order to alleviate certain problems, needed to utilize medications such as antidepressants and other mood regulators. In the expanding role of the "D" mode, some years later, Lazarus commented that the biological modality should encompass an understanding of nutrition and exercise as relevant to good physical and mental health. Thus, the multimodal approach demonstrated the link between biological factors and psychological functioning. Lazarus realized the importance of incorporating both dimensions into counseling.

The "holistic" model was similar to Lazarus' approach where the "whole" or "total" individual was observed and investigated by counselors. Ewing (1977) included exercise and diet as being part of a holistic approach to therapy. Counselors who used this approach taught responsibility to the client, responsibility which related to every aspect of the client's being. This encompassed the life style of the client; including the control over the mind and bodily functions. Simply stated, these factors of the psychological and the physical affect a person's health (Martin and Martin, 1982).

The common thread running throughout the above theories is the fact as Martin and Martin stated, "We believe that there is a strong relationship among diet, nutrition, relaxation, and physical exercise in regard to achieving good mental health" (p. 22). Thus, it would appear that counselors should attend to the client's specific sleeping, exercising, and eating habits in assessment and treatment since they all relate to good mental health and well-being (Allen, 1977; Gerler, 1979; Martin & Martin, 1982; Pearson & Long, 1982; and Schmitz, 1985).

Schmitz believed that these were essential and thus suggested that "the body of Orthomolecular research be incorporated into the diagnostic and treatment programs of those who deliver psychological services" (p. 185). To be able to incorporate Orthomolecular theory into counseling therapy, helping professionals need to have access to diagnostic assessments within the dimensions of the

physiological realm. The helping professional can verbally assess a client's sleeping pattern and exercise program due to the relative simplicity and concreteness of the elements involved. It is much more difficult, however, to acquire accurate nutritional information because of the complexity of contributing factors. Because nutrition is one determining factor in mental illness (psycho/nutrition), counselors should learn to recognize and understand symptoms of inadequate diet in clients.

Dietary intervention and assessment tools, therefore, would certainly be advantageous to aid the counselor in this process. For assessment purposes, only one inventory exists which measures a student's mental health as defined by Orthomolecular theory. That inventory is the PNI developed by Schmitz (1985). The PNI, however, is composed of 268 items. Because of the length of the inventory and the length of time involved for scoring, the PNI would not be suitable for assessment purposes in counseling. It would be difficult to persuade a client to take the PNI for diagnostic purposes.

Thus, of particular interest to this researcher was to have access to a shorter version of an assessment instrument that identified college students' poor mental health as defined by Orthomolecular theory. The second purpose of this study, therefore, was to refine the PNI to increase its practicality for use as a psycho / nutritional screening device for clients that have been determined to have emotional and or adjustment problems.

RESEARCH QUESTIONS

The first research question of this study replicated that of the question posed in the Schmitz (1985) study:

Is there a relationship between the symptoms displayed by maladjusted college students and factors associated with the lack of mental health as defined by Orthomolecular theory? More specifically, is it possible to predict whether a college student is adjusted or maladjusted on the basis of his/her score on an inventory designed to measure mental health as defined by Orthomolecular theory? (p. 180-181) The second research question which was examined in this study was: *Is it possible to empirically develop a shorter version of the PNI?* Specifically, is it possible to find those

items of the Psycho/Nutrition Inventory which significantly discriminate between the two criterion groups of adjusted and maladjusted college students?

Finally, the third research question which was posed in this study was: *Is it possible to predict whether a college student has poor mental health as defined by Orthomolecular theory on the basis of his or her score on the ICSA designed to measure adjustment or maladjustment?* Specifically, is it possible given a subject's score on the ICSA to predict where the subject's same score would fall on the shorter version of the PNI?

METHODOLOGY

Subjects

The subjects for this study were 200 students taking classes in the College of Education, in the spring semester of 1986. This researcher chose a relatively large number of subjects because the psychometric properties of the instruments are based on the subject pool (Edwards, 1970). The subjects were representative of both genders, a range in age from 19 to 56 years old, and a variety of 26 majors. All collegiate levels were represented from the freshmen to the doctoral level. Classes targeted were those in the College of Education due to the ease of access and cooperation of the faculty members.

The second group of subjects for this study were 66 students who were taking a class in the College of Education in the fall semester of 1984. Once again, the subjects were representative of both genders, a range in age from 19 to 41, and a variety of 8 majors. All collegiate levels were represented from the freshmen to the doctoral level.

Instruments

Two instruments which were utilized in the study were the Psycho/Nutrition Inventory (PNI) and the Index of College Student Adjustment (ICSA).

The only existing psycho/nutrition instrument was the PNI developed by Schmitz (1985). During the spring of 1983, Schmitz held a psycho/nutrition seminar for a small group of graduate students. As part of the seminar, they researched the field of Orthomolecular theory extensively and developed sample questions to be used in the development of the PNI. According to Schmitz, "Only those questions related to mental health and psychological state and supported

by Orthomolecular research, could be included in the pool of items from which the inventory would be developed" (p. 183). These items were then analyzed for their appropriateness in support of his research. The initial inventory contained 400 items, items which were randomly placed on a test sheet. The instrument was field tested in a class with almost 100 students. The results were tabulated and an item analysis was conducted. An instrument was then developed containing 268 items, the PNI. The PNI has a true-false format. The inventory was keyed so that the higher the score, the poorer the diet of the student as defined by ortho-molecular theory. The instructions read as follows:

Please respond to the following 268 items on the answer sheet you have been provided. If you agree with, and/or find that the statement describes you, blacken in the T for True. If you do not agree with, and/or find that the statement does not describe you, blacken in the F for False. Please try to answer each question. The answers were marked on optically scanned computerized answer sheets.

The psychometric properties of the PNI based on the Schmitz (1985) study of 74 students enrolled in a counseling psychology course were a mean of 83.4, standard deviation of 16.7, and a Kuder-Richardson 20 reliability coefficient of .849.

In conjunction with the PNI, the ICSA was also utilized. Schmitz (1985) developed the ICSA based upon the results of a study by Kleinmuntz (1960). Kleinmuntz's purpose was to "make an initial attempt at identification of the college maladjusted" (p. 209). He chose to do this by an item analysis of true false responses to the Minnesota Multiphasic Personality Inventory (MMPI) of two groups of college students. His two groups were labeled the "criterion adjusted" and the "criterion maladjusted". The former were 40 students randomly chosen who came to the Mental Hygiene Clinic for routine purposes, and "only those records were retained for item analysis in which the student's health questionnaire contained no information pertaining to prior psychiatric treatment" (p. 209). The latter group were 40 students who "voluntarily contacted, or had been encouraged to contact the clinic by one of the staff physicians,

and who had remained in psychotherapy for three or more interviews" (p. 209).

For his statistics, Kleinmuntz realized that "the differences between the proportion of significant responses in the two criterion groups were expressed in terms of their phi coefficients" (p. 209). Thus, Kleinmuntz used the phi coefficient of .287 because that is the proportion that samples of 40 vs 40 must reach in order to be significant at the .01 level. The results of this study indicated that 43 items of the Minnesota Multiphasic Personality Inventory (MMPI) differentiated between the adjusted and maladjusted college students at the .01 significance level. Once Kleinmuntz combined his 43 items into a scale, he chose to re-score his criterion sub-samples for the new scale. He found that the mean score of the maladjusted group was 23.15 with a standard deviation of 9.38. The mean score of the criterion adjusted group was 6.78, with a standard deviation of 5.20. Kleinmuntz performed a "t" test on the difference between the means which yielded a critical ratio of 9.57, a significance beyond the .001 level. Such results indicate that the 43 items discriminate significantly between the two criterion groups. Kleinmuntz repeated this process with two additional groups of students, and the mean difference between the groups was highly significant again, significant at the .001 level. Kleinmuntz also determined the percentage of correct sortings (hits) which were achieved with a cutting score of 15. He found that he could correctly identify 96 percent of the criterion adjusted and 959b of the criterion maladjusted. For the new group it was 93 percent and 96 percent respectively.

When Kleinmuntz gave a closer inspection to the 43 items, he realized that the items clustered into a number of characteristics which appeared to describe the maladjusted college student. The first factor seemed to be a "feeling of ineffectualness and worth-lessness" (p. 210). The students also seemed to "have doubts about their ability to make proper decisions" (p. 210). The second cluster showed an inability to get started in doing things and a lack of interest in life. Life appearing to be a strain for them was the third factor associated with the maladjusted student. The fourth cluster characterized them as "nervous, easily upset, as worriers, and persons fearful of going to pieces" (p.

210). Gastro-intestinal preoccupation resulted as the fifth cluster of items. The sixth cluster described the maladjusted students as expressing "their inability to concentrate and to keep their minds from wandering" (p. 210).

Kleinmuntz described, therefore, the maladjusted college student as "ineffectual, pessimistic, procrastinating, anxious, and worried person, who tends to somatize and who finds that much of the time life is a strain" (p. 210). Schmitz identified the 43 items of the MMPI which Kleinmuntz found to discriminate between his two criterion groups and typed them on a test sheet in the order in which they appeared on the MMPI. The ICSA also has a true-false format. The instrument was keyed so that the higher the score, the more maladjusted the student. The instructions read as follows:

This inventory consists of numbered statements. Read each statement and decide whether it is true as applied to you or false as applied to you. Mark "A" if your response is true, "B" if false. Remember to give your own opinion of yourself. Do not leave any blank spaces if you can avoid it. Please use a 2 pencil and record your responses on the answer sheet provided. Thank you. The answers were marked on optically scanned computerized answer sheets.

The psychometric properties based on the Schmitz (1985) study of 74 students enrolled in a counseling psychology course were a mean of 13.5, a standard deviation of 7.4, with a Kuder-Richardson reliability coefficient of .875.

Procedure

The subjects were given the PNI and ICSA and the three corresponding optically scanned computerized answer sheets, all of which were taken home to be completed. On one of the three answer sheets, the subjects were asked to indicate their sex, birthdate, college level (including graduate students at the masters and doctoral levels), and student I.D. numbers. Student numbers were needed for identification purposes in order to match the sets of answer sheets and for confidentiality purposes. Subjects were also asked to indicate their majors. On the other two answer sheets, the student's I.D. number was all that was needed. Instruments and answer sheets were returned during the next class ses-

sion. Some students received extra credit for their participation in the study. The students were given the researcher's name and phone number if they wanted the results of the study.

The second group of 66 subjects completed the PNI and the ICSA in the fall of 1984. They were asked to provide the same information as above and also completed the instruments at home.

Data Analysis

After the collection of data for 200 subjects, the data were manually matched to 199 usable sets. The data were scored and analyzed by an optical scanning machine at the Missouri Testing and Evaluation Services. A computer program was written so that the following information could be received for each inventory: frequency count of item respondents; item analysis; raw score distribution; mean score; median; standard deviation; semi-interquartile range; Kuder-Richardson 20 reliability coefficient; and the standard error of measurement.

To determine the relationship between the adjusted and maladjusted college students and Orthomolecular theory, this researcher employed the quadrant analysis technique (Schmitz, 1985; Kleinmuntz, 1960). Quadrant analysis was used for test validation and prediction (McNemar, 1969). Quadrant analysis is the determination of the rate of hits and misses achieved by setting cut-off scores based on means and standard deviations. For the purposes of this study, this researcher replicated the procedures used in the Schmitz study. Thus, Schmitz utilized the mean scores on both instruments as the cut-off points. Hits were determined as whether the subject scored above the mean on one inventory and above the mean on the other; conversely, whether the subject scored below the mean on one inventory and below the mean on the other. The first percentage of hits and misses calculated used the means of both inventories as the cut-off scores (Schmitz, 1985). For the second percentage, the cut-off scores were one standard deviation above and below the mean of the ICSA and the mean of the PNI. This strategy was utilized because the ICSA has fewer items than the PNI and the researcher wanted to

have "tighter" groups of adjusted and maladjusted students. Namely, by choosing one standard deviation above and below the mean on the ICSA, the groups were more extreme in their maladjustment and in their adjustment.

To empirically develop a shorter version of the PNI, the chi square analysis was chosen as the appropriate statistical method. The chi square test was used as the procedure because the data were in the form of frequencies (Howell, 1982). Kleinmuntz (1960) used a phi coefficient to distinguish his 43 items from the 566 items on the MMPI. The phi coefficient and chi square, however, have a direct linear relationship (Howell, 1982) and ask the same question in two different ways. Both ask whether the variables are related or correlated. For the purposes of this study, either analysis was appropriate, given the properties of the data, i.e. two dichotomous variables, one degree of freedom, and frequency data. Because the phi coefficient is not used as widely as the chi square, the chi square analysis was used. Thus, a chi square analysis was performed on each item of the PNI to find those items which significantly discriminated between the groups of adjusted and maladjusted college students. A 2x2 contingency table was produced for each of the 268 items, indicating the frequency of responses for the adjusted and maladjusted groups, with one degree of freedom. For purposes of the chi square analysis, the maladjusted group was determined as those subjects who scored 16 and above on the ICSA and those who scored 12 and below were classified as the adjusted group.

Based on the chi square analysis, items were found which discriminated between the two groups. The researcher then re-scored the new items of the PNI on a key. The 199 subjects' data were re-scanned by the computer to gather data such as the mean, standard deviation, etc. only on the new items, as well as to determine new percentages of hits and misses. Once this was accomplished, the researcher then re-scored the new items of the PNI on a new group of subjects, N = 66 matched sets, for the purpose of cross validation. The same quadrant analysis was employed with the new items of the PNI and the new sample of N = 66 to determine the percentages of hits and misses. Both sets of cut-off scores were utilized. The means of both instruments for the first percentage were used, as well as one standard deviation above and below the mean of the ICSA and the mean of the shorter version of the PNI were utilized for the second percentage. These analyses were performed to once again determine the relationship between adjustment and mental health as defined by Orthomolecular theory for the shorter version of the PNI.

Results

First, the researcher analyzed the data to look at the distribution of the sample. The sample was slightly asymmetrical with the distribution somewhat bottom heavy, which resulted in slightly more "adjusted" subjects in the study than "maladjusted". The researcher expected to have this finding as the subjects in the study came from a general "normal functioning" population. Because of the large N, the researcher achieved two separate groups of relative adjustment and maladjustment based on a continuum. The concept of having two criterion groups did succeed primarily because of the large N in the study.

With N = 199, the mean score for the ICSA was 13.6 and the median response was an 11.8. The standard deviation for the sample on the ICSA was 7.0, with a standard error of measurement of 2.6. The Kuder Richardson 20 reliability coefficient was .860. These statistics were quite similar to Schmitz (1985).

The mean score for the PNI was 81.8 and the median response was 80.6. The standard deviation for the sample on the PNI was 17.7, with a standard error of measurement of 6.5. The Kuder Richardson 20 reliability coefficient was .866. These statistics were again quite similar to Schmitz (1985), with both instruments having a high degree of internal consistency.

The data showed only 194 matched sets when the researcher manually matched the scores for the quadrant analysis, although there were 199 subjects for the determination of the statistics. It seemed that a few student I.D. numbers did not match on both lists of the PNI and ICSA.

The first quadrant analysis, hits and misses above and below the means on the ICSA and PNI, yielded students' scores in the predicted direction 66% of the time or 129 out of 194. Table 1 illustrates the comparison of the matched scores for the first quadrant

Comparison of Matched Scores on the ICSA and PNI Based upon the Sample of N = 194

Table 1
(n - 194)

		PNI**	
		Scored Below Mean	Scored Above Mean
Scored Above Mean	57	33 ICSA*	
Scored Below Mean	32	72	

Hit Ratio: 129/194 = 66%

* Mean = 13.6   Standard Deviation = 7 ** Mean = 81.8   Standard Deviation =17.7
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Comparison of Matched Scores on the ICSA and PNI
Based upon the Sample of N = 194
Table 2
(n = 64)
PNI**

		Scored Above Mean	Scored Below Mean
	- Scored Above 20	29	10
ICSA*			
	-- Scored Below 6	4	21

Hit Ratio: 50/64 = 78%

- Score is one standard deviation above the mean
- Score is one standard deviation below the mean
* Mean =13.6   Standard Deviation = 7
** Mean = 81.8   Standard Deviation =17.7

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Comparison of Matched Scores on the ICSA and PNI32
Based upon the Sample of N = 194
Table 3
(n = 194)

		PNI32**	
		Scored Above Mean	**Scored Below Mean**
	Scored Above Mean	66	24
ICSA*			
	Scored Below Mean	30	74
			Hit Ratio: 140/194 = 72%

* Mean = 13.6   Standard Deviation = 7
** Mean = 12.3   Standard Deviation = 4.7

Comparison of Matched Scores on the ICSA and PNI32
Based upon the Sample of N = 194
Table 4
(n = 57)
PNI32**

		Scored Above Mean	**Scored Below Mean**
	- Scored Above 20	32	7
ICSA*			
	--Scored Below 5	2	16
			Hit Ratio: 48/57 = 84%

- Score is one standard deviation above the mean
~ Score is one standard deviation below the mean
* Mean =13.6   Standard Deviation = 7
** Mean =12.3   Standard Deviation = 4.7

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Comparison of Matched Scores on the ICSA and PNI32

Based upon the Sample of N =   66

Table 5

(n = 66)

	PNI32**	
	Scored Above Mean	**Scored Below Mean**
Scored Above Mean	19	**8**
ICSA*		
Scored Below Mean	14	**25**
		Hit Ratio: 44/64 = 67%

* Mean = 13   Standard Deviation = 7.3
** Mean = 12.4   Standard Deviation = 3.9

Comparison of Matched Scores on Based upon the   the ICSA and PNI32 of N = 66 Sample

Table 6

(n = 32)

	PNI32**	
	Scored Above Mean	**Scored Below Mean**
- Scored Above 20 ICSA*	8 8	**3**
-- Scored Below 8		**13**
	Hit Ratio: 21/32 = 66%	

 - Score is one standard deviation above the mean - Score is one standard deviation below the mean

  * Mean =13   Standard Deviation = 7.3 ** Mean = 12.4 Standard Deviation = 3.9

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Outline of the Results of Matched Scores on the ICSA, the PNI, and the PNI32

N = **194**

1. Mean of ICSA, Mean of PNI Relationship = 66%
2. One standard deviation + Mean of ICSA, Mean of PNI Relationship = 78%
3. Mean of ICSA, Mean of PNI32 Relationship = 72%
4. One standard deviation ± Mean of ICSA, Mean of PNI32 Relationship = 84%

N = 66

5. Mean of ICSA, Mean of PNI 32 Relationship = 67%
6. One standard deviation ± Mean of ICSA, Mean of PNI32 Relationship = 66%

analysis. This is interpreted as 129 subjects scoring above the means on both the PNI and ICSA or below the means on both inventories because there were 129 hits.

The second quadrant analysis, hits and misses one standard deviation above and below the mean on the ICSA and the mean on the PNI, yielded students' scores in the predicted direction 78*% of the time or 50 out of 64. Table 2 illustrates these results.

The chi square analysis of the PNI resulted in 32 items which discriminated between the two groups at the .01 significance level or beyond. Thus, the new items are items which significantly discriminate between the two criterion groups of adjusted and maladjusted college students.

Based upon the shorter version of the PNI 32 items (PNI32) and the N = 199, the mean score for the PNI32 was 12.3 and the median response was 12.3 The standard deviation was 4.7, with a standard error of measurement of 2.4. The Kuder Richardson 20 reliability coefficient was .732. The ICSA statistics for this sample remained the same because they were not altered.

The third quadrant analysis, hits and

misses above and below the means, was determined with N = 194, PNI32 and the ICSA. This analysis yielded students' scores in the predicted direction 72% of the time or 140 out of 194. Table 3 illustrates these results.

The fourth quadrant analysis, hits and misses one standard deviation above and below the mean of the ICSA and the mean of the PNI32, was determined for this same group of subjects. This analysis yielded students' scores in the predicted direction 84% of the time or 48 out of 57. Table 4 illustrates the results of the fourth quadrant analysis.

Based upon N = 66, statistics were determined for the ICSA and the PNI32. The mean score for the ICSA was 13.0 and the median response was 10.3. The standard deviation was 7.3, with a standard error of measurement of 2.6. The Kuder Richardson 20 reliability coefficient was .873.

For this same population, the mean score for the PNI32 was 12.4 and the median response was 12.5. The standard deviation was 3.9, with a standard error of measurement of 2.5. The Kuder Richardson 20

reliability coefficient was .601.

Quadrant analyses were determined for the N = 66 sample. The fifth quadrant analysis, hits and misses above and below the means, was determined for N = 66, PNI32, and the ICSA. Table 5 illustrates the results. Students scored in the predicted direction 67% of the time or 44 out of 66.

The sixth quadrant analysis, hits and misses one standard deviation above and below the mean of the ICSA and the mean of the PNI32, was determined for this same group of subjects. This analysis yielded students' scores in the predicted direction 66% of the time or 21 out of 32. Table 6 illustrates the results. This was the last analysis determined for the study.

SUMMARY AND CONCLUSIONS

This study was conducted to examine the relationship between adjustment/maladjustment of college students and their mental health as defined by Orthomolecular theory. Two instruments were utilized in this study to test that relationship. The first was the 268 item Psycho/Nutrition Inventory utilized to measure mental health as defined by Orthomolecular theory. The second instrument was the 43 item Index of College Student Adjustment designed to measure college students' adjustment/maladjustment. The study was also conducted to significantly reduce the 268 items on the Psycho/Nutrition Inventory to a substantially lower number of items.

Based upon the results of this study, the following conclusions seemed warranted:

1. There does indeed seem to be a connection between the adjustment/maladjustment scores of college students and their mental health as defined by Orthomolecular theory (see Outline of Results).
2. There does seem to be merit in the use of the PNI as a predictive measure for determining a college student's degree of psychological adjustment.
3. There does seem to be merit in the use of the ICSA as a predictive measure for determining a college student's degree of mental health as defined by Orthomolecular theory.

DISCUSSION

In response to the first research question posed in this study it is apparent that there is a relationship between psychological adjustment/maladjustment and psycho/nutrition among the college students included in this study. In this study, the relationships between the two variables are stable, primarily indicating a 2 out of 3 ratio of correctly predicting where a student's score would fall on one instrument, given his/her score on the other instrument.

The highest percentage of hits and misses, however, was the 78% in the quadrant 2 analysis, approximately a 3 out of 4 ratio. Although the 84% from quadrant 4 is technically the highest, it was used as a validity check on the new items. The reason for this is simply that the responses of the 199 subjects were utilized in choosing the 32 items for the shorter version of the PNI, so the relationship of the 199 subjects, the PN132, and ICSA should be highly correlated. The high 78% might be explained by the fact that the sample was large, N = 194, and that the standard deviations above and below the mean on the ICSA were utilized in addition to the mean on the PNI. The allowance of the standard deviation above and below the mean on the ICSA helped to make the groups more extreme in their adjustment and in their maladjustment.

The 78% hit rate is similar to the rate of 83.8% in the Schmitz study. While it is true that these were calculated with different cutoff scores, the evidence shows that there is indeed a relationship nevertheless. The 66% hit rate is actually the percentage which directly replicates the Schmitz study. The decrease from the 83.8% found in the Schmitz study to the 66% found in this study might be explained by several reasons. For example, the fact that the subjects in this study were more heterogeneous due to the number of different classes that were targeted (as opposed to the one class Schmitz targeted) may account for some of the difference in the percentages between the two studies. One might argue, in addition, that the subjects in the Schmitz study were in a counseling psychology class and perhaps were more in touch with the subject matter, as well as being more in touch with their psychological states, feelings, and bodily functions. This study was also conducted with a larger sample and actually may demonstrate more of an accurate estimation between the two variables, than the 74 subjects in the Schmitz study. Finally, it should be brought to attention that the Schmitz

study was an exploratory study to determine the relationship between the two variables. The present study was a replication of that study, designed to gain more data about the research questions.

In response to the second research question posed in this study, it was possible to empirically develop a shorter version of the PNI, as 32 items were found through the chi square analysis. The 32 items were analyzed to answer the third research question. Thus, the primary purpose of the second group of subjects, N = 66, was used to cross validate the 32 items of the PNI. The hit rate of 67% determined by the means was on par with the hit rate determined from the sample of N = 194; the following hit rate of 66%, however, determined by the standard deviations was not as similar to the 78% of the sample N = 194. Once again the reason may be that the number of subjects, N = 66, was substantially smaller. The reliability coefficient dropped on the PNI32, probably because of the smaller number of subjects in the second group. Another reason for the reduction could be that the "L", "F", and "K" items of the MMPI were removed from the item pool. Nevertheless, this research demonstrated that a correlation exists between psycho/nutrition and maladjustment as determined by the PNI32 and ICSA.

Despite the fact that a correlation exists between the PNI32 and the ICSA, the generalizations which can be drawn from the PNI32 should be restricted because of the limited research. Other research designs need to be employed. For example, the PNI32 needs to be administered without being encased within the 268 item PNI. With the presence of the other 236 items, the respondents could easily develop a "set" response with regard to how they answer the items. The subjects' responses to items prior to and surrounding the 32 items could influence the way in which the subjects answer the 32 items. Thus, research with the PNI32 as an instrument in its own right should be employed. Further research with the PNI32 and the ICSA also needs to be explored.

In addition to the discussion about the study, one question which is often brought up regarding psycho/nutrition research has to do with which comes first — Do poor nutritional and corollary habits which maladjusted students possess cause poor mental

health or does the poor mental health of maladjusted college students encourage poor nutritional and corollary habits? The literature demonstrates evidence for both causations and suggests that it is a cycle. Thus, one does not come before the other. Because the cycle needs to be broken, it would seem that the best approach would be to treat the physiological symptoms. Thus, it would logically follow to start treatment by effectively controlling the nutritional and corollary habits, thereby increasing the probability of other treatment strategies being effective.

SUGGESTIONS FOR FUTURE RESEARCH

Suggestions for future research in the area of psycho/nutrition are numerous. The field is growing in many directions and as a result, many research opportunities are present. Pertaining to this study, however, are several research suggestions that center around the development and use of the PNI and PNI32. Other more global suggestions or recommendations focus on the field of Orthomolecular theory in general and its integration within the helping professionals' domain.

Pertaining to the immediate study, the first suggestion is for other researchers to partially and/or completely replicate this study. Although this study replicated the Schmitz (1985) study, the results were not as conclusive as those of Schmitz. Generalizations of these findings are not yet possible due to the low number of subjects that have been measured with the instruments. A replication of the current study, therefore, would be valuable in order to compare the results of the inventories and their stability over time. Furthermore, the same procedures should be used to analyze hits and misses of different populations within the college environment in order to gather more representative data on college students. The previous studies utilized students participating in College of Education classes, and although the demographics revealed a variety of majors, these results can not be expected to generalize to the population of college students at large.

In reference to the instruments of the study, another suggestion is to utilize only the 32 item PNI in order to gather more data, including validity measures. The PNI32 has only been normed on 66 students; thus larger

samples should be used to gather more data. The reliability and the validity should be stable for the PN132 is used as a psycho/ nutrition screening inventory among college students. The first refinement of the inventory should be focused for use solely in the college environment, in cooperation with the ICSA.

Once the PNI32 is utilized as a screening inventory, it would be beneficial to generalize the use of the PNI32 to different populations other than just college students. There is a need for a psycho/nutrition inventory in mental health settings, hospital settings, and rehabilitation settings. To this researcher's knowledge, the PNI and PNI32 are the only existing psycho/nutrition inventories that would be available to be used in these settings.

In these settings, other assessment tools are available which can be used in conjunction with the PNI32. Thus, another suggestion is to gather more data on the PNI32 with such inventories as the Beck Depression Inventory or MMPI to determine the relationship between them. More data with other well established inventories can only add to the support of the PNI32. For example, one might expect the PNI32 to be highly correlated with the Beck Depression Inventory. Strong correlations between the inventories would be more evidence of the validity of the theory and its effect on many different populations.

A more global suggestion is to increase the awareness of the helping professionals of the ever mounting evidence which links nutrition and mental health. This is important as more and more significant contributions are being made in the field. One channel through which to accomplish this awareness is to emphasize Orthomolecular theory and the relationship between nutrition and holistic models should be emphasized in training concurrently with rational-emotive theories, existential theories, and other theories. Research on the topic of Orthomolecular theory should also be incorporated into counselling courses as evidence of its impact upon human beings and their health. Seminars on the topic should be taught as Schmitz has previously done. Incorporation of these aspects into the training of professional practitioners would be a major step in spreading the knowledge of the link between

Orthomolecular theory and good mental health.

Finally, knowledge of Orthomolecular theory needs to extend beyond the fields of medicine and psychology to other related fields. Knowledgeable professionals should share in this responsibility and impart their knowledge to other professionals in these related areas. Sharing information, gaining ideas and brainstorming are all positive outcomes of the interactions with other professionals. In addition, training seminars could be held jointly to help integrate and develop cohesion among the helping professionals. Thus, the effect of cooperation among professionals will induce a ripple effect, with the end result being an increase in the knowledge of the field of Orthomolecular theory across several disciplines.

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