INFORMATION TO USERS

This manuscript has been reproduced from the microfilm master. UMI films the text directly from the original or copy submitted. Thus, some thesis and dissertation copies are in typewriter face, while others may be from any type of computer printer.

The quality of this reproduction is dependent upon the quality of the copy submitted. Broken or indistinct print, colored or poor quality illustrations and photographs, print bleedthrough, substandard margins, and improper alignment can adversely affect reproduction.

In the unlikely event that the author did not send UMI a complete manuscript and there are missing pages, these will be noted. Also, if unauthorized copyright material had to be removed, a note will indicate the deletion.

Oversize materials (e.g., maps, drawings, charts) are reproduced by sectioning the original, beginning at the upper left-hand corner and continuing from left to right in equal sections with small overlaps. Each original is also photographed in one exposure and is included in reduced form at the back of the book.

Photographs included in the original manuscript have been reproduced xerographically in this copy. Higher quality 6" x 9" black and white photographic prints are available for any photographs or illustrations appearing in this copy for an additional charge. Contact UMI directly to order.
Prediction of food supplement use among college students: The role of beliefs, attitude, subjective norm and intention

Lowell, Alison Eldridge, Ph.D.

The University of Arizona, 1991

Copyright ©1991 by Lowell, Alison Eldridge. All rights reserved.
PREDICTION OF FOOD SUPPLEMENT USE AMONG COLLEGE STUDENTS: THE ROLE OF BELIEFS, ATTITUDE, SUBJECTIVE NORM AND INTENTION

by
Alison Eldridge Lowell

Copyright © Alison E. Lowell 1991

A Dissertation Submitted to the Faculty of the COMMITTEE ON NUTRITIONAL SCIENCES (GRADUATE) In Partial Fulfillment of the Requirements For the Degree of DOCTOR OF PHILOSOPHY In the Graduate College THE UNIVERSITY OF ARIZONA

1991
As members of the Final Examination Committee, we certify that we have read the dissertation prepared by Alison Eldridge Lowell entitled Prediction of Food Supplement Use Among College Students: The Role of Beliefs, Attitude, Subjective Norm and Intention and recommend that it be accepted as fulfilling the dissertation requirement for the Degree of Doctor of Philosophy.

[Signatures and dates for committee members]

Final approval and acceptance of this dissertation is contingent upon the candidate's submission of the final copy of the dissertation to the Graduate College.

I hereby certify that I have read this dissertation prepared under my direction and recommend that it be accepted as fulfilling the dissertation requirement.

[Signature]

Dissertation Director

[Date]
STATEMENT BY AUTHOR

This dissertation has been submitted in partial fulfillment of requirements for an advanced degree at The University of Arizona and is deposited in the University Library to be made available to borrowers under the rules of the Library.

Brief quotations from this dissertation are allowable without special permission, provided that accurate acknowledgment of source is made. Requests for permission for extended quotation from or reproduction of this manuscript in whole or in part may be granted by the copyright holder.

SIGNED: Alison E. Lowell
ACKNOWLEDGMENT

Many thanks are due to the following individuals for their support:

Edward Sheehan, Lon Larson, Lyle Bootman, Donald McNamara and Bobby Reid, for generously supporting this research with time, money, encouragement and critical appraisal.

James Lowell, my husband, for giving me the opportunity to do my Ph.D. and for all the encouragement and help along the way.

Gary Mechler, Nick Busch, Paul Johnson, Brad Fiero, Virginia Turner, Frank Rizzuto, Meera Pathak, and Raquel Goldsmith, for the use of their class time to administer my survey forms.

Karen Warren, for technical assistance with SAS.

All the students at Pima College who completed my survey, for without your help this research never would have happened.
# TABLE OF CONTENTS

LIST OF TABLES .................................................................................................................. 7

LIST OF FIGURES ............................................................................................................ 10

ABSTRACT ......................................................................................................................... 12

INTRODUCTION .............................................................................................................. 14

   The Theory of Reasoned Action .................................................................................. 18

   Purpose ....................................................................................................................... 25

   Hypotheses .................................................................................................................. 26

   Exploratory Questions ............................................................................................... 26

   Assumptions ............................................................................................................... 27

   Limitations .................................................................................................................. 27

   Definitions ................................................................................................................... 28

REVIEW OF LITERATURE .......................................................................................... 30

   Food Faddism ............................................................................................................ 30

   Vitamin and Mineral Supplementation ..................................................................... 34

   Survey Methodology ................................................................................................. 43

METHODS ....................................................................................................................... 48
**LIST OF TABLES**

<table>
<thead>
<tr>
<th>Table</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Food supplement use among college-aged individuals: A comparison of selected research</td>
<td>37</td>
</tr>
<tr>
<td>2. Potentially toxic effects of megadoses of vitamins</td>
<td>41</td>
</tr>
<tr>
<td>3. Potentially toxic effects of megadoses of minerals</td>
<td>42</td>
</tr>
<tr>
<td>4. Demographics of student respondents in the Pima Community College food supplement use survey by supplement use category (supplement Non-Users, Sporadic Users and Regular Users)</td>
<td>57</td>
</tr>
<tr>
<td>5. Multiple and single food supplements consumed by all supplement users in the 3 months prior to completing the Pima Community College food supplement use survey</td>
<td>58</td>
</tr>
<tr>
<td>6. Miscellaneous food supplements consumed by all supplement users in the 3 months prior to completing the Pima Community College food supplement use survey</td>
<td>59</td>
</tr>
<tr>
<td>7. Beliefs about vitamin and mineral supplementation in the Pima Community College food supplement use survey by supplement use category (supplement Non-Users, Sporadic Users and Regular Users)</td>
<td>67</td>
</tr>
<tr>
<td>8. Pearson correlation coefficients (r) and probabilities of the association among give statements about vitamin/mineral supplementation among students in the Pima Community College food supplement use survey</td>
<td>72</td>
</tr>
<tr>
<td>Table</td>
<td>Page</td>
</tr>
<tr>
<td>---------------------------------------------------------------------------------------------------------------------------------------</td>
<td>------</td>
</tr>
<tr>
<td>9. Health beliefs about vitamins and minerals among students in the Pima Community College food supplement use survey by supplement use category (supplement Non-Users, Sporadic Users and Regular Users)</td>
<td>75</td>
</tr>
<tr>
<td>10. Pearson correlation coefficients ($r$) and probabilities of the association among four statements about the health benefits of food supplements among students in the Pima Community College food supplement use survey</td>
<td>79</td>
</tr>
<tr>
<td>11. Comparison of frequency of use of sources of nutrition information among Non-Users, Sporadic Users and Regular Users of food supplements in the Pima Community College food supplement use survey</td>
<td>81</td>
</tr>
<tr>
<td>12. Beliefs, evaluation statements and belief products for Non-Users in the Pima Community College food supplement use survey</td>
<td>85</td>
</tr>
<tr>
<td>13. Beliefs, evaluation statements and belief products for Sporadic Users in the Pima Community College food supplement use survey</td>
<td>86</td>
</tr>
<tr>
<td>14. Beliefs, evaluation statements and belief products for Regular Users in the Pima Community College food supplement use survey</td>
<td>87</td>
</tr>
<tr>
<td>15. Belief products for calcium and bee pollen supplementation for Non-Users, Sporadic Users and Regular Users of food supplements in the Pima Community College food supplement use survey</td>
<td>88</td>
</tr>
<tr>
<td>16. Pearson correlation coefficients ($r$) between belief products and attitude toward calcium and bee pollen use for food supplement Non-Users, Sporadic Users and Regular Users in the Pima Community College food supplement use survey</td>
<td>91</td>
</tr>
</tbody>
</table>
Table Page

17. Normative beliefs, motivation to comply and normative belief products for Non-Users of food supplements in the Pima Community College food supplement use survey .............................................................. 94

18. Normative beliefs, motivation to comply and normative belief products for Sporadic Users of food supplements in the Pima Community College food supplement use survey .............................................................. 95

19. Normative beliefs, motivation to comply and normative belief products for Regular Users of food supplements in the Pima Community College food supplement use survey .............................................................. 96

20. Normative belief products for calcium and bee pollen supplementation for Non-Users, Sporadic Users and Regular Users of food supplements in the Pima Community College food supplement use survey ...................... 98

21. Pearson correlation coefficients (r) between normative belief products and subjective norm relative to calcium and bee pollen supplement use for food supplement Non-Users, Sporadic Users and Regular Users in the Pima Community College food supplement use survey .............................................. 99

22. Comparison of means and standard deviations for model components by type of promotional pamphlet (calcium or bee pollen) and by supplement use group (Non-User, Sporadic User, and Regular User) in the Pima College food supplement use survey .............................................................. 109
<table>
<thead>
<tr>
<th>Figure</th>
<th>Description</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Food supplement use continuum</td>
<td>16</td>
</tr>
<tr>
<td>2.</td>
<td>Factors determining a person's behavior:</td>
<td></td>
</tr>
<tr>
<td></td>
<td>The Theory of Reasoned Action</td>
<td>20</td>
</tr>
<tr>
<td>3.</td>
<td>The Theory of Reasoned Action with mathematical terminology</td>
<td>23</td>
</tr>
<tr>
<td>4.</td>
<td>Indirect effects of external variables on behavior</td>
<td>24</td>
</tr>
<tr>
<td>5.</td>
<td>Frequency of food supplement use</td>
<td></td>
</tr>
<tr>
<td></td>
<td>by Pima Community College students</td>
<td>55</td>
</tr>
<tr>
<td>6.</td>
<td>Percentage of Regular and Sporadic food supplement users in the Pima</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Community College food supplement use survey taking various multiple</td>
<td>62</td>
</tr>
<tr>
<td></td>
<td>vitamins/minerals</td>
<td></td>
</tr>
<tr>
<td>7.</td>
<td>Percentage of Regular and Sporadic food supplement users in the Pima</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Community College food supplement use survey taking various single vitamins</td>
<td>63</td>
</tr>
<tr>
<td></td>
<td>or minerals</td>
<td></td>
</tr>
<tr>
<td>8.</td>
<td>Percentage of Regular and Sporadic food supplement users in the Pima</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Community College food supplement use survey taking miscellaneous food</td>
<td>64</td>
</tr>
<tr>
<td></td>
<td>supplements</td>
<td></td>
</tr>
<tr>
<td>9.</td>
<td>Path coefficients for predicted calcium supplement use by Non-Users in the</td>
<td>102</td>
</tr>
<tr>
<td></td>
<td>Pima Community College food supplement use survey</td>
<td></td>
</tr>
<tr>
<td>10.</td>
<td>Path coefficients for predicted bee pollen supplement use by Non-Users</td>
<td>103</td>
</tr>
<tr>
<td></td>
<td>in the Pima Community College food supplement use survey</td>
<td></td>
</tr>
<tr>
<td>Figure</td>
<td>Page</td>
<td></td>
</tr>
<tr>
<td>--------</td>
<td>------</td>
<td></td>
</tr>
<tr>
<td>11. Path coefficients for predicted calcium supplement use by Sporadic Users in the Pima Community College food supplement use survey</td>
<td>104</td>
<td></td>
</tr>
<tr>
<td>12. Path coefficients for predicted bee pollen supplement use by Sporadic Users in the Pima Community College food supplement use survey</td>
<td>105</td>
<td></td>
</tr>
<tr>
<td>13. Path coefficients for predicted calcium supplement use by Regular Users in the Pima Community College food supplement use survey</td>
<td>106</td>
<td></td>
</tr>
<tr>
<td>14. Path coefficients for predicted bee pollen supplement use by Regular Users in the Pima Community College food supplement use survey</td>
<td>107</td>
<td></td>
</tr>
</tbody>
</table>
ABSTRACT

Vitamin and mineral supplementation practices of 502 college students were examined. Based on self reported use within the three months prior to completing the survey, a total of 62% of the sample of students at Pima Community College reported supplement use. Respondents were classified as non-users (38%), sporadic users (25%) or regular users (37%) of food supplements. Sporadic users were students who reported using supplements less than once per week, while regular users reported weekly or daily use. Among students taking multi-supplements, the most commonly consumed were multiple vitamins (44.9%) and multivitamins plus minerals (30.8%), with sporadic users reporting significantly lower use than regular users. The most common single supplement was vitamin C used by 55.7% of the students. Other popular single supplements were calcium (25.6%), vitamin E (21.6%) and iron (17.1%). Amino acids, garlic, aloe vera, yeast and fish oil were the most popular unconventional food supplements used. Supplement users believed that vitamins and minerals provided them with health benefits undocumented by scientific literature. Family members, newspapers, magazines, and books were the most common sources for nutrition information among these college students. Attitude was found to be a significant predictor of intention to take calcium or bee pollen supplements based on exposure to promotional pamphlets, while normative influences (family, friends and physicians) were much less strong. Improved physical vitality and scientific basis were among the strongest correlates with attitude and were the strongest predictors of behavioral intention to take calcium or
bee pollen among the college students tested. These data underscore the need for educational efforts targeted toward specific errors in the beliefs of these students. Common misconceptions like vitamins and minerals increase pep and energy, reduce stress and prevent the common cold need to be refuted and scientifically based nutritional recommendations must be emphasized. The most effective vehicle for educational efforts targeting college students should be made using the sources for nutrition most used by them: popular books, magazines, and other media sources.
INTRODUCTION

People are constantly bombarded by messages about nutrition. These come from a variety of sources, some credible and some with no scientific basis whatsoever. One pervasive nutrition myth is that one cannot get all the nutrients needed by food alone. To compensate for gross inadequacies in the diet, promoters of this myth recommend nutrition supplements for most people. Consumer Reports (1986) has dubbed these promoters "vitamin pushers." These self-proclaimed nutrition experts advocate food supplements as "extra insurance" against the possibility of undernourishment due to stress, disease or environmental hazard (National Dairy Council, 1981). They believe that if a little is good, more must be better, and as a result, nutrition supplements are promoted in large doses to increase energy, prevent disease, reduce the effects of stress, or improve athletic ability (Consumer Reports, 1986).

Unfortunately, excess nutrition supplementation can cause serious harm. The American public spends about $6 billion a year on nutrition supplements (Fuerst, 1987). Aside from the tremendous cost, large doses of vitamins and minerals can have serious adverse effects (Marshall, 1985; Oveson, 1984). The Surgeon General's Report (Department of Health and Human Services, 1988) states "Nutrition fraud may lead to deleterious health consequences, caused by the failure to seek legitimate medical care, by potentially toxic components of foods and products, by nutrient toxicities and deficiencies, by diversion of monies from essential treatments, and by interference with sound nutrition education."

This is a lesson that has little impact on the American public. Scientists repeatedly state that healthy individuals can meet their nutrient needs with diet, rather than with vitamin and mineral supplementation (National Research Council,
The American public, however, does not believe this, as 40 to 60 percent of adults in this country report using some kind of nutritional supplement (Subar and Block, 1990; Sheehan et al., 1989; Stewart et al., 1985; Worthington-Roberts and Breskin, 1984).

Food supplements take many forms. They may be vitamins, minerals, enzymes, amino acids, herbs or other food products. To aid in the distinction between the various types of nutrition supplements, a classification system has been devised, based on the scientific rationale for their use. Refer to Figure 1 for a diagram of the classification scheme. Food supplementation occurs on a continuum from appropriate use to inappropriate use. The first category (I) represents supplement use based on clinical deficiency. This is, of course, a completely appropriate use of nutritional supplements. Secondly, there is supplement use with a sound scientific basis (Category II). Thirdly, supplements can be used based on a misinterpretation of scientific data (Category III). Finally, some supplements are used due to promotion with no scientific basis at all (Category IV). This would represent a completely inappropriate use of nutritional supplements. Examples of each will follow.

First, nutrition supplementation is appropriate in instances of deficiency, such as iron for iron deficiency anemia or vitamin C for treatment of scurvy. Supplements in Category I are usually prescribed by physicians based on a clinical evaluation. The use of vitamins or minerals for prevention and/or treatment of specific deficiency diseases has been well documented scientifically, and in fact, essential vitamins and minerals were discovered because they were capable of preventing and treating disorders such as scurvy, pellagra, rickets, etc.
Figure 1. Food Supplement Use Continuum.

CATEGORY I
Supplement use based on clinical need
Examples: iron to treat iron deficiency anemia, Vitamin C to treat scurvy

CATEGORY II
Supplement use based on significant scientific evidence
Examples: calcium supplements to help prevent osteoporosis, prenatal vitamins during pregnancy

CATEGORY III
Supplement use based on distortion of scientific data
Examples: Vitamin C to prevent and/or cure colds, Vitamin A to treat acne

CATEGORY IV
Supplement use with no scientific basis
Examples: Bee Pollen to improve vitality, Laetrile for treatment of cancer

Inappropriate
Useless
Not Based on Science

NUTRITION SUPPLEMENTATION

Appropriate
Useful
Scientifically Based
In Category II, dietary supplements are promoted on the basis of significant scientific evidence. Examples of supplements in this category are minerals like calcium for increased bone density or prenatal vitamins for pregnant women. These supplements are often recommended by physicians or dietitians, but may be purchased without a prescription. They are used because there is substantial scientific evidence that supplementation is necessary to promote good health.

Category III contains supplements that are promoted on the basis of distorted scientific information. An example is Linus Pauling's promotion of megadoses of vitamin C to prevent or cure colds (Marshall, 1985). Despite Pauling's endorsement of this notion, most medical scientists conclude that supplemental vitamin C neither prevents colds nor shortens their duration (Herbert and Barrett, 1985). Other examples of supplement use based on misinterpretation of scientific data include vitamin A for cure of acne, B6 for premenstrual syndrome, and selenium for boosting the immune system. Note that supplements listed in these examples also have legitimate scientific uses and would appear in Category I for their role in prevention of deficiency diseases.

Finally, there are supplements that are promoted with no scientific basis at all (Category IV). These include many "nutrients" promoted in health food stores, such as chlorophyll, bee pollen, rutin, or inositol. While these products may be important for insects and bacteria, they are not necessary for humans and provide no health benefit (Herbert and Barrett, 1985). Other examples in this category are RNA (ribonucleic acid) and DNA (deoxyribonucleic acid) tablets, powdered glandular products, laetrile, and enzymes. Again, there is no scientific basis for their use as therapy for humans as these substances are broken down during normal digestion. In fact, some may actually cause direct harm, such as cyanide poisoning.
in the case of laetrile, allergic reactions in the case of enzymes and glandular products, and dangerous elevations in serum uric acid levels in the case of RNA (Herbert and Barrett, 1985).

Before educational strategies combatting nutrition supplement misinformation can be implemented, the factors contributing to the decision to take food supplements must be analyzed. Examining the attitudes, beliefs, and normative references of college aged supplement users and non-users using the Theory of Reasoned Action (Ajzen and Fishbein, 1980) provides useful information about the factors involved in the decision to take food supplements. This information may then provide the basis for developing effective educational strategies to combat the inappropriate use of nutritional supplements.

For years, nutrition education programs have been developed and implemented with no clear theoretical basis. Although many have been successful, it has been very difficult to identify the variables involved in how these programs positively influence nutrition knowledge, attitudes, or nutrition related behaviors (Brun, 1985). As stated by Olson and Kelly (1989), "A priority for nutrition education throughout the 1980s has been the application of established theoretical frameworks for human behavior to the study of nutrition-related behaviors." This is evidenced by the number of conferences held during the decade on strategies for theory building in the field of nutrition (Brun and Rhoades, 1983; Brun, 1985; Lewis, 1987).

The Theory of Reasoned Action

Although there are many theoretical models of the determinants of health behavior, the model chosen for this research was the Theory of Reasoned Action (Ajzen and Fishbein, 1980). The Theory of Reasoned Action has been successfully
used to predict a variety of health related behaviors such as donating blood, using various birth control measures, obtaining flu vaccinations, purchasing generic prescription drugs and using vitamin supplements (Warshaw and Davis, 1985; Sheppard, Hartwick and Warshaw, 1988; Cotugna, 1989). The theory assumes that behavior is under volitional control, and that behavior is based on a rational decision to act. The model specifies the relationships among beliefs, attitude, perception of social pressures (subjective norm) and behaviors. The components of the model and their relationships are depicted in Figure 2.

According to the model, the immediate determinant of behavior is the intent to behave in a certain way. If someone intends to engage in a given behavior, chances are they will, barring any unforeseen factors affecting the decision. Behavioral intention is determined by two factors, attitude toward the behavior and subjective norm. Attitude toward the behavior is defined as the person’s positive or negative evaluation of the behavior, whereas subjective norm is the person’s perception of social pressures to perform the behavior. Finally, attitude is explained by behavioral beliefs (beliefs about outcomes of a behavior) and expectations (the evaluation of each outcome), and the subjective norm is defined as one’s normative beliefs (beliefs about what others think you should do) and one’s motivation to comply with those beliefs.

The Theory of Reasoned Action can be expressed mathematically as

\[ B \sim BI = (A_{beh})w_1 + (SN)w_2 \]

where B is overt behavior, which is theorized to be mediated by BI, behavioral intention. In turn, behavioral intention is determined by \((A_{beh})\), one’s attitude toward performing the behavior, and \((SN)\), subjective norm defined as one’s perception of the influence of significant others toward performing the behavior.
Figure 2. Factors determining a person's behavior: The Theory of Reasoned Action.

The person's beliefs that the behavior leads to certain outcomes and his evaluations of these outcomes

The person's beliefs that specific individuals or groups think he should or should not perform the behavior and his motivation to comply with the specific referents

Attitude toward the behavior

Relative importance of attitudinal and normative considerations

Subjective norm

Intention

Behavior

Note: Arrows indicate the direction of influence.
(From Ajzen and Fishbein, 1980)
W₁ and w₂ are regression weights determined to predict the degree of association between the variables A_{beh} and SN and the behavioral intention (BI).

Attitude toward the behavior (A_{beh}) is a function of the sum of a person's salient beliefs about a behavior and his evaluation of the outcomes of those beliefs. For this reason, the model is often referred to as a value-expectancy model. Mathematically, this can be expressed as

\[ A_{beh} = \sum_{i=1}^{n} b_i e_i \]

where \( b_i \) is the belief that performing a given behavior, \( b \), leads to a particular outcome, \( i \). This is multiplied by the subject's evaluation, \( e \), of outcome \( i \). The total number of salient beliefs a person holds about a given behavior is represented by \( n \).

The other determinant of behavioral intention is subjective norm (SN). SN is determined by a person's perception of what other people think he should do and his motivation to comply with those individuals or groups. The subjective norm component can be represented by

\[ SN = \sum_{i=1}^{n} n b_i m_i \]

where \( n b_i \) is the normative belief (the subject's belief that significant others, \( i \), think he should or should not perform a given behavior). The term \( m_i \) refers to the subject's motivation to comply with the expectations of the significant others. The total number of salient normative referents with respect to a given behavior is represented as \( n \).

The complete mathematical model of the Theory of Reasoned Action, therefore, can be written as
The mathematical terminology has been included in Figure 3 for improved clarity.

In applying the Theory of Reasoned Action to this research, someone’s intention to take calcium or bee pollen supplements is determined by 1) their beliefs about the consequences of taking those food supplements and the value these consequences have for them and 2) their beliefs about whether relevant others think they should or should not take those food supplements and their motivation to comply with those others. Specifically, the beliefs examined were whether calcium or bee pollen supplement use is based on sound scientific principles, whether the supplement would improve disease resistance, physical vitality, or improve the diet, or whether the supplement would be a waste of money or lead to undesirable side effects. The three normative referents examined were the perceived influence of family members, friends and doctors.

External variables, such as various demographic factors, were not directly measured in the model because Ajzen and Fishbein do not believe there is a direct relationship between these factors and behavior. External variables are thought to affect behavior only to the extent that they affect the determinants of behavior. Figure 4 illustrates the relationship between external variables and the components of the model. Demographic information on age, sex, race, division in college (lower division students are freshman and sophomores, and upper division students are juniors and seniors) and area of specialization (business, education, health related professions, liberal arts, science and engineering, and undecided) were collected, however, since many other researchers use these variables for comparative purposes.
Figure 3. The Theory of Reasoned Action with mathematical terminology.

The person's beliefs (b) that the behavior leads to certain outcomes (i) and his evaluations of these outcomes (e)

\[ \sum_{i=1}^{n} b_i e_i \]

The person's beliefs (nb) that specific individuals or groups think he should or should not perform the behavior (i) and his motivation to comply with the specific referents (m)

\[ \sum_{i=1}^{n} nb_i m_i \]

Note: Arrows indicate the direction of influence.
(From Ajzen and Fishbein, 1980)
Figure 4. Indirect effects of external variables on behavior.

EXTERNAL VARIABLES

Demographics
- Age
- Sex
- Occupation
- Socioeconomic status
- Religion
- Education

Attitudes
- Attitudes toward people
- Attitudes toward institutions

Personality Traits
- Introversion
- Extroversion
- Neuroticism
- Authoritarianism
- Dominance

Beliefs that the behavior leads to certain outcomes

Attitude toward the behavior

Evaluation of the outcomes

Relative importance of components

Intention

Behavior

--- Possible explanations for observed relations between external variables and behavior.

Stable theoretical relations linking beliefs to behavior.

(From Ajzen and Fishbein, 1980)
The Theory of Reasoned Action specifies that for each behavioral situation and target population, the salient beliefs and relevant others should be identified through pilot tests and interviews with individuals representative of the population to be studied (Montano, 1986). For this study, a list of behavioral beliefs underlying people's attitude toward taking calcium and bee pollen supplements and a list of normative referents which influence that behavior were obtained from the literature and tested on a sample of college students. Following the Ajzen and Fishbein guidelines, a questionnaire was then developed to determine the beliefs, attitudes, subjective norms and intentions to take either calcium or bee pollen supplements in the population under study. The purpose was to determine if college students distinguish between food supplements promoted on the basis of scientific evidence and those that are promoted on the basis of no scientific evidence. In other words, do they perceive useless food supplements like bee pollen to be the same as scientifically based supplements such as calcium.

Purpose

The purposes of the research were: 1) to investigate the differences in beliefs about food supplements between undergraduate college students who take supplements and those who do not, 2) to use the Theory of Reasoned Action to predict the intent to use single supplements based on exposure to one of two commonly available promotional pamphlets about calcium and bee pollen, and 3) to compare the differences in perceptions of the scientific basis for the use of calcium and bee pollen among supplement users and non-users.

The theoretical framework for the proposed research was Ajzen and Fishbein's Theory of Reasoned Action (Ajzen & Fishbein, 1980). The theory
elucidates the relationship between beliefs, attitudes, social factors, intentions, and behaviors.

**Hypotheses**

**H01:** There is no statistical difference in beliefs about nutrition supplements when comparing college students who use supplements and those who do not (refers to Vitamins and Minerals Q1-Q6, Health Beliefs Q1-Q5).

**H02:** There is no statistical difference in attitudes about calcium or bee pollen supplements when comparing college students who use supplements and those who do not (refers to response to promotional pamphlets Q1, Q3-Q13).

**H03:** There is no statistical difference in subjective norm related to the use of calcium or bee pollen supplements when comparing college students who use supplements and those who do not (refers to response to promotional pamphlets Q15-Q21).

**H04:** There is no statistical difference in behavioral intention related to the use of calcium or bee pollen supplements when comparing college students who use supplements and those who do not (refers to response to promotional pamphlets Q2, Q14).

**Exploratory Questions:**

**E1:** Which components of the Theory of Reasoned Action are the best predictors of supplement use behavior? This is of interest for future nutrition education intervention programs. If the factors influencing supplement use behavior are identified, nutrition education programs can be developed to target those pivotal elements for change.

**E2:** What is the rate of nutrition supplementation among study subjects at Pima College in Arizona? Is their current use of food supplements correlated with
their susceptibility to nutrition misinformation as determined by response to promotional pamphlets? Health fraud is a serious problem in the United States. People spend an estimated $6 billion on food supplements each year. Not only is this a huge amount of money to spend unnecessarily, but excess supplementation may also have harmful side-effects.

E3: Do supplement users and non-users in the study population differ in terms of the sources from which they seek nutrition information? This is of interest for the purposes of future educational efforts.

Assumptions

1. Students who respond to the survey are representative of the college population enrolled in degree programs at Pima College.

2. The salient beliefs and normative referents chosen for the survey are the same for the entire sample.

3. There is no bias among students who chose to answer the questionnaire and those who did not.

Limitations

The sample was self-selected and non-random. The study was limited to students enrolled at Pima College in 1990 and 1991 who attended classes where the survey was administered. The sampled population, therefore, was not representative of all college students or even of all students in southern Arizona or at Pima College. The generalization of the results to other college students or the population as a whole is inappropriate.

Only two promotional pamphlets were used in the experimental phase of the study covering only calcium and bee pollen supplementation. The conclusions drawn from use of only two supplements may not be representative of all possible
situations students may face. Their reactions to other supplements in real situations may be different from those in this experimental situation.

Definitions

Attitude: "an attitude is an index of the degree to which a person likes or dislikes an object" (Ajzen and Fishbein, 1980, p.64), "a learned, emotionally toned predisposition to react in a particular way toward something" (Schwartz, 1976)

Attitude Toward the Behavior: "the individual’s positive or negative evaluation of performing the behavior" (Ajzen and Fishbein, 1980, p.6)

Behavioral Beliefs: "the beliefs that underlie a person’s attitude toward the behavior" (Ajzen and Fishbein, 1980, p.7)

Behavioral Intention: "the likelihood that a person will engage in a given behavior" (Ajzen and Fishbein, 1980, p.42)

Beliefs: "mental acceptance of something as true, even though absolute certainty may be absent" (Guralnik, 1980), "assessments of what a person thinks is true or false" (Dillman, 1978)

External Variables: "personality characteristics, such as authoritarianism, introversion-extroversion, and need for achievement; demographic variables, including, sex, age, social class, and race; and such factors as social role, status, socialization, intelligence, and kinship patterns" (Ajzen and Fishbein, 1980, p.8,9)

Food Faddism: an unusual pattern of food behavior enthusiastically adopted by its adherents with the expectation that some special health benefit will result (Jarvis, undated)
Food Supplement: "Products sold as capsules, pills, wafers, powders, liquids, etc., which are intended to supply one or more food nutrients to an individual's diet" (Schutz et al., 1982) Interchangeable with the term "nutrition supplement"

Food Supplement Non-User: a person who was not taking any food supplements when the survey was administered and who had not reported taking any food supplements in the three months prior to completing the questionnaire.

Food Supplement Regular User: a person who reported taking food supplements at least once per week during the three months prior to completing the questionnaire.

Food Supplement Sporadic User: a person who reported taking food supplements less often than once per week during the three months prior to completing the questionnaire.

Normative beliefs: "the person's beliefs that specific individuals or groups think he should or should not perform the behavior" (Ajzen and Fishbein, 1980, p.7)

Salient beliefs: "the immediate determinants of the person's attitude," the relatively small number of beliefs (5 to 9) that a person can attend to at any moment (Ajzen and Fishbein, 1980, p.63)

Subjective norm: "the person's perception of the social pressures put on him to perform or not perform the behavior in question" (Ajzen and Fishbein, 1980, p.6)
REVIEW OF LITERATURE

Food Faddism

The American Dietetic Association (1981) defined a normal diet as "a diet whose aim is to maintain a healthy person in a state of nutritive sufficiency. It should provide amounts of energy, protein, vitamins, minerals, and other nutrients sufficient to meet the needs of the individual in his particular stage of the life cycle." Sound nutrition theory is based on agreement with the statements that a normal diet is one which is designed to meet the known nutritional requirements of practically all healthy persons, and that maintenance of good general eating habits promotes a healthy body.

The Surgeon General's Report on Nutrition and Health (Department of Health and Human Services, 1988) provides substantial information linking poor dietary habits with increases incidence of chronic diseases. The report also suggests that by adopting sound nutritional behaviors, the incidence of chronic diseases such as coronary heart disease, stroke, high blood pressure, some types of cancer, diabetes mellitus, obesity, osteoporosis, diverticulosis, dental caries, and periodontal disease could be reduced. For maintenance of optimal health, the report emphasizes seven dietary recommendations: (1) eat a variety of foods, (2) maintain desirable weight, (3) avoid too much fat, saturated fat, and cholesterol, (4) eat foods with adequate starch and fiber, (5) avoid too much sugar, (6) avoid too much sodium, and (7) if you drink alcoholic beverages, do so in moderation. Many other agencies have published similar recommendations in the last decade.

Since new information about the relationship between nutrition in health and disease is published continuously, health practitioners need to remain current, both with the latest scientifically documented information and with information that is
unsubstantiated. Only by familiarizing themselves with reliable information and recent research results will health practitioners be able to accurately answer their patient's questions about nutrition (Polk, 1985). Health professionals must also be acquainted with and capable of critiquing fraudulent health programs so that they can pass this information to the public (Rynearson, 1974; Saegert and Young, 1982; Herbert, Jarvis and Monaco, 1983). What follows, therefore, is a brief discussion of the myths about nutrition perpetrated by followers of the alternative health movement.

In an article about physicians and nutrition education, Winnick (1988) wrote "No field is inundated with more self-styled experts and out-and-out quacks than the field of nutrition." This is a sad, but true statement. Nutrition myths run rampant through magazines, "health" conferences for the public, and media broadcasts.

National Analysts (1972) reported in their national survey of consumers that a very large majority of Americans have at least some misconceptions about nutrition. Two-thirds of those surveyed believed that extra vitamins gave them more pep and energy. More than half of the sample population had misconceptions about chemical food additives, food processing and storage, the condition of the soil, and the use of so called "chemical" fertilizers. These themes are very popular throughout alternative health literature (Todhunter, 1973).

Food faddists have opposed food additives and "chemical" fertilizers for several decades. Jerome I. Rodale, founder of the magazine Prevention in the 1950's, built an "organic" foods empire based on the philosophy that foods grown without the use of commercial fertilizers and sprays had something that ordinary foods lacked, and that this something could prevent much ill health (Deutsch, 1977). In 1965, the American Academy of Nutrition, an organization of anti-fluoridation
fanatics, was quoted as attributing widespread malnutrition in the United States to the use of chemically-contaminated foodstuffs resulting from the use of pesticides and the addition of fluorides to water supplies (American Dental Association, 1965). Every year, the Cancer Control Society, an organization that promotes unscientific cancer therapies, reprints a list of "Nutrition Rules to Follow" from the International College of Applied Nutrition. The list includes suggestions such as "Eat natural foods and eat them raw when possible," "Don't eat foods containing chemical preservatives, dyes, artificial colors, etc.," "Use organically grown fruits and vegetables," and "Don't use fruits and vegetables which have been sprayed, fumigated, dyed, or waxed" (Cancer Control Society, 1988). The use of "natural" and "organic" foods, as well as the avoidance of chemical food additives and preservatives is promoted at many health fairs, such as those held by the Coalition of Health Organizations, the National Health Federation and the Cancer Control Society.

Sloan, Powers, and Hom (1986) wrote that consumers view "chemical" food additives as a source of danger, afraid that these additives will cause disease or even death. These beliefs resound throughout the "natural" or "organic" foods movement. According to Sloan, 71 percent of consumers tested agreed with the statement that "natural foods are always better for you than processed foods."

The basic premise behind the promotion of "natural" or "organic" foods is that they are somehow safer, more nutritious, or better than other foods. The National Dairy Council (1981) stated that there is no scientific evidence to support these claims. In fact, the only difference usually found between conventional foods and those sold as "natural" is the price, the latter usually 35 to 50 percent higher. In regard to food additives, Whelan and Stare (1983) claimed that these substances
enhance our food supply by making it "more plentiful, economical, attractive, healthful, and altogether more enjoyable" than it would be without them.

Another common myth about America's food supply is that food processing and storage drastically reduces the nutritive value of foods (Walczak, 1974). While nutrients are lost during the processing, storage, and transportation of foods, the losses are minimal. Alternative health literature disagrees. The International College of Applied Nutrition, a questionable group that promotes holistic health, published a statement on food preservation. In it, modern processing methods were criticized as having "two dangerous drawbacks: 1. They usually destroy enzymes, hormones, and reduce the vitamin activity of the food by abnormally high temperatures or by the addition of or treatment with chemicals; 2. They remove the germinal and life-giving portion of the food by mechanical or chemical extraction." Furthermore, they conclude that while this remaining "residue" that we call food has a long shelf-life, "most of the real food elements which are essential the health" are lost (Walczak, 1974).

There is also the notion that soils are depleted of important nutrients, thereby compromising the quality of our food supply. Carlton Fredericks, a self-proclaimed nutrition "expert" who wrote for Prevention magazine but has no legitimate nutrition background, contends that "Many of our foods spring from soils which have been over-cultivated or under-fertilized...yielding vegetables and fruits below standard in vitamin-mineral content" (1972). Cheraskin and Ringsdorf, promoters of alternative therapies, attribute part of the "inadequacy" of the American diet to the poor condition of the soil (1971). According to Whelan and Stare (1983), if nutrients are missing form the soil, plants simply will not grow. To exist, plants must be able to take their essential nutrients from the soil.
The Surgeon General's Report on Diet and Health (Department of Health and Human Services, 1988) indicates that the myth that "modern foods are grown on depleted soil, are overprocessed, and therefore, cannot provide good nutrition" still underlies contemporary food faddism. Another of the myths about our food supply persisted by food faddists is that because our food comes from inadequate soil, and then we further harm its nutrient supply by overprocessing it and adding chemicals to it, it is unhealthy and cannot provide us with proper nutrition. The nutritional adequacy of our diets is further compromised by improper cooking methods and by the fact that so many people eat "on the go." These practices, the myth continues, puts every American in danger of nutritional deficiency and necessitates the use of nutritional supplements by nearly everyone (Consumer Reports, 1986).

**Vitamin and Mineral Supplementation**

The use of vitamin and mineral supplements is a prevalent practice in the United States. Data from the second National Health and Nutrition Examination Survey (NHANES II) revealed that approximately 35 percent of the 27,801 respondents took vitamin and/or mineral supplements. This rate was up from approximately 23 percent as reported in the earlier NHANES I study (Block et al., 1988). Overall, supplement use rates were even higher among whites, women, those over 50, college educated, and more affluent individuals (Koplan et al., 1986). A more recent national survey reported that 40 percent of the population was using one or more vitamin/mineral supplements (Stewart et al., 1985). Most of these were classified as light users, taking an average of 1.4 supplements per day, but 42 percent of the supplement users were classified as heavy or very heavy users (Levy and Schucker, 1987). The most recent data on the demographics of vitamin and
mineral supplement users characterized them as white females, over the age of 25, in good health with annual family incomes greater than $40,000 and high school diplomas (Moss and Levy, 1989).

Supplement use among adult Americans living in Western states seems to be higher than that reported in other national surveys. Schutz et al. (1982) reported 67 percent of their sample of 2,451 adults used some form of vitamin or mineral supplement. The typical supplement user in this study was found to be a young female with some college education and a belief in the efficacy of supplements for disease prevention and cure. Nutrition supplements continue to be widely used in Western states. Bowerman and Harrill (1983) observed supplement use in 53 percent of adults in Colorado. Vitamin C and multivitamins were the most commonly reported supplements used. Medeiros et al. (1989) reported that 54 percent of their 1,730 subjects took some type of food supplement within a week of completing the questionnaire. Multiple supplements were consumed most frequently, followed by vitamin C, calcium and vitamin E. The typical regular user tended to be a white, married female in good health, 30 to 39 years old with some college education (Read et al., 1989). Supplement users were more likely than non-users to believe that nutrition supplements exerted a beneficial health effect.

Higher levels of supplementation have been reported among smaller groups. Sheehan et al. (1989) reported that vitamin and mineral supplements were used by 60 percent of the elderly living in seven western states. In a survey of family practice patients in the Seattle area, 67 percent were found to use nutritional supplements on a regular basis or to treat illness (English and Carl, 1981). Food supplement use among a small group of cancer patients was recently reported to average 77 percent (Read, 1990). In addition to commonly consumed supplements such as
multivitamins and vitamin C, more than half of these patients also used herbal preparations and other products promoted by food faddists, including brewer's yeast, desiccated liver, garlic oil, lecithin, pau d'arco tea, and tryptophan. Rabb (1987) reported supplement use to be 80 percent among a group of women attending Extension Service programs who were mostly over 65. The overwhelming majority reported using calcium supplements and vitamin C. Among elite athletes, supplements are used regularly by 50 to 70 percent (Neiman et al., 1989). Multiple vitamins and vitamin C were reported to be the most commonly consumed among marathon runners.

Only a handful of studies have been done on nutrition supplementation of college-aged subjects. This group is important, however, because patterns established as young adults may carry over into later adulthood. Table 1 summarizes previous research on supplement use among young adults. The studies are discussed below.

Supplement use among late teens was reported to be between 10 and 28 percent (Sobal and Muncie, 1988). These findings support the NHANES II data for 11 to 19 year olds (Looker et al., 1987). In this age group, between 10 and 14 percent of the population consumed supplements regularly, and 16 to 17 percent reported irregular use. Most teenagers took only a single multivitamin, although there was considerable misinformation about purported health benefits of nutrition supplements. Common misconceptions were that supplements helped them perform better in sports, cured or prevented colds, and were needed for increased pep and energy (Sobal and Muncie, 1988).

In a somewhat older population, food supplement use appears to be slightly higher. In a group of 16 to 24 year olds, 35 percent of the men and 39 percent of the
Table 1. Food supplement use among college-aged individuals: A comparison of selected research.

<table>
<thead>
<tr>
<th>Population Surveyed</th>
<th>Number</th>
<th>Age</th>
<th>Sex</th>
<th>Location</th>
<th>Supplement Users (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Adults&lt;sup&gt;1&lt;/sup&gt;</td>
<td>669</td>
<td>25-34</td>
<td>M</td>
<td>nationwide</td>
<td>17.6</td>
</tr>
<tr>
<td></td>
<td>1,541</td>
<td>25-34</td>
<td>F</td>
<td>(NHANES I)</td>
<td>26.4</td>
</tr>
<tr>
<td>Student Families&lt;sup&gt;2&lt;/sup&gt;</td>
<td>147</td>
<td></td>
<td>F &amp; M</td>
<td>Univ. Minnesota</td>
<td>51</td>
</tr>
<tr>
<td>Adults&lt;sup&gt;3&lt;/sup&gt;</td>
<td>26</td>
<td>19-50</td>
<td>M</td>
<td>Colorado</td>
<td>46</td>
</tr>
<tr>
<td></td>
<td>53</td>
<td>19-50</td>
<td>F</td>
<td></td>
<td>58</td>
</tr>
<tr>
<td>Adults&lt;sup&gt;4&lt;/sup&gt;</td>
<td>74</td>
<td>18-30</td>
<td>M</td>
<td>Colorado</td>
<td>69</td>
</tr>
<tr>
<td></td>
<td>104</td>
<td>18-30</td>
<td>F</td>
<td></td>
<td>88</td>
</tr>
<tr>
<td>Adults&lt;sup&gt;5&lt;/sup&gt;</td>
<td>5,915</td>
<td>18-50</td>
<td>M</td>
<td>nationwide</td>
<td>28.9</td>
</tr>
<tr>
<td></td>
<td>6,588</td>
<td>18-50</td>
<td>F</td>
<td>(NHANES II)</td>
<td>38.1</td>
</tr>
<tr>
<td>College Students&lt;sup&gt;6&lt;/sup&gt;</td>
<td>117</td>
<td>undergrad</td>
<td>M</td>
<td>Wisconsin</td>
<td>30</td>
</tr>
<tr>
<td></td>
<td>216</td>
<td>undergrad</td>
<td>F</td>
<td></td>
<td>50</td>
</tr>
<tr>
<td>High School Graduates&lt;sup&gt;7&lt;/sup&gt;</td>
<td>313</td>
<td>21-23</td>
<td>F</td>
<td>Ohio</td>
<td>33.9</td>
</tr>
<tr>
<td>Medical Students&lt;sup&gt;8&lt;/sup&gt;</td>
<td>180</td>
<td>1st yr,85</td>
<td>F &amp; M</td>
<td>Maryland</td>
<td>52</td>
</tr>
<tr>
<td></td>
<td>180</td>
<td>1st yr,86</td>
<td>F &amp; M</td>
<td>Maryland</td>
<td>63</td>
</tr>
<tr>
<td>Adults&lt;sup&gt;9&lt;/sup&gt;</td>
<td>86</td>
<td>20-35</td>
<td>F</td>
<td>Iowa</td>
<td>36</td>
</tr>
<tr>
<td>Adults&lt;sup&gt;10&lt;/sup&gt;</td>
<td>433</td>
<td>16-24</td>
<td>M</td>
<td>nationwide</td>
<td>35.3</td>
</tr>
<tr>
<td></td>
<td>502</td>
<td>16-24</td>
<td>F</td>
<td></td>
<td>38.8</td>
</tr>
<tr>
<td>College students&lt;sup&gt;11&lt;/sup&gt;</td>
<td>335</td>
<td>17-22</td>
<td>F</td>
<td>Alabama</td>
<td>54</td>
</tr>
</tbody>
</table>

1 Block et al., 1988
2 Bootman and Wertheimer, 1980
3 Bowerman and Harrill, 1983
4 Harrill and Bowski, 1982
5 Koplan et al., 1986
6 Schulz, 1988
7 Schwartz, 1975
8 Sobal and Muncie, 1985
9 Sowers and Wallace, 1986
10 Stewart et al., 1985
11 Vickery, Phillips, and Crenshaw, 1985
women used supplements. These rates are lower than the average of 40 percent reported for all ages. Vitamin C was the most commonly consumed supplement among all study participants and among those in this age group (Stewart et al., 1985). Harrill and Bowski (1981) reported that 18 percent of men and 32 percent of women between the ages of 18 and 30 took supplements. Multivitamins or multivitamins plus iron were the most commonly used preparations, followed by vitamin C. The most common reasons reported for use of supplements were that they prevented colds or other illness, they provided energy, and that they compensated for inadequacies in the diet (Harrill and Bowski, 1981). Multivitamins followed by vitamin C were also the most commonly used nutrition supplements in two other studies of young adult women (Schwartz, 1975; Sowers and Wallace, 1986).

Bootman and Wertheimer (1980) evaluated patterns of vitamin usage among college students living in married student housing in Minnesota. In all, 51 percent indicated that a family member took vitamins regularly or as needed for acute disorders. Again, the most commonly consumed supplements were multivitamins, taken as dietary supplements, and vitamin C, taken as therapy for colds, flu, and sore throats. While more women than men were reported as taking supplements, the difference was not significant. This survey elicited responses only for fourteen specific vitamins, so it is unknown if other supplements were used for extravagant reasons by these students.

Entering medical school students were reported as having higher vitamin supplementation rates for regular and occasional use than the married students. Eleven percent of the class reported that they always took vitamins, and 52 percent responded that they usually or sometimes took vitamins (Sobal and Muncie, 1985).
Over half of the students felt that vitamin C was useful in treating colds. Only 6 percent, however, included taking vitamins as one of the three most important things they did to protect their health. No difference in supplement use was reported between male and female medical students.

In a survey to assess concern for personal dietary habits among college women, nutrient supplementation was common. Twenty-six percent reported using supplements regularly and 28 percent used them occasionally (Vickery, Phillips and Crenshaw, 1985). Those who were most concerned with their personal dietary habits were most likely to take supplements as insurance against dietary deficiency. No information was given on the types of supplements most commonly consumed.

Most recently, Schulz (1988) examined the exercise and supplementation habits of 333 college students. No relationship was found between exercise level and supplement use, but more athletes believed that the supplements helped them than did sedentary individuals. Multivitamins and multivitamins plus iron were the most commonly consumed supplements, followed by vitamin C. Only athletes were found to consume megadoses (greater than 1000 times the U.S. RDA for any nutrient) or inappropriate nutrition supplements, such as lecithin, grapefruit pills, or amino acids. Sex differences in consumption were observed, with 50 percent of the women and 30 percent of the men regularly consuming supplements. Most reported using supplements as "nutritional insurance" and "to avoid illness."

The Committee on Diet and Health from the Food and Nutrition Board Commission on Life Sciences of the National Research Council stated in their report on Diet and Health (National Research Council Committee on Diet and Health, 1989) that the use of dietary supplements in the United States is extensive and increasing. The numerous studies discussed above illustrate this point. Healthy
individuals, however, should be able to meet their nutrient needs with diet, rather than with vitamin and mineral supplementation (Rudman, 1983; Callaway et al., 1987; Council on Scientific Affairs, 1987; National Research Council Committee on Diet and Health, 1989). A policy statement jointly issued by the American Dietetic Association, the American Institute of Nutrition, the American Society for Clinical Nutrition, and the National Council Against Health Fraud, states that "The Recommended Dietary Allowances represent the best currently available assessment of safe and adequate intakes and serve as the basis for the U.S. Recommended Daily Allowances shown on many product labels. There are no demonstrated benefits of self supplementation beyond these allowances" (American Dietetic Association Task Force on Vitamin and Mineral Supplementation, 1987). The American Medical Association (Council on Scientific Affairs, 1987), the American Heart Association (1987), the National Institute on Aging (1983), the Surgeon General's Report (Department of Health and Human Services, 1988), and the National Research Council's Committee on Diet and Health (1989) also agree with the American Dietetic Association's policy statement.

With so many Americans taking supplements, there is ample opportunity for misuse. The Council on Scientific Affairs (1987) defined misuse as "any application of a vitamin or vitamins in a dose that is inappropriate or for a purpose that has no basis in established scientific practice." Evans and Lacey (1986) wrote that "injudicious self medication with large doses of vitamins may cause severe toxic complications." Tables 2 and 3 summarize the potentially toxic effects of megadoses of vitamins and minerals. Without monitoring of supplement usage by physicians and the absence of consultation with pharmacists or dietitians, the danger of supplement misuse is substantial.
Table 2. Potentially toxic effects of megadoses of vitamins.

<table>
<thead>
<tr>
<th>Vitamin</th>
<th>Toxic Symptoms</th>
<th>Amount</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>Headache, vomiting, diplopia, alopecia, dryness of the nucous membranes, desquamation, bone abnormalities, liver damage, spontaneous abortion, birth defects^2</td>
<td>Toxicity appears with sustained intakes of 15,000 ug retinol (50,000 IU), &gt; 10 times the RDA; birth defects occur at &gt; 20,000 IU^2</td>
</tr>
<tr>
<td>D</td>
<td>Hypercalcemia and hypercalciuria leading to deposition of calcium in soft tissues and irreversible renal and cardiovascular damage^2</td>
<td>&gt; 45 ug (1,800 IU) cholecalciferol per day, &gt; 5 times the RDA^2</td>
</tr>
<tr>
<td>E</td>
<td>Nausea, diarrhea, headache, fatigue, muscle weakness, rapid pulse, reproductive failure, risk of fatty liver^3</td>
<td>Most adults can tolerate 100 to 800 mg per day, &gt; 10-80 times RDA^2</td>
</tr>
<tr>
<td>C</td>
<td>Rebound scurvy, diarrhea, interference in copper and iron absorption, damage to tooth enamel, interference with laboratory tests for glucose in the urine and occult blood in fecal samples^3</td>
<td>&gt; 1,000 mg per day; &gt; 20 times the RDA, occult blood detection can be obscured with as little as 55 mg vitamin C in the feces^3</td>
</tr>
<tr>
<td>Niacin (nicotinic acid)</td>
<td>Flushing, headaches, cramps, nausea, irregular heartbeats, liver damage and high blood glucose levels^3</td>
<td>Flushing may result from as little as 300 mg^3; 3-9 g produce metabolic problems^2</td>
</tr>
<tr>
<td>B_6</td>
<td>Neurological symptoms, ataxia^2</td>
<td>&gt; 1 g, 50 to 75 times the RDA^2</td>
</tr>
</tbody>
</table>

1 Note: Vitamins not listed do not generally have any reported toxicities, even at very high doses.
2 National Research Council Committee on Diet and Health, 1989
3 Marshall, 1985
Table 3. Potentially toxic effects of megadoses of minerals.

<table>
<thead>
<tr>
<th>Mineral</th>
<th>Toxic Symptoms</th>
<th>Amount</th>
</tr>
</thead>
<tbody>
<tr>
<td>Calcium</td>
<td>Constipation, increased risk for urinary stone formation, inhibition of absorption of essential minerals(^2), and calcium deposits in soft tissue(^3)</td>
<td>&gt; 2,500 mg per day, 3 times the RDA(^2)</td>
</tr>
<tr>
<td>Iron</td>
<td>Hemochromatosis (genetic), death (usually in children)(^2,3)</td>
<td>Lethal dose is 200 to 250 mg/kg body weight, approximately 3 g ferrous sulfate for a 2 yr old(^2)</td>
</tr>
<tr>
<td>Zinc</td>
<td>Vomiting, copper deficiency, microcytosis, impairment of immune responses and reduction of serum high-density lipoproteins (HDL)(^2)</td>
<td>Copper status is impaired at 18.5-25 mg per day(^2); HDL lowered at 80-150 mg per day(^2); immune responses and blood changes at 10-20 times the RDA(^2); acute toxicity occurs at 1-2 g in a single dose(^3)</td>
</tr>
<tr>
<td>Selenium</td>
<td>Nausea, abdominal pain, diarrhea, nail and hair changes, peripheral neuropathy, fatigue and irritability(^2)</td>
<td>5 mg per day for hair loss and nail changes, &gt;25 mg for other symptoms in a single dose(^2) or 4-8 mg daily(^3)</td>
</tr>
</tbody>
</table>

1 Note: Most minerals are toxic when ingested in high quantities. Since incidences of such toxicity are rare, especially related to dietary or supplement intake, these minerals have not been included in this table.
2 National Research Council Committee on Diet and Health, 1989
3 Marshall, 1985
Survey Methodology

According to Kerlinger (1986), survey research is accomplished by "selecting and studying samples chosen from the populations to discover the relative incidence, distribution, and interrelations of sociological and psychological variables." The purpose of a survey is to assess various characteristics of populations of people. Since it is very difficult in most cases to study whole populations, samples are drawn from those populations for evaluation. The purpose of sample surveys, therefore, is to focus on "the vital facts of people, and their beliefs, opinions, attitudes, motivations, and behavior" (Kerlinger, 1986). From this definition then, it is easy to see why examining the factors involved in supplement use among college students using the Theory of Reasoned Action is appropriately done using a survey.

There are several ways to obtain sample surveys. Personal interviews are regarded by Kerlinger as the best survey method. While this may be true, personal interviews are usually very expensive and time consuming. They are best suited for subjects in one geographical region, unless substantial travel expenses are budgeted or there are multiple geographical sites for analysis, such as is the case for the NHANES III study (Department of Health and Human Services, National Center for Health Statistics, 1988). This survey involves clinical as well as verbal and written medical and nutritional histories, some of which would be unattainable with survey methods other than personal interview.

A less expensive alternative to the personal interview is the telephone survey (Dillman, 1978; Kerlinger, 1986). Among the drawbacks for this survey method, Kerlinger lists unwillingness to disclose more than superficial information, and nonresponse. A telephone survey, however, was used very successfully in recent research into the public use of questionable health care treatments (Louis Harris,
In this survey, random digit dialing was used to contact 2,089 subjects, of which 1,514 completed interviews (72.5 percent). While the same information could have been obtained by personal interview, it would have been impractical to undertake a large national survey of this type using that method.

Finally, there is the mail questionnaire. Again, Kerlinger sees little use for this method. The drawbacks for mail surveys include low response rate and inability to verify the responses given (Kerlinger, 1986). Dillman (1978) has tried to overcome some of these shortcomings by designing survey methodology for mail and telephone questionnaires called the "total design method."

The total design method (TDM) incorporates a variety of techniques that have been shown in previous research to increase response rates to mail and telephone surveys. These include attractive questionnaire layout (Levine and Gordon, 1958; Scott, 1961), use of addressed, stamped return envelopes (Watson, 1965; Hensley, 1974; Veiga, 1974), personalization of correspondence (Smith and Hewett, 1972; Buse, 1973), promise of anonymity and confidentiality (Reeder, 1960; Buse, 1973), and repeated follow-ups by mail or telephone (Eckland, 1965; Dillman, 1972; Buse, 1973). Dillman (1978) has adopted these and other techniques to provide researchers with a methodological "recipe" for success in mail and telephone surveys.

By following the TDM, Dillman reported that the average response rate for 48 surveys on a wide variety of topics was 74 percent, and response rates of 90 percent were attained for some specialized groups. Several surveys were done with college students. With a 118 item, 10 page questionnaire on energy use, 89 percent of 1000 students at Washington State University responded. In another survey of Washington State University students, 82 percent responded to 10 page
questionnaire of their attitudes about their college. Response rates in this range were also obtained for shorter questionnaires of college students (Dillman, 1978).

Some of the factors used in the TDM to increase response to mail surveys were examined in a recent meta-analysis by Fox, Crask and Kim (1988). On the average, response rates were enhanced with university sponsorship, prenotification by letter, stamped return postage, postcard follow-up, first-class outgoing postage, and the use of colored rather than white paper for the questionnaire. Monetary incentives were also found to increase response rate, even though the amounts given were usually small (Fox, Crask and Kim, 1988). These results are consistent with the use of Dillman's survey techniques.

Spry et al. (1989) reported success with monetary incentives of $5.00 but not $1.00. Lottery incentives included with surveys in addition to telephone or postcard prompts also proved effective in increasing response rates. Despite these incentives, Spry reported a relatively low overall response rate of 37 percent. While they did use university sponsorship, prenotification, and a follow-up mailing, other aspects of the TDM were not reported, such as questionnaire style or type of postage. The low response to this survey may also have been due to the large proportion of non-English speaking households in the area where the questionnaire was administered and a mobile population difficult to track for new addresses. Also, the subject of the questionnaire may have affected the response.

A relatively low response rate was also observed by Schwartz (1975). Only 31.3 percent responded to her survey of nutrition knowledge, attitudes, and practices of female high school graduates. The only aspects of the TDM reported, however, were university affiliation and use of a follow-up request. Schwartz (1976) achieved much better success later in her survey of Canadian public health nurses. Not only
was this a specialized population, but the survey techniques were much closer to those used in the TDM. Of 390 public health nurses in 18 health units in British Columbia, 352 (90.2 percent) returned their mailed questionnaires. In fact, 5 of the 18 health units had a 100 percent response. Each nurse received a packet containing the questionnaire, cover letters from the researcher and from a Health Branch official, and an addressed, stamped, return envelope. All questionnaires were mailed by first class, using the individual nurses names. For non-responders, a follow-up mailing was conducted.

Aspects of the TDM were used to enhance the response of Quebec physicians to a 70 item questionnaire aimed at determining the level of support for a number of patient care issues (Maheux, Legault and Lambert, 1989). In this study, nonrespondents to an initial mailing received either handwritten thank-you notes on the bottom of the letter accompanying the questionnaire or a personalized packet with the physicians title, name and address individually typed on the envelope rather than a computer generated label, stamps rather than metered postage, and a handstamped return envelope. Compared to groups that did not receive these enhancements, the handwritten note increased physician response by 40.7 percent, and the personalized packet improved response by 53.1 percent. By following the TDM, a cumulative response rate to all mailings was increased 84.1 percent.

The TDM was also used successfully in other recent surveys. Following Dillman's guidelines, Crosby, Ventura and Feldman (1989) were able to obtain a 93 percent response from a national sample of VA nurse practitioners. After their success, they reported that the TDM was "easy to understand, had intuitive appeal, and resulted in a relatively high response rate." Sheehan et al. (1989) reported a response rate of 70 percent using the TDM in a seven state survey of vitamin and
food supplement practices and nutrition beliefs of the elderly. While the response rate was lower than others, it is still very good considering that the population was not a specialized group.
METHODS

This study was designed to examine the differences in attitude, belief, subjective norm and intention to take food supplements in groups of undergraduate students from Pima Community College.

Subjects for the research were undergraduate students attending Pima Community College during the Fall Semester, 1990 and the Spring Semester, 1991. The survey was administered to students attending classes at the West Campus only. Students were solicited for participation if they 1) were undergraduates, 2) were enrolled in a degree program, and 3) attended the classes where the survey was administered. The survey was administered in a variety of classes, including biology, engineering, astronomy, nutrition, and sociology. Students were not excluded on the basis of their major course of study or their age, but this information was collected to control for possible confounding variables. Participation was voluntary and anonymous. Surveys were collected from classes until a sample size of 502 was achieved.

A 42 item questionnaire was developed to assess student’s views about vitamin and mineral food supplement use (6 questions), health beliefs (5 questions), food supplement use habits (4 questions), demographics (5 questions), sources of nutrition information (1 question), and responses to information about the use of either calcium or bee pollen supplements (21 questions). The latter 21 questions were developed according to the guidelines of Ajzen and Fishbein (1980) to measure behavioral beliefs, outcome evaluations, attitudes, normative beliefs, motivation to comply with normative referents, and intention to use either calcium or bee pollen supplements.
Reliability of multi-item constructs was tested using a reliability coefficient developed by Kerlinger (1986). Kerlinger defines reliability as the proportion of error variance to the total variance obtained with a measuring instrument subtracted from 1.00, the index of perfect reliability. Mathematically, the formula is represented by:

\[ r_{tt} = 1 - \frac{V_e}{V_{ind}} \]

where \( r_{tt} \) is the reliability coefficient, \( V_e \) is the error variance and \( V_{ind} \) is the variance resulting from individual variances. Kerlinger's formula is computationally different from Cronbach's Coefficient Alpha, but yields the same results (Kerlinger, 1986).

The booklet was designed following Dillman's Total Design Method (1978), even though the questionnaire was not to be used as a mail survey. First, the questionnaire was printed as a booklet consisting of 8 1/2" x 14" paper folded in the middle and stapled. Secondly, no questions appeared on the front cover of the booklet. The cover was attractively designed to stimulate interest in the questionnaire. Thirdly, the questionnaire was printed in a photographically reduced form. Each page was printed on a laser printer using 10-point Times-Roman type in a 7" x 9 1/2" space on 8 1/2" x 11" paper. Each page was then photographically reduced to 79 percent of the original size to fit the booklet form. Finally, the booklet was reproduced onto paper using a good copy machine. Questions were phrased to reflect wording and style conventions acceptable to Dillman. Copies of the questionnaire can be found in Appendix 1 and Appendix 2.

Five-point Likert scales were used for most of the questions in the Vitamins and Minerals and Health Beliefs sections of the questionnaire. Responses for these
sections ranged from "strongly disagree" to "strongly agree." They were scored from 1 (strongly disagree) to 5 (strongly agree), with the exception of one question in the Vitamins and Minerals section (People who eat a variety of foods every day can get all the vitamins and minerals they need). This one was scored from 5 to 1. Therefore, the higher score in these two sections, the more the respondent believed that vitamins or minerals had health benefits not substantiated by science (ie. they believe that vitamins and minerals provide pep and energy, help protect health, prevent colds, reduce stress, etc.). The remaining questions in these sections and the questions in the food supplement use habits and demographics sections were multiple choice.

When asked to indicate types of food supplements currently used, subjects were asked to make a mark next to each of the supplements taken any time within the last three months. Supplements were coded with a one (1) if the respondent reported taking it or with a zero (0) if they did not. Comparisons between sporadic and regular food supplement users were made with the Chi square statistic.

In the section on nutrition information, respondents were asked to choose how often they seek nutrition information from a list of thirteen sources. Responses were rarely, occasionally and frequently, which were coded as 1, 2, and 3 respectively. If they did not check any of the boxes, a score of 0 was entered. For purposes of analysis, only responses of occasionally and frequently were compared among the supplement use groups. Again, Chi square was used to detect differences among the supplement use groups.

For the questions related to calcium or bee pollen supplementation, semantic differential scales were used. Word pairs included good/bad, helpful/harmful, important/unimportant, likely/unlikely, and wise/foolish. Responses were scores
from +3 to -3 for the attitude, belief, and subjective norm statements, and from 1 to 7 for the evaluation and motivation to comply statements. Examples of the different types of questions and their scoring follows.

A belief statement:

My taking calcium supplements during the next 3 months will help insure a good diet.

likely +3 : +2 : +1 : 0 : -1 : -2 : -3 unlikely

An evaluation statement:

For me, insuring that I have a good diet is

good 7 : 6 : 5 : 4 : 3 : 2 : 1 bad

The Theory of Reasoned Action states that attitudes are determined by the salient beliefs an individual holds about performing a given behavior and the value the individual has for the outcome of the behavior. Mathematically, attitude is determined by multiplying the score for beliefs held about the behavior by the evaluation of the outcome of performing the behavior. The products are then summed for the total set of beliefs. In this survey, if respondents rated it very likely (+3) that calcium supplements would help insure a good diet and they felt that insuring a good diet was very good (7), they would have a score of +21. On the other hand, if they felt that insuring a good diet was very good (7) but felt calcium supplements were very unlikely to be effective (-3), their score would be -21.
Similarly, if they were unsure of calcium supplements insuring a good diet (0), but felt insuring a good diet was very important (+3), their score would be 0.

Predictions of attitudes toward calcium or bee pollen supplements were made using these belief product scores. If the score was positive, the attitude was predicted to be positive. If the score was negative, the attitude was predicted to be negative.

A similar method was used to determine the respondent's subjective norm. The two multiplicands in this case were beliefs about what significant others think the respondent should do and their motivation to comply with those beliefs. Examples of these questions and their scoring follows.

A Normative Belief statement:

My family thinks that my taking calcium supplements is:

\[
\text{good } +3 : +2 : +1 : 0 : -1 : -2 : -3 \text{ bad}
\]

A Motivation to Comply statement:

Generally speaking, I do what my family thinks I should do.

likely 7 : 6 : 5 : 4 : 3 : 2 : 1 unlikely

Correlation coefficients (Pearson's r) and multiple correlation coefficients (R) were used to describe the relationships among the various components of the model. In addition, the standardized regression coefficients served as estimates of the weights (w) of the relative importance of attitude and subjective norm in predicting behavioral intention to take calcium or bee pollen supplements.
Analysis of variance and the Chi square statistic were used to evaluate differences among independent variables, supplement use, type of scenario and demographic variables. Post-hoc testing for analysis of variance was done using Tukey's studentized range test. Two versions of the questionnaire were administered. The first version included a pamphlet from the National Dairy Council entitled Calcium: You Never Outgrow Your Need for It (1987). The second version of the questionnaire included a promotional pamphlet about the health benefits of using bee pollen from the Mr. Bee Pollen company entitled The Jim Devlin Natural Health Program (Moore, 1988). All other questions in each questionnaire were identical to one another.

The two brochures were chosen because they represented supplements widely separated on the food supplement use continuum (Figure 1). The use of calcium for the prevention of osteoporosis is based on significant scientific evidence. The use of bee pollen, however, is without apparent scientific basis. Secondly, professionally prepared, colored brochures were available for each supplement. Thirdly, the effectiveness of the two brochures was tested favorably in a pilot study of students at Pima Community College. The students found both brochures to be attractive and easy to read in a short period of time.

Descriptive statistics were used to summarize the demographic data and prevalence of food supplement use. All statistics were performed using SAS/PC® (SAS Institute Inc., Cary, North Carolina).
RESULTS

Demographics

Surveys on the vitamin and mineral supplementation habits of college students were completed by 502 students enrolled in academic courses at the West Campus of Pima Community College during the Fall semester, 1990 and the Spring semester, 1991. Of the students completing the survey, 294 were female and 208 were male. Students ranged in age from 17 to 67 years, with the average age 25.6 ± 8.2 years. The students were predominantly white (64.9%) with 21.9% Hispanics, 3.6% Asians, 2.6% Blacks, 4.8% Others and 2.2% who did not respond. Most of the students classified themselves as lower division (74.9% freshman and sophomores). The remainder were upper division students (25.1% juniors and seniors). Most respondents were liberal arts majors (30.5%) followed by students in health related professions (20.3%), education (16.9%), science and engineering (14.9%), business (9.6%) and undecided/undeclared (7.8%).

In terms of their recent food supplement usage, students responded that they were non-users (37.9%) or they reported some frequency of use within the three months prior to taking the survey. Of those that reported food supplement use, 19.3% stated that they used supplements less than once a month, 8.9% reported use about once a month, 11.1% two to three times per month, 10.8% about once a week, 17.7% two to three times per week, 26.6% daily and 5.6% more than once per day (Figure 5).

To simplify, 37.9% of the respondents were categorized as non-users (n = 190), 25.3% were categorized as sporadic users (n = 127) and 36.8% were categorized as regular users (n = 185). Sporadic users were students who reported using food supplements less often than once per week (ie. less than once a month,
Figure 5. Frequency of food supplement use by Pima Community College Students.
about once a month, or two to three times per month). Regular users were those students who reported taking food supplements at least once per week (i.e. about once a week, two to three times per week, daily or more than once per day). Table 4 summarizes the demographic characteristics of the respondents by supplement use category.

**Supplement Use Characteristics**

A comparison of supplement use habits of regular and sporadic food supplement users can be seen in Tables 5 and 6. Of the students who reported taking food supplements regularly (n=185), the most frequently consumed multiple supplement was multiple vitamins (45.4%), followed by multiple vitamins plus minerals (40.0%). B-complex vitamins were the next most commonly used (24.9%) with multiple vitamins plus iron the fourth most popular choice (22.7%). All other multiple supplements (Geritol, Prenatal vitamins, B-complex plus iron and other combination supplements) were consumed by 20 (10.8%) or fewer subjects. Note that the numbers of multiple supplements used do not total 100%. This reflects multiple checking for many of the participants. Respondents checked more than one multi-supplement if they used more than one multi-supplement at a time or if they consumed more than one type of multi-supplement in the three months prior to taking the survey. Over half of the sample (52.4%) used only one multiple supplement in the three months prior to the survey. An additional 41.1% used more than one supplement while the remaining 6.5% of regular supplement users did not take any combination supplement.

Among regular supplement users, the most frequently consumed single supplement was vitamin C, used by 56.2%. The next most common was calcium (30.8%), followed by vitamin E (26.0%), vitamin A (20.0%), and iron (19.5%).
Table 4. Demographics of student respondents in the Pima Community College food supplement use survey by supplement use category (supplement Non-Users, Sporadic Users and Regular Users).

<table>
<thead>
<tr>
<th>Demographic Characteristic</th>
<th>Non-Users n=190(^1) (%)</th>
<th>Sporadic Users n=127(^1) (%)</th>
<th>Regular Users n=185(^1) (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age</td>
<td>25.4 ± 7.7</td>
<td>24.6 ± 7.8</td>
<td>26.4 ± 9.0</td>
</tr>
<tr>
<td>Race</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Asian</td>
<td>9 (4.7%)</td>
<td>5 (3.9%)</td>
<td>4 (2.2%)</td>
</tr>
<tr>
<td>Black</td>
<td>6 (3.2%)</td>
<td>2 (1.6%)</td>
<td>5 (2.7%)</td>
</tr>
<tr>
<td>Hispanic</td>
<td>43 (22.6%)</td>
<td>27 (21.3%)</td>
<td>40 (21.6%)</td>
</tr>
<tr>
<td>White</td>
<td>114 (60.0%)</td>
<td>86 (67.7%)</td>
<td>126 (68.1%)</td>
</tr>
<tr>
<td>Other</td>
<td>13 (6.8%)</td>
<td>4 (3.1%)</td>
<td>7 (3.8%)</td>
</tr>
<tr>
<td>No Answer</td>
<td>5 (2.6%)</td>
<td>3 (2.4%)</td>
<td>3 (1.6%)</td>
</tr>
<tr>
<td>Division(^2)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lower</td>
<td>145 (76.3%)</td>
<td>96 (75.6%)</td>
<td>134 (72.4%)</td>
</tr>
<tr>
<td>Upper</td>
<td>45 (23.7%)</td>
<td>30 (23.6%)</td>
<td>51 (27.6%)</td>
</tr>
<tr>
<td>Sex</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>77 (40.5%)</td>
<td>55 (43.3%)</td>
<td>76 (41.1%)</td>
</tr>
<tr>
<td>Female</td>
<td>113 (59.5%)</td>
<td>72 (56.7%)</td>
<td>109 (58.9%)</td>
</tr>
<tr>
<td>Major in College</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Business</td>
<td>16 (8.4%)</td>
<td>15 (11.8%)</td>
<td>17 (9.2%)</td>
</tr>
<tr>
<td>Education</td>
<td>34 (17.9%)</td>
<td>20 (15.8%)</td>
<td>31 (16.8%)</td>
</tr>
<tr>
<td>Health-Related</td>
<td>36 (19.0%)</td>
<td>33 (26.0%)</td>
<td>33 (17.8%)</td>
</tr>
<tr>
<td>Liberal Arts</td>
<td>60 (31.6%)</td>
<td>30 (23.6%)</td>
<td>63 (34.1%)</td>
</tr>
<tr>
<td>Science</td>
<td>30 (15.8%)</td>
<td>17 (13.4%)</td>
<td>28 (15.1%)</td>
</tr>
<tr>
<td>Undecided</td>
<td>14 (7.3%)</td>
<td>12 (9.4%)</td>
<td>13 (7.0%)</td>
</tr>
</tbody>
</table>

1 Numbers in each column may not add up to N by column due to missing data.
2. Lower Division students are freshman and sophomores; Upper Division students are juniors and seniors.
Note: No significant differences were noted among aggregate demographic scores by supplement use category (Chi-square analysis).
Table 5. Multiple and single food supplements consumed by all supplement users in the 3 months prior to completing the Pima Community College food supplement use survey.

<table>
<thead>
<tr>
<th>Type of Supplement</th>
<th>Total Users n=305¹</th>
<th>Regular Users n=185¹,²</th>
<th>Sporadic Users n=120¹,²</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td># Used (% of Total Users)</td>
<td># Used (% of Regular Users)</td>
<td># Used (% of Sporadic Users)</td>
</tr>
<tr>
<td>MULTIPLES</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Multiple Vitamins</td>
<td>140 (44.9%)</td>
<td>84 (45.4%)</td>
<td>56 (44.1%)</td>
</tr>
<tr>
<td>Multivits + Minerals</td>
<td>94 (30.8%)</td>
<td>74 (40.0%)</td>
<td>20 (16.7%) ***</td>
</tr>
<tr>
<td>B-Complex</td>
<td>62 (20.3%)</td>
<td>46 (24.9%)</td>
<td>16 (13.3%) **</td>
</tr>
<tr>
<td>Multivits + Iron</td>
<td>57 (18.7%)</td>
<td>42 (22.7%)</td>
<td>15 (12.5%) *</td>
</tr>
<tr>
<td>Prenatal Vitamins</td>
<td>27 (8.9%)</td>
<td>20 (10.8%)</td>
<td>7 (5.8%)</td>
</tr>
<tr>
<td>B-complex + Iron</td>
<td>25 (8.2%)</td>
<td>16 (8.6%)</td>
<td>9 (7.5%)</td>
</tr>
<tr>
<td>Other Multiples</td>
<td>8 (2.6%)</td>
<td>6 (3.2%)</td>
<td>2 (1.7%)</td>
</tr>
<tr>
<td>Geritol</td>
<td>2 (0.7%)</td>
<td>2 (1.1%)</td>
<td>0 (0%)</td>
</tr>
<tr>
<td>SINGLES</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Vitamin C</td>
<td>170 (55.7%)</td>
<td>104 (56.2%)</td>
<td>66 (55.0%)</td>
</tr>
<tr>
<td>Calcium</td>
<td>78 (25.6%)</td>
<td>57 (30.8%)</td>
<td>21 (17.5%) **</td>
</tr>
<tr>
<td>Vitamin E</td>
<td>62 (21.6%)</td>
<td>48 (26.0%)</td>
<td>18 (15.0%) *</td>
</tr>
<tr>
<td>Iron</td>
<td>52 (17.1%)</td>
<td>36 (19.5%)</td>
<td>16 (13.3%)</td>
</tr>
<tr>
<td>Vitamin A</td>
<td>49 (16.1%)</td>
<td>37 (20.0%)</td>
<td>12 (10.0%) *</td>
</tr>
<tr>
<td>Vitamin B₆</td>
<td>40 (13.1%)</td>
<td>28 (15.1%)</td>
<td>12 (10.0%)</td>
</tr>
<tr>
<td>Vitamin B₁₂</td>
<td>38 (12.5%)</td>
<td>26 (14.1%)</td>
<td>12 (10.0%)</td>
</tr>
<tr>
<td>Potassium</td>
<td>36 (11.8%)</td>
<td>26 (14.1%)</td>
<td>10 (8.3%)</td>
</tr>
<tr>
<td>Zinc</td>
<td>34 (11.2%)</td>
<td>26 (14.1%)</td>
<td>8 (6.7%) *</td>
</tr>
<tr>
<td>Vitamin D</td>
<td>32 (10.5%)</td>
<td>20 (10.8%)</td>
<td>12 (10.0%)</td>
</tr>
<tr>
<td>Niacin</td>
<td>15 (4.9%)</td>
<td>12 (6.5%)</td>
<td>3 (2.5%)</td>
</tr>
<tr>
<td>Other Single Vits.</td>
<td>7 (2.3%)</td>
<td>7 (3.8%)</td>
<td>0 (0%)</td>
</tr>
<tr>
<td>Vitamin K</td>
<td>3 (1.0%)</td>
<td>3 (1.6%)</td>
<td>0 (0%)</td>
</tr>
<tr>
<td>Other Single Mins.</td>
<td>3 (1.0%)</td>
<td>3 (1.6%)</td>
<td>0 (0%)</td>
</tr>
</tbody>
</table>

¹ Numbers in each column may not add up to N due to multiple use within a category of supplements.

² Levels of significance are illustrated as * p < 0.05, ** p < 0.01, *** p < 0.001; p values are for the comparison of sporadic and regular food supplement users.
Table 6. Miscellaneous food supplements consumed by all supplement users in the 3 months prior to completing the Pima Community College food supplement use survey.

<table>
<thead>
<tr>
<th>Type of Supplement</th>
<th>Total Users n=305¹</th>
<th>Regular Users n=185¹,²</th>
<th>Sporadic Users n=120¹,²</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td># Used (% of Total Users)</td>
<td># Used (% of Regular Users)</td>
<td># Used (% of Sporadic Users)</td>
</tr>
<tr>
<td>OTHER</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Amino Acids</td>
<td>56 (18.4%)</td>
<td>42 (22.7%)</td>
<td>14 (11.7%)**</td>
</tr>
<tr>
<td>Garlic</td>
<td>45 (14.8%)</td>
<td>23 (12.4%)</td>
<td>22 (18.3%)</td>
</tr>
<tr>
<td>Aloe Vera</td>
<td>30 (9.8%)</td>
<td>17 (9.2%)</td>
<td>13 (10.8%)</td>
</tr>
<tr>
<td>Yeast</td>
<td>22 (7.2%)</td>
<td>11 (6.0%)</td>
<td>11 (9.2%)</td>
</tr>
<tr>
<td>Other Misc.</td>
<td>16 (5.1%)</td>
<td>12 (6.5%)</td>
<td>4 (3.2%)</td>
</tr>
<tr>
<td>Fish Oil</td>
<td>15 (4.9%)</td>
<td>10 (5.4%)</td>
<td>5 (4.2%)</td>
</tr>
<tr>
<td>Lecithin</td>
<td>13 (4.3%)</td>
<td>10 (5.4%)</td>
<td>3 (2.5%)</td>
</tr>
<tr>
<td>Bee Pollen</td>
<td>12 (3.9%)</td>
<td>8 (4.3%)</td>
<td>4 (3.3%)</td>
</tr>
<tr>
<td>Chlorophyll</td>
<td>10 (3.3%)</td>
<td>7 (3.8%)</td>
<td>3 (2.5%)</td>
</tr>
<tr>
<td>Sea Salt</td>
<td>7 (2.3%)</td>
<td>3 (1.6%)</td>
<td>4 (3.3%)</td>
</tr>
<tr>
<td>Spirulina</td>
<td>8 (2.6%)</td>
<td>6 (3.2%)</td>
<td>2 (1.6%)</td>
</tr>
<tr>
<td>Barleygreen</td>
<td>5 (1.6%)</td>
<td>4 (2.2%)</td>
<td>1 (0.8%)</td>
</tr>
<tr>
<td>Coenzyme Q-10</td>
<td>5 (1.6%)</td>
<td>5 (2.7%)</td>
<td>0 (0%)</td>
</tr>
<tr>
<td>Germanium</td>
<td>1 (0.3%)</td>
<td>1 (0.5%)</td>
<td>0 (0%)</td>
</tr>
<tr>
<td>Glandulars</td>
<td>1 (0.3%)</td>
<td>1 (0.5%)</td>
<td>0 (0%)</td>
</tr>
</tbody>
</table>

1 Numbers in each column may not add up to N due to multiple use within a category of supplements.
2 Levels of significance are illustrated as * p < 0.05, ** p < 0.01, *** p < 0.001; p values are for the comparison of sporadic and regular food supplement users.
Vitamin B₆, zinc, vitamin B₁₂ and potassium were the next most commonly used single supplements (15.1% of regular users used B₆; 14.1% used the others). Vitamin D, vitamin K, niacin and other vitamins and minerals were consumed by 20 (10.8%) or fewer subjects. Of regular supplement users, 24.3% did not take single supplements. An additional 25.9% reported taking only one single food supplement. Thirty students in the sample (16.2%) reported taking more than 5 single supplements during the three months prior to completing the survey.

Other food supplements were not very popular among regular supplement users with the exception of one. A total of 22.7% of the regular users reported using amino acids or protein powder. Garlic was the next most commonly used miscellaneous supplement with 12.4% users. Less than 10% of the regular users reported using aloe vera, yeast, lecithin and fish oil. Less than 5% reported use of bee pollen, chlorophyll, spirulina, coenzyme Q-10, barleygreen, sea salt, glandulars or germanium. Supplements not on the list were reportedly used by 6.5% of the subjects. A total of 79 regular users took 160 food supplements in this category for an average of 2 each. Six subjects (3.2%) took more than 5 types of supplements in this category during the three months prior to completing the survey.

A similar trend was seen for sporadic users of supplements (n=120). In the multiple supplement category, the most popular choices were multiple vitamins (44.1%), followed by multiple vitamins plus minerals (16.7%), B-Complex (13.3%), and multiple vitamins plus iron (12.5%). Less than 10% of the sporadic users reported taking any of the other multiple vitamins listed in this group: B-complex plus iron, prenatal vitamins, other multiple vitamins or Geritol.

The most commonly consumed single supplements by sporadic users were vitamin C (55.0%), calcium (17.5%) and vitamin E (15.0%). The next most
common supplements were vitamin A, vitamin B₆, vitamin D and vitamin B₁₂ (10.0% each). Less than 10% of the sporadic users reported taking the following food supplements: potassium, zinc, niacin or vitamin K. A total of 26.0% of the sporadic users did not use any single supplement and 35.4% used only one. Nine students (7.1%) reported taking 5 or more single supplements in the three months prior to completing the survey.

In terms of other food supplement consumption, sporadic users were again similar to regular users in that garlic and amino acids/protein powder were the most commonly used (18.3% for garlic, 11.7% for protein powder). The next most commonly consumed supplement was aloe vera (10.8%) followed by yeast (9.2%). Fewer than 5% of the sporadic users took any of the other supplements in this category (fish oil, bee pollen, sea salt, chlorophyll, lecithin, spirulina, barleygreen, glandulars, coenzyme Q-10, germanium, and others). The majority (55.1%) of sporadic users did not use any food supplement in this category. A total of 27.6 percent used only one. Only 2 students out of 127 (1.6%) sporadic users reported consumption of 5 or more supplements in this group.

As indicated previously, the number of supplements used by regular and sporadic food supplement users were presented in Tables 5 and 6. Figures 6, 7 and 8 compare the regular and sporadic use groups by supplement use type (multiple vitamins/minerals, single vitamins/minerals and other food supplements) in graphical form for improved clarity.

Overall, sporadic users consumed fewer multiple supplements than regular users, averaging $1.0 \pm 0.7$ supplements for sporadic users and $1.6 \pm 1.0$ multi-supplements for regular users over three months. This difference was statistically significant ($p < 0.0001$). Sporadic users also consumed fewer single
Figure 6. Percentage of Regular and Sporadic food supplement users in the Pima Community College food supplement use survey taking various multiple vitamins/minerals.

Percent of Users Taking Multi-supplements

Regular Users
Sporadic Users
Figure 7. Percentage of Regular and Sporadic food supplement users in the Pima Community College food supplement survey taking various single vitamins or minerals.
Figure 8. Percentage of Regular and Sporadic food supplement users in the Pima Community College food supplement use survey taking miscellaneous food supplements.
vitamin/mineral supplements than regular users ($p < 0.0049$). In this case, sporadic users consumed an average of $1.6 \pm 1.7$ single vitamin/mineral supplements while regular users averaged $2.3 \pm 2.6$ single supplements in the three month period. Consumption of other miscellaneous food supplements was low, averaging $0.7 \pm 1.1$ for sporadic users and $0.9 \pm 1.5$ for regular users, and did not differ significantly between the two groups. For all food supplements combined, sporadic users consumed an average of $3.3 \pm 2.7$ supplements while regular users took an average of $4.8 \pm 3.9$ supplements during the three months prior to taking the survey.

Several differences in consumption of specific vitamins or minerals were seen between regular users and sporadic users. Sporadic users reported significantly lower consumption of multivitamins plus minerals than regular users ($p < 0.001$). The sporadic users also reported significantly lower use of B-complex multivitamins ($p < 0.01$) and multivitamins plus iron ($p < 0.05$). For the single food supplements, sporadic users reported significantly lower use for calcium ($p < 0.01$), and for vitamin E, vitamin A, and zinc ($p < 0.05$). The only significant difference between sporadic users and regular users for miscellaneous food supplements was seen for amino acids/protein powders. For this supplement, regular users reported significantly higher usage than sporadic users ($p < 0.01$). It is interesting to note that sporadic users reported lower use than regular users for all food supplements except garlic, aloe vera, yeast and sea salt. This, however, was not significant. All of these products were categorized as miscellaneous food supplements because they are not vitamins or minerals.

The number and type of food supplements used were also examined for any association with the demographic variables. No significant differences were found
in supplement use patterns by sex, race, age group, store of purchase, division in college or college major (p > 0.05).

**Vitamins and Minerals**

The section of the survey entitled "Vitamins and Minerals" lists five common misconceptions about nutrition supplementation (vitamins provide pep and energy, people require vitamins if they feel tired and run down, vitamins are necessary because diets are inadequate, vitamin supplements are necessary to insure proper nutrition, and vitamins in excess of the Recommended Dietary Allowances protect health) and requests that the subjects indicate how much they agree or disagree with each statement. A higher score denotes stronger agreement with the statements and consequently more misinformation about vitamins and minerals. It was expected that supplement users would have higher scores on this section than non-users. This was, in fact, the case. Refer to Table 7 for a comparison of responses to each of the questions according to food supplement use level.

The statement "I believe that extra vitamins provide pep and energy" was a very good discriminator among the three food supplement use levels. Regular users had the highest average score (3.5 ± 1.0), followed by sporadic users (3.2 ± 1.0) and lastly, non-users (2.7 ± 1.0). Since a score of 5 represents 'strongly agree,' a score of 1 represents 'strongly disagree,' and a score of 3 represents 'neutral,' the average score for regular users indicates that they tended to agree with the statement that extra vitamins provide pep and energy. Sporadic users also tended to agree with that statement, whereas non-users tended to disagree. One-way analysis of variance was performed to examine the differences among the supplement use groups. The F-value was 29.49 (df=2, 495; p=0.0001). Tukey's studentized range test (p=0.05)
Table 7. Beliefs about vitamin and mineral supplementation among students in the Pima Community College food supplement use survey by supplement use category (supplement Non-Users, Sporadic Users and Regular Users).

<table>
<thead>
<tr>
<th>Vitamin/Mineral Statement</th>
<th>Non-Users n = 190 Mean ± SD¹</th>
<th>Sporadic Users n = 127 Mean ± SD¹</th>
<th>Regular Users n = 185 Mean ± SD¹</th>
</tr>
</thead>
<tbody>
<tr>
<td>Extra vitamins provided pep and energy.</td>
<td>2.7 ± 1.0 a</td>
<td>3.2 ± 1.0 b</td>
<td>3.5 ± 1.0 c</td>
</tr>
<tr>
<td>People need extra vitamins if they feel tired and run down.</td>
<td>3.0 ± 1.0 a</td>
<td>3.3 ± 0.9 b</td>
<td>3.4 ± 0.9 b</td>
</tr>
<tr>
<td>Eating a variety of foods provides all the vitamins and minerals necessary.</td>
<td>2.2 ± 1.0² a</td>
<td>2.4 ± 1.1² ab</td>
<td>2.5 ± 1.1² b</td>
</tr>
<tr>
<td>People should take supplemental vitamins or minerals to insure proper nutrition.</td>
<td>2.7 ± 1.0 a</td>
<td>3.2 ± 1.0 b</td>
<td>3.7 ± 0.9 c</td>
</tr>
<tr>
<td>People can protect their health by exceeding the RDAs.</td>
<td>2.3 ± 0.9 a</td>
<td>2.7 ± 1.0 b</td>
<td>2.9 ± 1.1 b</td>
</tr>
<tr>
<td>Overall Average</td>
<td>2.6 ± 0.7 a</td>
<td>3.0 ± 0.6 b</td>
<td>3.2 ± 0.6 c</td>
</tr>
</tbody>
</table>

¹ Questions were scored on a 5 point Likert scale ranging from strongly disagree (1) to strongly agree (5).
² This question was scored in reverse, so the lower the number the stronger the agreement.

Note: Different letters across rows signify statistical differences (p < 0.05).
was used to show that the differences among the three supplement use groups were significant.

The statement, "If people feel tired and run down, they probably need more vitamins or minerals," discriminated only between supplement users and non-users, but not between the sporadic and regular users (F-value = 8.18; df=2, 495; p=0.0003). Regular and sporadic supplement users tended to agree with the statement and non-users tended to be neutral. Regular users again had the highest average score (3.4 ± 0.9), followed by sporadic users (3.3 ± 0.9). Non-users had the lowest average score (3.0 ± 1.0). For this statement, regular and sporadic users had significantly higher average scores than non-users (Tukey, p=0.05), but the two user groups were not significantly different from one another.

The statement "People who eat a variety of foods every day can get all the vitamins and minerals they need" was scored in reverse, to continue the pattern that a higher score meant more misinformation about vitamins and minerals. Regular users had the highest average score (2.5 ± 1.1) followed closely by sporadic users (2.4 ± 1.1). Students who did not take food supplements had the lowest score (2.2 ± 1.0). For this question, all respondents tended to agree that people who eat a variety of foods can get all the vitamins and minerals they need. One-way analysis of variance (F-value = 5.54; df=2, 295; p=0.042) and Tukey's studentized range test (p=0.05) were used to discriminate among the supplement use groups. The responses for non-users were significantly lower than the responses for regular users of supplements, but neither was significantly different than sporadic users.

The next statement, "I feel most people should take supplemental vitamins or minerals to insure that they get proper nutrition," was the best discriminator among the three supplement use categories. Regular users had the highest score (3.7 ± 0.9),
indicating that they generally agree that supplemental vitamins are necessary. Sporadic users had the next highest score (3.2 ± 1.0), also indicating a tendency to agree that supplemental vitamins are necessary. Non-users of food supplements had an average score of 2.7 ± 1.0, indicating that they disagreed with the statement that supplemental vitamins were necessary. One-way analysis of variance was performed. The F-value was 44.74 (df=2,495; p=0.0001). Tukey's studentized range test (p=0.05) showed that regular users had significantly higher scores than sporadic users, who in turn, had significantly higher scores than non-users of food supplements.

The statement that "People can protect their health if they take more vitamins than provided for in the RDAs" was able to discriminate between supplement users and non-users, without distinguishing between regular and sporadic users (F-value = 16.50; df=2, 494; p=0.0001). Regular users had the highest score (2.9 ± 1.1) indicating a slight disagreement with the statement. Sporadic users had the next highest score (2.7 ± 1.0), also indicating some disagreement with the idea that exceeding the RDAs would protect their health. The two user groups did not differ significantly from one another (Tukey, p=0.05). Supplement non-users had the lowest score (2.3 ± 0.9) indicating the highest level of disagreement with the statement. This value was significantly lower than those for either of the supplement use categories.

Overall, the vitamin and mineral statements were good discriminators for the three food supplement use levels. Regular users had the highest aggregate score of 3.2 ± 0.6 indicating a general tendency toward agreement with the vitamin/mineral statements and the most misinformation about the function of and need for supplemental vitamins and minerals. Sporadic users had the next highest overall
score of $3.0 \pm 0.6$ indicating neutrality toward the statements about vitamins and minerals. The lowest total score was that of the non-users who averaged $2.6 \pm 0.7$. They exhibited a general disagreement toward the vitamin/mineral statements and consequently the least amount of misinformation about food supplement use. One-way analysis of variance was used to examine the differences among the three supplement use groups. The F-value was 42.44 (df=2, 494; $p=0.0001$). Tukey's studentized range test ($p=0.05$) showed that regular users of food supplements had significantly higher overall scores (and the most misinformation) about vitamins and minerals than either of the other two groups. Sporadic users had the next highest overall score, and this was significantly higher than non-users. It was hypothesized ($H_0$) that there was no statistical difference in beliefs about food supplements. This null hypothesis should be rejected since there were statistically significant differences among the supplement use groups (non-users, sporadic users and regular users of food supplements).

The final question in the Vitamins/Minerals section of the questionnaire was designed to check the perceived importance of food supplements relative to a balanced diet. A scale from one (indicating that students believed a balanced diet was more important than vitamin/mineral supplements) to three (indicating students thought food supplements were more important than a balanced diet) was used for this question. A score of two indicated that students believed a balanced diet and food supplements were of equal importance.

Perceived importance of a balanced diet relative to food supplement use proved to be a good discriminator among the three supplement use groups. Students who did not use food supplements had the lowest average score ($1.2 \pm 0.7$) indicating the strongest belief that a balanced diet is more important than food
supplements. The sporadic users had the next highest average score (1.3 ± 0.5). These students had a slight tendency toward believing that a balanced diet and food supplements were of equal importance. Finally, regular users had the highest average score for this question (1.5 ± 0.5). They had the highest inclination to believe that a balanced diet and supplements were of equal importance. Few students surveyed felt that food supplements were more important than a balanced diet. One-way analysis of variance was performed (F-value = 14.52; df=2, 481; p=0.0001). The three supplement use groups (regular users, sporadic users and non-users) were significantly different from one another (p=0.05).

All five statements about vitamins and minerals were highly correlated with one another (Table 8). For most statements, the probability of obtaining the calculated correlation coefficients by chance was less than 0.0001. The reliability of the five statements about vitamins and minerals was tested using a reliability coefficient developed by Kerlinger (1986). For these five statements, the reliability coefficient (r_{tt}) was found to be 0.98, indicating very high reliability. The composite score for all five statements about vitamins and minerals was significantly correlated with the students' feelings about the relative importance of a balanced diet and food supplements (Pearson r = 0.40796, p < 0.0001). Despite the significance of the relationship, the proportion of variance explained by the vitamin/mineral statements in one's feelings about the relative importance of a balanced diet versus food supplements was only 16.6 percent.

Demographic variables were evaluated for an association with each of the vitamin/mineral statements. There were no differences in responses to these statements by students' division in college (lower division versus upper division) or
Table 8. Pearson correlation coefficients (r) and probabilities of the association among five statements about vitamin/mineral supplementation among students in the Pima Community College food supplement use survey.

<table>
<thead>
<tr>
<th>Vitamin / Mineral Statement</th>
<th>VM1</th>
<th>VM2</th>
<th>VM3</th>
<th>VM4</th>
<th>VM5</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Pearson r</td>
<td>Pearson r</td>
<td>Pearson r</td>
<td>Pearson r</td>
<td>Pearson r</td>
</tr>
<tr>
<td></td>
<td>p value</td>
<td>p value</td>
<td>p value</td>
<td>p value</td>
<td>p value</td>
</tr>
<tr>
<td></td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
</tr>
<tr>
<td>VM1: I believe that extra vitamins provide pep and energy.</td>
<td>1.00000</td>
<td>0.47719</td>
<td>0.22566</td>
<td>0.43469</td>
<td>0.36659</td>
</tr>
<tr>
<td></td>
<td>0.0</td>
<td>0.0001</td>
<td>0.0001</td>
<td>0.0001</td>
<td>0.0001</td>
</tr>
<tr>
<td></td>
<td>498</td>
<td>498</td>
<td>498</td>
<td>498</td>
<td>497</td>
</tr>
<tr>
<td>VM2: If people feel tired and run down, they probably need more vitamins or minerals.</td>
<td>1.00000</td>
<td>0.15328</td>
<td>0.45877</td>
<td>0.33450</td>
<td></td>
</tr>
<tr>
<td></td>
<td>0.0</td>
<td>0.0006</td>
<td>0.0001</td>
<td>0.0001</td>
<td></td>
</tr>
<tr>
<td></td>
<td>498</td>
<td>498</td>
<td>498</td>
<td>497</td>
<td></td>
</tr>
<tr>
<td>VM3: People who eat a variety of foods every day can get all the vitamin and mineral they need.</td>
<td>1.00000</td>
<td>0.24734</td>
<td>0.11880</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>0.0</td>
<td>0.0001</td>
<td>0.0080</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>498</td>
<td>498</td>
<td>497</td>
<td></td>
<td></td>
</tr>
<tr>
<td>VM4: I feel most people should take supplemental vitamins or minerals to insure that they get proper nutrition.</td>
<td>1.00000</td>
<td>0.43887</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>0.0</td>
<td>0.0001</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>498</td>
<td>497</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>VM5: People can protect their health if they take more vitamins than provided for in the RDAs.</td>
<td>1.00000</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>0.0</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>497</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

1 Numbers in cells less than N=502 reflect missing data.

Vitamin/Mineral Statements:
VM1: I believe that extra vitamins provide pep and energy.
VM2: If people feel tired and run down, they probably need more vitamins or minerals.
VM3: People who eat a variety of foods every day can get all the vitamin and mineral they need.
VM4: I feel most people should take supplemental vitamins or minerals to insure that they get proper nutrition.
VM5: People can protect their health if they take more vitamins than provided for in the RDAs.
by race. When evaluating an age effect, students younger than 30 tended to have more misinformation about vitamin and mineral supplements than students older than 30. Despite this trend, only a few statistically significant differences were found. Students older than 30 tended to disagree more strongly with the statement that people need more vitamins and minerals if they feel tired and run down, whereas students younger than 30 tended to agree with this statement. Significant differences (F-value = 3.06; df=3, 492; p=0.0279) were found only between the 30-39 year olds and the 20-29 year olds (Tukey, p=0.05). Students over 30 also had significantly lower scores than those younger than 30 for the statement that people can protect their health if they take more vitamins than provided for in the RDAs (F-value = 4.97; df=3, 491; p=0.0021). The only other demographic interaction with statements about vitamins and minerals was with respect to the statement that "People can protect their health if they take more vitamins than provided for in the RDAs." For this statement, women in the survey sample scored significantly lower than men (F-value = 14.39; df=1, 495; p=0.0002), indicating that women tended to disagree with the statement more than men (Tukey, p=0.05). There were no other significant relationships among the vitamin-mineral statements and demographic variables.

**Health Beliefs**

The idea that food supplements help prevent or cure disease was tested by evaluating students' responses to four statements. For each statement, the respondent was asked to circle one of five choices ranging from 'strongly disagree,' scored as 1, to 'strongly agree,' scored as a 5. A neutral response was scored as 3. Therefore, a higher score indicated stronger agreement with each of the four statements: vitamin C prevents colds, many mental disorders are caused by vitamin
deficiencies, food supplements reduce stress, and diseases such as cancer are caused by lack of vitamins and minerals. A comparison of the health belief statements by supplement use groups (non-users, sporadic users and regular users) can be seen in Table 9.

The statement, "Vitamin C can prevent colds," was able to discriminate between supplement users and non-users, but not between sporadic and regular users. Regular users had the highest average score (3.3 ± 0.9), indicating a general tendency toward agreement with the statement. Sporadic users of supplements had the second highest score (3.2 ± 1.0), which was not significantly different from that of the regular users (p > 0.05) and also indicated a general tendency toward agreement with the statement that vitamin C can prevent colds. Students who did not use food supplements had the lowest score (3.0 ± 1.0), indicating a neutral response to this statement. The response of the non-users was, however, significantly lower than that of the two supplement user groups. One-way analysis of variance was performed (F-value = 5.66; df=2, 496; p=0.0037). All post-hoc tests were done using Tukey's studentized range test (p = 0.05).

For the statement, "Many mental disorders are caused by vitamin deficiencies," regular users had significantly higher responses than non-users (p < 0.05), but were not significantly different from sporadic users. The regular users averaged 2.9 ± 1.0, indicating a slight tendency to disagree with the statement. Sporadic users and non-users disagreed even more with the statement that mental disorders are caused by vitamin deficiencies, with average scores of 2.6 ± 0.9 and 2.5 ± 0.9, respectively. These were not significantly different from one another. The F-value was 7.31 (df=2, 495; p = 0.0007).
Table 9. Health beliefs about vitamins and minerals among students in the Pima Community College food supplement survey by supplement use category (supplement Non-Users, Sporadic Users and Regular Users).

<table>
<thead>
<tr>
<th>Health Belief Statement</th>
<th>Non-Users n=190 Mean ± SD(^1)</th>
<th>Sporadic Users n=127 Mean ± SD(^1)</th>
<th>Regular Users n=185 Mean ± SD(^1)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vitamin C can prevent colds.</td>
<td>3.0 ± 1.0 a</td>
<td>3.2 ± 1.0 ab</td>
<td>3.3 ± 0.9 b</td>
</tr>
<tr>
<td>Many mental disorders are caused by vitamin deficiencies.</td>
<td>2.5 ± 0.9 a</td>
<td>2.6 ± 0.9 ab</td>
<td>2.9 ± 1.0 b</td>
</tr>
<tr>
<td>Food supplements can help reduce stress.</td>
<td>2.7 ± 0.8 a</td>
<td>3.2 ± 0.9 b</td>
<td>3.4 ± 0.9 c</td>
</tr>
<tr>
<td>Diseases such as cancer can be caused by a lack of vitamins and minerals.</td>
<td>2.3 ± 0.9 a</td>
<td>2.5 ± 0.9 ab</td>
<td>2.6 ± 0.9 b</td>
</tr>
<tr>
<td>Overall Average</td>
<td>2.6 ± 0.6 a</td>
<td>2.9 ± 0.6 b</td>
<td>3.1 ± 0.6 b</td>
</tr>
</tbody>
</table>

1 Questions were scored on a 5 point Likert scale ranging from strongly disagree (1) to strongly agree (5).

Note: Different letters across supplement use categories signify statistical differences (p < 0.05).
The statement that "Food supplements can help reduce stress" proved to be the best discriminator among supplement use levels in the health belief section of the questionnaire. Regular supplement users tended to agree with this statement, with an average score of \(3.4 \pm 0.9\). Sporadic users had the second highest score (\(3.2 \pm 0.9\), followed by students who did not use food supplements (\(2.7 \pm 0.8\)). Sporadic users also tended to believe that food supplements help reduce stress, but their responses were not as strong as the regular food supplement users. Non-users tended to disagree with the statement. One-way analysis of variance was performed (\(F\)-value = 30.81; \(df=2, 495\); \(p=0.0001\)) and Tukey's studentized range test (\(p=0.05\)) showed significant differences among the three supplement use groups.

Finally, the statement "Diseases such as cancer can be caused by a lack of vitamins and minerals" mimicked the trends seen before, with regular users of food supplements having the highest average score (\(2.6 \pm 0.9\), followed by sporadic users (\(2.5 \pm 0.9\)). Non-users again had the lowest average score (\(2.3 \pm 0.9\)). For this statement, all supplement use groups tended to disagree with the statement that cancer can be caused by a lack of vitamins and minerals. Food supplement non-users disagreed the most with the statement that diseases such as cancer can be caused by a lack of vitamins and minerals. The responses from regular users were significantly different from non-users (Tukey, \(p=0.05\)), but sporadic users were not different from either non-users or regular users. The \(F\)-value was 5.27 (\(df=2, 496\); \(p=0.0054\)).

When all health belief questions were evaluated together, regular food supplement users had the highest average score (\(3.1 \pm 0.6\)), indicating slight agreement with the statements in the health belief section. Sporadic users had an overall score of \(2.9 \pm 0.6\), indicating a slight disagreement with these statements.
Finally, non-users had an average score of $2.6 \pm 0.6$, indicating a stronger disagreement with the health belief statements than that of the sporadic users. A one-way analysis of variance was determined ($F$-value = 23.24; $df=2, 494$; $p=0.0001$). Tukey's studentized range test ($p=0.05$) showed significant differences between non-users and food supplement users, but not between the two supplement use groups. The hypothesis ($H_{01}$) stating that there is no statistical difference in beliefs about food supplements should therefore be rejected, since statistical differences were seen between supplement non-users and those who regularly or sporadically take food supplements.

The last question in the health beliefs section was designed to check the perceived overall health benefits food supplements had to offer. When asked, "To what extent do you feel food supplements benefit your health?" students responded that food supplement were of great, some, little, or no benefit to their health. For this question, the higher the average score, the smaller the perceived health benefits of food supplements. Not surprisingly, non-users had the highest average score ($2.7 \pm 0.9$) indicating that students who do not take food supplements tend to believe they are of little benefit to overall health. Sporadic supplement users had the next highest average score ($2.1 \pm 0.6$) indicating that students who take supplements on an irregular basis think food supplements are of some benefit to their health. Regular supplement users had the lowest average score ($1.7 \pm 0.6$) indicating that students who regularly take food supplements believe that they are a great benefit to their health. A one-way analysis of variance was calculated. The $F$-value was 82.15 ($df=2, 493; p=0.0001$). The three supplement use groups were all significantly different from one another ($p < 0.05$).
Pearson correlation coefficients were calculated for the four statements about the ability of food supplements to prevent or cure disease. All were positively correlated with one another and probabilities that these correlations were different than chance associations were all significant. Results of the correlations can be seen in Table 10. The reliability of the four health beliefs statements was calculated (Kerlinger, 1986). The reliability coefficient, $r_{tt}$, was found to be 0.96, indicating high reliability among the statements.

When the aggregate score for all four health belief statements was calculated and compared with the perceived health benefits of food supplements, a significant negative correlation was obtained. This was to be expected since a higher score on the question about perceived health benefits of food supplements meant that the respondent felt they were of little benefit, whereas a higher score for the other health belief statements indicated that food supplements would prevent or cure disease.

The health beliefs statements were also evaluated with respect to the demographic variables. No significant effects of sex, division in college (lower division versus upper division), or race were seen. Associations were seen between the statement "Many mental disorders are caused by vitamin deficiencies," college major and age. Students in the health related professions had the highest average scores for this statement. Their responses were significantly higher than responses for students in liberal arts, with business majors and education majors close to significance. All students tended to disagree with the statement, however. This was the only statement in the health beliefs section for which students in the health related professions had the highest score. For all other statements in the health beliefs section, education majors had the highest average scores, but these results
Table 10. Pearson correlation coefficients (r) and probabilities of the association among four statements about the health benefits of food supplements among students in the Pima Community College food supplement use survey.

<table>
<thead>
<tr>
<th>Health Belief Statement</th>
<th>HB1 Pearson r</th>
<th>HB2 Pearson r</th>
<th>HB3 Pearson r</th>
<th>HB4 Pearson r</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>p value N</td>
<td>p value N</td>
<td>p value N</td>
<td>p value N</td>
</tr>
<tr>
<td>HB1</td>
<td>1.00000 0.0 499</td>
<td>0.13418 0.0027 498</td>
<td>0.30325 0.0001 498</td>
<td>0.21716 0.0001 499</td>
</tr>
<tr>
<td>HB2</td>
<td>1.00000 0.0 498</td>
<td>0.29829 0.0001 497</td>
<td>0.34796 0.0001 498</td>
<td></td>
</tr>
<tr>
<td>HB3</td>
<td>1.00000 0.0 498</td>
<td>0.30930 0.0001 498</td>
<td></td>
<td></td>
</tr>
<tr>
<td>HB4</td>
<td>1.00000 0.0 499</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

1 Numbers in cells less than N = 502 reflect missing data.

**Health Belief Statements:**
- HB1  Vitamin C can prevent colds.
- HB2  Many mental disorders are caused by vitamin deficiencies.
- HB3  Food supplements can help reduce stress.
- HB4  Diseases such as cancer can be caused by a lack of vitamins and minerals.
were not significant. Students over 30 had the highest average scores for this statement, also. The calculated F-value for the mental disorders statement by age was 11.11 (df=3, 492; p = 0.0001). Students over 30 were significantly different from students under 30 years of age (Tukey, p = 0.05), in that they tended to believe many mental disorders were caused by vitamin deficiencies, whereas younger students disagreed.

**Sources of Nutrition Information**

Information about nutrition is available from a variety of sources. Students in the Pima Community College food supplement survey were asked to indicate the frequency with which they seek nutrition information from the following sources: books, chiropractors, family members, friends, grocery stores, health food stores, home economists, newspapers/magazines, nutritionists/dietitians, pharmacists, physicians (MDs), television/radio or other sources. Table 11 reports the sources of nutrition information occasionally or frequently used by non-users, sporadic users and regular users of food supplements.

Differences were seen among non-users, sporadic users and regular users of food supplements for frequency of use of various sources of nutrition information. Regular users of food supplements were more likely than sporadic users or non-users to rely on books for their nutrition information. Sporadic and regular users were more likely to seek nutrition information from chiropractors and health food stores than non-users. No other significant differences among the three supplement use groups were seen.

Overall, the sources of nutrition information most frequently sought by all respondents to the survey were family members, books and newspapers/magazines. Friends and physicians (MDs) were also among the most frequently sought sources.
Table 11. Comparison of frequency of use of sources of nutrition information among Non-Users, Sporadic Users and Regular Users of food supplements in the Pima Community College food supplement use survey.

<table>
<thead>
<tr>
<th>Source of Nutrition Information</th>
<th>Non-Users (n=190) # Used (% of Non-Users)</th>
<th>Sporadic Users (n=127) # Used (% of Sporadic Users)</th>
<th>Regular Users (n=185) # Used (% of Regular Users)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Books</td>
<td>113 (59.5%)</td>
<td>78 (61.4%)</td>
<td>132 (71.4%)*</td>
</tr>
<tr>
<td>Chiropractors</td>
<td>12 (6.3%)</td>
<td>20 (15.8%)*</td>
<td>25 (13.5%)*</td>
</tr>
<tr>
<td>Family Members</td>
<td>128 (67.4%)</td>
<td>89 (70.1%)</td>
<td>128 (69.2%)</td>
</tr>
<tr>
<td>Friends</td>
<td>118 (62.1%)</td>
<td>87 (68.5%)</td>
<td>114 (61.6%)</td>
</tr>
<tr>
<td>Grocery Stores</td>
<td>69 (36.3%)</td>
<td>32 (25.2%)</td>
<td>59 (31.9%)</td>
</tr>
<tr>
<td>Health Food Stores</td>
<td>50 (26.3%)</td>
<td>51 (40.2%)*</td>
<td>77 (41.6%)*</td>
</tr>
<tr>
<td>Home Economists</td>
<td>17 (9.0%)</td>
<td>11 (8.7%)</td>
<td>19 (10.3%)</td>
</tr>
<tr>
<td>Newspaper/Magazines</td>
<td>127 (66.8%)</td>
<td>80 (63.0%)</td>
<td>127 (68.7%)</td>
</tr>
<tr>
<td>Dietitians</td>
<td>53 (27.9%)</td>
<td>39 (30.7%)</td>
<td>63 (34.1%)</td>
</tr>
<tr>
<td>Pharmacists</td>
<td>48 (25.3%)</td>
<td>25 (19.7%)</td>
<td>54 (29.2%)</td>
</tr>
<tr>
<td>Physicians (MDs)</td>
<td>105 (55.3%)</td>
<td>59 (46.5%)</td>
<td>105 (56.8%)</td>
</tr>
<tr>
<td>TV/Radio</td>
<td>92 (48.4%)</td>
<td>56 (44.1%)</td>
<td>85 (46.0%)</td>
</tr>
<tr>
<td>Other</td>
<td>11 (5.8%)</td>
<td>11 (8.7%)</td>
<td>12 (6.5%)</td>
</tr>
</tbody>
</table>

1 Levels of significance are illustrated as * p < 0.05, ** p < 0.01, *** p < 0.001; p values are for the comparison of sporadic or regular users with non-users.
The most infrequently used sources by all groups were chiropractors and home economists.

Several demographic associations were seen in the data from the sources of nutrition information section. Women used books \( (p < 0.001) \), newspapers and magazines \( (p < 0.001) \), dietitians \( (p < 0.05) \) and physicians \( (p < 0.01) \) significantly more frequently as sources of nutrition information than the men in this sample. Upper division students (juniors or seniors) relied on books for nutrition information significantly more than lower division students (freshman and sophomores). This was significant at the 0.05 level. The only significant relationship between race and sources of nutrition information was that Hispanics were most likely to seek nutrition information from family members compared to students of other races \( (p < 0.05) \).

Students in the health professions sought nutrition information from books significantly more often than students in other majors \( (p < 0.01) \). They also used nutritionists/dietitians significantly more \( (p < 0.05) \). Education and liberal arts majors were most likely to rely on family members and friends for their nutrition information compared to students in other majors \( (p < 0.01 \text{ for family}; p < 0.05 \text{ for friends}) \). Science, engineering and business majors reported the greatest use of home economists compared to students in other majors \( (p < 0.05) \). Liberal arts majors and students in the health related professions were most likely to seek nutrition information from the newspaper or from magazines than students in other majors \( (p < 0.001) \). Finally, students in education, liberal arts and health related professions sought nutrition information from physicians more often than students in science, engineering or business \( (p < 0.01) \). No significant differences were seen among students with different college majors for the use of chiropractors, grocery
stores, health food stores, pharmacists or television/radio as sources of nutrition information.

Students younger than 30 years old relied on family members most heavily for nutrition information (p < 0.001) compared to older students. Family members and friends were used less and less as people got older, as would be expected. Compared to other age groups, those under 30 were more likely to seek information from pharmacists, but this was not significant. Students 30 years and older used books as sources of nutrition information significantly more than students under 30 (p < 0.05). Older students tended to use chiropractors as sources of nutrition information more than younger students, but this was not significant. Health food stores were used most by students between the ages of 30 and 39. No significant differences were seen by age for seeking nutrition information from grocery stores, health food stores, home economists, newspapers/magazines, nutritionists/dietitians, physicians, television or radio.

Promotional Pamphlet Evaluation

The final section of the questionnaire on food supplement use among students at Pima Community College was designed to investigate the respondent’s attitudes, normative beliefs and behavioral intention to take either calcium supplements or bee pollen using the Theory of Reasoned Action as the theoretical framework.

Belief products were calculated by multiplying the belief strength (+3 for extremely likely to -3 for extremely unlikely) by the outcome evaluation (ranging from 7 for extremely good to 1 for extremely bad) for each statement. Individual belief statements, their evaluation statements and calculated belief products can be seen in Table 12 for supplement non-users, Table 13 for sporadic users and Table 14
for regular users. Beliefs held by non-users were neutral for both calcium and bee pollen, in contrast to sporadic users and regular users who tended to have stronger beliefs about calcium supplementation. The evaluation statements all tended to be high with the exception of the evaluation of spending money on calcium or bee pollen. Note that multiplying the average for each belief statement by the average for each evaluation of that belief does not give the average belief product. The calculations were performed on each respondent, and then averaged.

By comparing the products of each belief strength and evaluation among non-users, sporadic users and regular users of food supplements, differences among the groups can be identified (Table 15). For all belief products, calcium and bee pollen were found to be significantly different from one another ($p > 0.001$). Both non-users and supplement users believed the statement that calcium improves resistance to disease. However, supplement users had significantly higher belief products for this statement than non-users ($p < 0.001$). Non-users negatively evaluated the association of bee pollen and disease resistance, but sporadic users and regular users of food supplements tended to be neutral ($p < 0.001$). A similar pattern was seen for the two statements that calcium or bee pollen improves physical vitality and insures a good diet. For these two statements, supplement non-users had the lowest evaluation whereas supplement users regarded the statements more positively. Again, the differences between the non-users and the two supplement use groups were statistically significant ($p < 0.001$) and the calcium beliefs were significantly higher than the bee pollen beliefs ($p < 0.0001$). Regular food supplement users disagreed most strongly with the statement that calcium supplements are a waste of money, but sporadic supplement users were the ones who had the strongest belief that bee pollen was not waste of money ($p < 0.01$).
Table 12. Beliefs, evaluation statements and belief products for Non-Users in the Pima Community College food supplement survey.

<table>
<thead>
<tr>
<th>Belief</th>
<th>Calcium mean</th>
<th>Bee Pollen mean</th>
<th>Calcium mean</th>
<th>Bee Pollen mean</th>
<th>Calcium mean</th>
<th>Bee Pollen mean</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Calcium or bee pollen will improve my resistance to disease.</td>
<td>0.34 ± 1.95</td>
<td>-0.43 ± 1.59</td>
<td>6.24 ± 1.21</td>
<td>5.80 ± 1.38</td>
<td>2.56 ± 12.16</td>
<td>-2.51 ± 9.54</td>
</tr>
<tr>
<td>2. Calcium or bee pollen will improve my physical vitality.</td>
<td>-0.02 ± 1.96</td>
<td>-0.41 ± 1.71</td>
<td>6.43 ± 0.85</td>
<td>5.91 ± 1.35</td>
<td>-0.25 ± 13.09</td>
<td>-2.51 ± 10.53</td>
</tr>
<tr>
<td>3. Calcium or bee pollen will help insure a good diet.</td>
<td>0.08 ± 1.90</td>
<td>-0.57 ± 1.64</td>
<td>6.41 ± 0.88</td>
<td>5.99 ± 1.18</td>
<td>0.29 ± 12.48</td>
<td>-3.38 ± 10.56</td>
</tr>
<tr>
<td>4. Purchasing calcium or bee pollen will be a waste of money.</td>
<td>-0.01 ± 2.15</td>
<td>0.68 ± 1.97</td>
<td>3.68 ± 2.03</td>
<td>2.91 ± 1.76</td>
<td>-2.84 ± 9.03</td>
<td>0.62 ± 6.11</td>
</tr>
<tr>
<td>5. Using calcium or bee pollen will lead to side effects.</td>
<td>-1.16 ± 1.68</td>
<td>-0.33 ± 1.34</td>
<td>5.38 ± 1.71</td>
<td>5.38 ± 1.65</td>
<td>-5.78 ± 9.84</td>
<td>-2.11 ± 7.54</td>
</tr>
<tr>
<td>6. Using calcium or bee pollen is based on science.</td>
<td>1.71 ± 1.26</td>
<td>0.21 ± 1.71</td>
<td>4.81 ± 1.59</td>
<td>4.49 ± 1.53</td>
<td>8.90 ± 6.86</td>
<td>1.34 ± 7.88</td>
</tr>
</tbody>
</table>

1 Belief statements were scored from +3 (extremely likely) to -3 (extremely unlikely).
2 Evaluation statements were scored from 7 (extremely good, wise or important) to 1 (extremely bad, foolish or unimportant).
3 Belief products have a possible range of +21 to -21.
Table 13. Beliefs, evaluation statements and belief products for Sporadic Users in the Pima Community College food supplement use survey.

<table>
<thead>
<tr>
<th>Belief</th>
<th>Calcium mean ± SD</th>
<th>Bee Pollen mean ± SD</th>
<th>Evaluation mean ± SD</th>
<th>Calcium mean ± SD</th>
<th>Bee Pollen mean ± SD</th>
<th>Belief Product mean ± SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Calcium or bee pollen will improve my resistance to disease.</td>
<td>1.17 ± 1.38</td>
<td>-0.05 ± 1.71</td>
<td>6.22 ± 1.13</td>
<td>5.95 ± 1.37</td>
<td>7.44 ± 8.98</td>
<td>0.02 ± 10.67</td>
</tr>
<tr>
<td>Calcium or bee pollen will improve my physical vitality.</td>
<td>0.59 ± 1.46</td>
<td>0.03 ± 1.70</td>
<td>6.34 ± 0.98</td>
<td>6.18 ± 0.98</td>
<td>3.86 ± 9.11</td>
<td>0.35 ± 10.90</td>
</tr>
<tr>
<td>Calcium or bee pollen will help insure a good diet.</td>
<td>0.88 ± 1.44</td>
<td>-0.20 ± 1.77</td>
<td>6.27 ± 1.13</td>
<td>6.15 ± 1.07</td>
<td>5.17 ± 9.21</td>
<td>-1.37 ± 11.62</td>
</tr>
<tr>
<td>Purchasing calcium or bee pollen will be a waste of money.</td>
<td>-0.73 ± 1.74</td>
<td>-0.08 ± 2.00</td>
<td>4.54 ± 1.65</td>
<td>3.70 ± 1.72</td>
<td>-4.00 ± 9.11</td>
<td>-1.57 ± 7.26</td>
</tr>
<tr>
<td>Using calcium or bee pollen will lead to side effects.</td>
<td>-1.32 ± 1.58</td>
<td>-0.45 ± 1.38</td>
<td>5.46 ± 1.51</td>
<td>5.75 ± 1.50</td>
<td>-7.05 ± 9.53</td>
<td>-2.92 ± 7.50</td>
</tr>
<tr>
<td>Using calcium or bee pollen is based on science.</td>
<td>1.71 ± 1.31</td>
<td>0.22 ± 1.69</td>
<td>5.42 ± 1.25</td>
<td>5.18 ± 1.28</td>
<td>9.75 ± 7.46</td>
<td>1.10 ± 9.56</td>
</tr>
</tbody>
</table>

1 Belief statements were scored from +3 (extremely likely) to -3 (extremely unlikely).
2 Evaluation statements were scored from 7 (extremely good, wise or important) to 1 (extremely bad, foolish or unimportant).
3 Belief products have a possible range of +21 to -21.
Table 14. Beliefs, evaluation statements and belief products for Regular Users in the Pima Community College food supplement use survey.

<table>
<thead>
<tr>
<th>Belief</th>
<th>Calcium mean ± SD</th>
<th>Bee Pollen mean ± SD</th>
<th>Calcium mean ± SD</th>
<th>Bee Pollen mean ± SD</th>
<th>Calcium mean ± SD</th>
<th>Bee Pollen mean ± SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Calcium or bee pollen will improve my resistance to disease.</td>
<td>1.11 ± 1.45</td>
<td>-0.10 ± 1.36</td>
<td>6.37 ± 1.10</td>
<td>6.01 ± 1.28</td>
<td>7.15 ± 9.72</td>
<td>-0.45 ± 8.35</td>
</tr>
<tr>
<td>Calcium or bee pollen will improve my physical vitality.</td>
<td>0.88 ± 1.46</td>
<td>0.09 ± 1.52</td>
<td>6.55 ± 0.85</td>
<td>6.23 ± 1.08</td>
<td>5.99 ± 9.76</td>
<td>0.67 ± 9.79</td>
</tr>
<tr>
<td>Calcium or bee pollen will help insure a good diet.</td>
<td>0.78 ± 1.49</td>
<td>-0.05 ± 1.50</td>
<td>6.49 ± 0.70</td>
<td>6.23 ± 1.00</td>
<td>5.19 ± 9.89</td>
<td>-0.27 ± 9.65</td>
</tr>
<tr>
<td>Purchasing calcium or bee pollen will be a waste of money.</td>
<td>-1.00 ± 1.93</td>
<td>0.45 ± 1.73</td>
<td>4.92 ± 1.72</td>
<td>3.50 ± 1.64</td>
<td>-7.38 ± 9.82</td>
<td>-0.02 ± 5.90</td>
</tr>
<tr>
<td>Using calcium or bee pollen will lead to side effects.</td>
<td>-1.06 ± 1.65</td>
<td>-0.29 ± 1.49</td>
<td>5.77 ± 1.64</td>
<td>5.70 ± 1.51</td>
<td>-6.36 ± 10.76</td>
<td>-1.27 ± 9.07</td>
</tr>
<tr>
<td>Using calcium or bee pollen is based on science.</td>
<td>1.92 ± 1.33</td>
<td>0.26 ± 1.65</td>
<td>5.93 ± 1.15</td>
<td>5.80 ± 1.19</td>
<td>11.58 ± 8.83</td>
<td>1.41 ± 10.07</td>
</tr>
</tbody>
</table>

1 Belief statements were scored from +3 (extremely likely) to -3 (extremely unlikely).
2 Evaluation statements were scored from 7 (extremely good, wise or important) to 1 (extremely bad, foolish or unimportant).
3 Belief products have a possible range of +21 to -21.
Table 15. Belief products for calcium and bee pollen supplementation for Non-Users, Sporadic Users and Regular Users of food supplements in the Pima Community College food supplement use survey.

<table>
<thead>
<tr>
<th>Belief</th>
<th>Non-Users mean belief product</th>
<th>Sporadic Users mean belief product</th>
<th>Regular Users mean belief product</th>
</tr>
</thead>
<tbody>
<tr>
<td>Calcium or bee pollen will improve my resistance to disease.</td>
<td>Calcium</td>
<td>2.55 a&lt;sup&gt;1&lt;/sup&gt;</td>
<td>Bee Pollen</td>
</tr>
<tr>
<td>Calcium or bee pollen will improve my physical vitality.</td>
<td>Calcium</td>
<td>-0.25 a</td>
<td>Bee Pollen</td>
</tr>
<tr>
<td>Calcium or bee pollen will help insure a good diet.</td>
<td>Calcium</td>
<td>0.29 a</td>
<td>Bee Pollen</td>
</tr>
<tr>
<td>Purchasing calcium or bee pollen will be a waste of money.</td>
<td>Calcium</td>
<td>-2.84 a</td>
<td>Bee Pollen</td>
</tr>
<tr>
<td>Using calcium or bee pollen will lead to side effects.</td>
<td>Calcium</td>
<td>-5.78 a</td>
<td>Bee Pollen</td>
</tr>
<tr>
<td>Using calcium or bee pollen is based on science.</td>
<td>Calcium</td>
<td>8.90 a</td>
<td>Bee Pollen</td>
</tr>
</tbody>
</table>

1 Different letters across rows signify statistical differences (p < 0.05).
2 Within each supplement use category, bee pollen and calcium belief products were significantly different from one another (p < 0.001).
All students disagreed that using calcium or bee pollen leads to side effects, but students responded that they were less likely to get side effects from calcium supplements than from bee pollen. Finally, no differences were seen among the supplement user groups for the scientific basis for taking either calcium or bee pollen. All supplement user groups agreed (erroneously) that the promotions of bee pollen and calcium were based on science, but the calcium supplements were perceived to have a significantly higher scientific basis than the bee pollen supplements. From this list, we can conclude that perceived improvement in disease resistance, improvement in physical vitality, contribution to a good diet and value for the money were the factors that contributed most to a student's decision to take either calcium or bee pollen supplements.

Pearson product moment correlations were determined to measure the degree of association between each belief product and the attitude toward supplement use for both users and non-users. The beliefs tested in the model were that the supplement (either calcium or bee pollen) would improve disease resistance, improve physical vitality, insure a good diet, be a waste of money, lead to side effects, and that its use was based on science. Attitude was a composite score obtained from three responses to the statement "My taking bee pollen supplements is good/bad, wise/foolish, helpful/harmful." These three responses were highly positively correlated with one another \( (r= .74, .68 \text{ and } .77 \text{ among the three statements, } p<0.0001) \), so the responses were averaged for each student prior to correlation with belief products. The reliability coefficient for these statements, \( r_{tt} \), was found to be 0.91.

All provided positive correlations with attitude except the statements that supplements would be a waste of money and lead to side effects. These two beliefs
were negatively correlated with attitude. The correlations among the belief
statements and attitude toward taking either calcium or bee pollen supplements for
non-users, sporadic users and regular food supplement users are shown in Table 16.
Overall, the beliefs about food supplements entered into the model were highly
significantly correlated with attitude for all supplement use groups, with the
exception of the belief about side effects.

When the individual belief products for calcium were regressed stepwise
against the variable attitude, three beliefs emerged as significant for supplement
non-users (p < 0.05). The most important variable in the non-user student’s
decision to take calcium was if its use would help insure a good diet (partial
R² = 0.2827, p < 0.0001). The second most important variable was whether the
supplement was based on science (partial R² = 0.0513, p < 0.01). The third variable
to enter the model was whether the use of the supplements was perceived to be a
waste of money (partial R² = 0.0426, p < 0.01). For non-users of food supplements,
the three variables (improved physical vitality, concern about wasting money and
scientific basis) yielded a total R² equal to 0.3765 for the belief products predicting
attitude toward calcium supplementation in this model.

Only two variables were significant in the prediction of supplement non-users
in their attitude toward bee pollen. The first was belief that bee pollen would
improve physical vitality (partial R² = 0.4106, p < 0.0001). The other significant
factor was whether bee pollen would be a waste of money (partial R² = 0.0504, p <
0.01). These two variables generated a total R² equal to 0.4610 for the belief
products predicting bee pollen supplementation among food supplement non-users.

Two variables were shown to be important predictors of attitude about
calcium supplements for sporadic users. Sporadic users felt that insuring a good diet
Table 16. Pearson correlation coefficients (r) between belief products and attitude toward calcium and bee pollen use for food supplement Non-Users, Sporadic Users and Regular Users in the Pima Community College food supplement use survey.

<table>
<thead>
<tr>
<th>Belief</th>
<th>Non-Users r with attitude</th>
<th>Sporadic Users r with attitude</th>
<th>Regular Users r with attitude</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Calcium n=93</td>
<td>Bee Pollen n=90</td>
<td>Calcium n=59</td>
</tr>
<tr>
<td>Calcium or bee pollen will improve my resistance to disease.</td>
<td>0.446****</td>
<td>0.498****</td>
<td>0.525****</td>
</tr>
<tr>
<td>Calcium or bee pollen will improve my physical vitality.</td>
<td>0.524****</td>
<td>0.641****</td>
<td>0.543****</td>
</tr>
<tr>
<td>Calcium or bee pollen will help insure a good diet.</td>
<td>0.532****</td>
<td>0.533****</td>
<td>0.575****</td>
</tr>
<tr>
<td>Purchasing calcium or bee pollen will be a waste of money.</td>
<td>-0.403****</td>
<td>-0.466****</td>
<td>-0.356**</td>
</tr>
<tr>
<td>Using calcium or bee pollen will lead to side effects.</td>
<td>-0.327***</td>
<td>-0.269**</td>
<td>-0.291*</td>
</tr>
<tr>
<td>Using calcium or bee pollen is based on science.</td>
<td>0.385****</td>
<td>0.344***</td>
<td>0.346**</td>
</tr>
</tbody>
</table>

1 Levels of significance are illustrated as * p < 0.05, ** p < 0.01, *** p < 0.001, and **** p < 0.0001 for correlations between belief products and attitude.
was the most important factor in their attitude about calcium supplements (partial $R^2=0.3306$, $p < 0.0001$). The second most important consideration for sporadic supplement users was that the supplements would not lead to any undesirable side effects (partial $R^2=0.0750$, $p < 0.01$). For sporadic supplement users, attitude toward calcium supplements was predicted best by two variables, insurance of a good diet, and perceived lack of side effects, for a total $R^2$ equal to 0.4058.

Improvement of physical vitality and insurance of a good diet were the two most important variables in the sporadic supplement user's attitude toward bee pollen. Physical vitality accounted for a partial $R^2=0.5262$ ($p < 0.0001$), whereas insurance of a good diet contributed a partial $R^2=0.0402$ ($p < 0.05$). The total $R^2$ for the model predicting the attitude of sporadic users toward bee pollen supplements was 0.5665.

To predict attitude about calcium supplements among regular users of food supplements, a three variable model of belief products was found to be significant. The most important consideration for regular supplement users was increased disease resistance (partial $R^2=0.3145$, $p < 0.0001$). The second belief product to enter into the model to predict attitude toward calcium supplements was whether their use was based on science (partial $R^2=0.0377$, $p \geq 0.05$). The third most important consideration was whether the supplement would be a waste of money (partial $R^2=0.0323$, $p \geq 0.05$). These three variables accounted for a total $R^2$ equal to 0.3845 in the model to predict the attitude of regular food supplement users toward calcium.

Finally, the factors contributing the most to the attitude of regular supplement users toward bee pollen were scientific basis, perceived side effects and the impact on physical vitality. Calculated partial $R^2$ values for each of these
variables in the prediction of attitude were 0.4209 (p < 0.0001) for science, 0.1038 (p < 0.0001) for side effects, and 0.283 (p < 0.05) for physical vitality. These three variables yielded a total $R^2$ value of 0.5530 to the model to predict attitude toward bee pollen supplementation among regular supplement users.

The second component of the Theory of Reasoned Action determined in the Pima Community College food supplement use survey was the degree of association between each normative belief product and the subjective norm statement. Subjective norm was assessed directly with the statement, "Most people who are important to me think that my taking calcium/bee pollen..." Responses ranged from +3 for extremely good to -3 for extremely bad. The normative belief products were calculated by multiplying the subject's belief that significant others think he should or should not take calcium or bee pollen supplements by the subject's motivation to comply with the significant others. Normative belief statements were scored from +3 for perception that normative referents think taking the supplement is extremely good to -3 for the perception that others think taking the supplement is extremely bad. The motivation to comply statements were scored from 7 for extremely likely to comply to 1 for extremely unlikely to comply. Therefore, normative belief products had a possible range of +21 to -21. Normative referents examined in the model were the roles of family, friends and doctors in one's decision to take either calcium or bee pollen supplements.

Average normative beliefs, motivation to comply statements and calculated normative belief products for calcium and bee pollen are presented in Tables 17, 18 and 19 for non-users, sporadic users and regular users, respectively. Normative belief statements for bee pollen had lower scores than normative belief statements
Table 17. Normative beliefs, motivation to comply and normative belief products for Non-Users of food supplements in the Pima Community College food supplement use survey.

<table>
<thead>
<tr>
<th>Normative Referent</th>
<th>Normative Beliefs&lt;sup&gt;1&lt;/sup&gt; mean ± SD</th>
<th>Motivation to Comply&lt;sup&gt;2&lt;/sup&gt; mean ± SD</th>
<th>Normative Belief Products&lt;sup&gt;3&lt;/sup&gt; mean ± SD</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Calcium n=93</td>
<td>Bee n=90</td>
<td>Calcium n=93</td>
</tr>
<tr>
<td>Family</td>
<td>0.70 ± 1.18</td>
<td>0.08 ± 0.96</td>
<td>3.76 ± 1.74</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>3.32 ± 60.4</td>
</tr>
<tr>
<td>Friends</td>
<td>0.58 ± 1.04</td>
<td>0.09 ± 0.84</td>
<td>3.22 ± 1.56</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>2.54 ± 4.93</td>
</tr>
<tr>
<td>Doctor</td>
<td>0.63 ± 1.15</td>
<td>0.16 ± 0.95</td>
<td>5.13 ± 1.41</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>3.69 ± 7.14</td>
</tr>
</tbody>
</table>

1 Normative Belief statements were scored from +3 (extremely good) to -3 (extremely bad).
2 Motivation to Comply statements were scored from 7 (extremely likely) to 1 (extremely unlikely).
3 Normative Belief products have a possible range of +21 to -21.
Table 18. Normative beliefs, motivation to comply and normative belief products for Sporadic Users of food supplements in the Pima Community College food supplement use survey.

<table>
<thead>
<tr>
<th>Normative Referent</th>
<th>Normative Beliefs$^1$ mean + SD</th>
<th>Motivation to Comply$^2$ mean + SD</th>
<th>Normative Belief Products$^3$ mean + SD</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Calcium</td>
<td>Pollen</td>
<td>Calcium</td>
</tr>
<tr>
<td>Family</td>
<td>0.92 ± 0.15</td>
<td>1.26</td>
<td>4.08 ± 3.80</td>
</tr>
<tr>
<td>Friends</td>
<td>0.80 ± 0.18</td>
<td>1.06</td>
<td>3.66 ± 3.53</td>
</tr>
<tr>
<td>Doctor</td>
<td>1.02 ± 0.17</td>
<td>1.35</td>
<td>5.20 ± 5.23</td>
</tr>
</tbody>
</table>

1 Normative Belief statements were scored from +3 (extremely good) to -3 (extremely bad).
2 Motivation to Comply statements were scored from 7 (extremely likely) to 1 (extremely unlikely).
3 Normative Belief products have a possible range of +21 to -21.
Table 19. Normative beliefs, motivation to comply and normative belief products for Regular Users of food supplements in the Pima Community College food supplement use survey.

<table>
<thead>
<tr>
<th>Normative Referent</th>
<th>Normative Beliefs(^1) mean ± SD</th>
<th>Motivation to Comply(^2) mean ± SD</th>
<th>Normative Belief Products(^3) mean ± SD</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Calcium Pollen</td>
<td>Calcium Pollen</td>
<td>Calcium Pollen</td>
</tr>
<tr>
<td>Family</td>
<td>1.15 ± 0.05 ±</td>
<td>3.78 ± 1.67</td>
<td>4.73 ± 5.82</td>
</tr>
<tr>
<td></td>
<td>1.33 ± 1.02 ±</td>
<td>1.67 ± 1.67</td>
<td>5.82 ± 3.93</td>
</tr>
<tr>
<td>Friends</td>
<td>0.83 ± -0.02 ±</td>
<td>3.46 ± 1.58</td>
<td>3.11 ± 4.75</td>
</tr>
<tr>
<td></td>
<td>1.18 ± 1.02 ±</td>
<td>1.74 ± 1.58</td>
<td>4.75 ± 4.06</td>
</tr>
<tr>
<td>Doctor</td>
<td>0.99 ± -0.10 ±</td>
<td>5.51 ± 1.14</td>
<td>5.79 ± 7.83</td>
</tr>
<tr>
<td></td>
<td>1.26 ± 0.99 ±</td>
<td>1.43 ± 1.14</td>
<td>5.04 ± 7.83</td>
</tr>
</tbody>
</table>

1 Normative Belief statements were scored from +3 (extremely good) to -3 (extremely bad).
2 Motivation to Comply statements were scored from 7 (extremely likely) to 1 (extremely unlikely).
3 Normative Belief products have a possible range of +21 to -21.
for calcium. There were no differences in normative belief statements by supplement use group.

Comparisons of normative belief products for calcium and bee pollen supplement use of non-users, sporadic users and regular users of food supplements are presented in Table 20. For all supplement use categories, respondents had a much more positive expectation that family, friends and doctors would endorse their taking of calcium supplements compared to bee pollen supplements. In all cases, the normative belief products were significantly higher for calcium ($p < 0.0001$). There were no significant differences among non-users, sporadic users or regular users of food supplements: all groups responded that their family, friends, and physicians would endorse the use of calcium but would not support the use of bee pollen.

Pearson correlation coefficients ($r$) between the normative belief products and subjective norm for each of the supplement user groups are shown in Table 21. All correlations between normative belief products and subjective norm were highly significant ($p < 0.001$).

A stepwise regression was performed to determine the relationship between each normative belief product and subjective norm. The importance of each variable in the model to predict subjective norm differed by supplement use group. The model best suited for calcium use among food supplement non-users was friends (partial $R^2=0.5609$, $p < 0.0001$), family (partial $R^2=0.0374$, $p < 0.01$), and doctor (partial $R^2=0.0137$, $p < 0.1$). The total predictive ability of these three variables for subjective norm of supplement non-users for calcium was $R^2$ equal to 0.6121. For non-users who were given the bee pollen scenario, a two factor model was most appropriate. Family (partial $R^2=0.5463$, $p < 0.0001$) was the first variable
Table 20. Normative belief products for calcium and bee pollen supplementation for Non-Users, Sporadic Users and Regular Users of food supplements in the Pima Community College food supplement use survey.

<table>
<thead>
<tr>
<th>Normative Referent</th>
<th>Non-Users belief product</th>
<th>Sporadic Users belief product</th>
<th>Regular Users belief product</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Calcium</td>
<td>Bee Pollen</td>
<td>Calcium</td>
</tr>
<tr>
<td>n=93</td>
<td>n=90</td>
<td>n=59</td>
<td>n=60</td>
</tr>
<tr>
<td>Family</td>
<td>3.32 a</td>
<td>0.62 b</td>
<td>4.19 a</td>
</tr>
<tr>
<td>Friends</td>
<td>2.54 a</td>
<td>0.44 b</td>
<td>3.02 a</td>
</tr>
<tr>
<td>Doctor</td>
<td>3.69 a</td>
<td>1.08 b</td>
<td>5.98 a</td>
</tr>
</tbody>
</table>

1 Different letters across rows signify statistical differences (p < 0.05).
2 Within each supplement use category, bee pollen and calcium belief products were significantly different from one another (p < 0.001).
Table 21. Pearson correlation coefficients (r) between normative belief products and subjective norm relative to calcium and bee pollen supplement use for food supplement Non-Users, Sporadic Users and Regular Users in the Pima Community College food supplement use survey.

<table>
<thead>
<tr>
<th>Normative Referent</th>
<th>Calcium</th>
<th>Bee Pollen</th>
<th>Calcium</th>
<th>Bee Pollen</th>
<th>Calcium</th>
<th>Bee Pollen</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>r with subjective norm</td>
<td>r with subjective norm</td>
<td>r with subjective norm</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Non-Users Sporadic Users</td>
<td>n=93</td>
<td>n=90</td>
<td>n=59</td>
<td>n=60</td>
<td>n=95</td>
<td>n=86</td>
</tr>
<tr>
<td>Family</td>
<td>0.709</td>
<td>0.739</td>
<td>0.655</td>
<td>0.600</td>
<td>0.675</td>
<td>0.810</td>
</tr>
<tr>
<td></td>
<td>****</td>
<td>****</td>
<td>****</td>
<td>****</td>
<td>****</td>
<td>****</td>
</tr>
<tr>
<td>Friends</td>
<td>0.749</td>
<td>0.607</td>
<td>0.600</td>
<td>0.508</td>
<td>0.572</td>
<td>0.709</td>
</tr>
<tr>
<td></td>
<td>****</td>
<td>****</td>
<td>****</td>
<td>****</td>
<td>****</td>
<td>****</td>
</tr>
<tr>
<td>Doctor</td>
<td>0.635</td>
<td>0.554</td>
<td>0.458</td>
<td>0.668</td>
<td>0.680</td>
<td>0.586</td>
</tr>
<tr>
<td></td>
<td>****</td>
<td>****</td>
<td>***</td>
<td>****</td>
<td>****</td>
<td>****</td>
</tr>
</tbody>
</table>

1 Levels of significance are illustrated as * p < 0.05, ** p < 0.01, *** p < 0.001, and **** p < 0.0001 for correlations between normative referents and subjective norm.
model followed by doctor (partial $R^2=0.0258$, $p < 0.05$). The calculated total $R^2$
for this two variable model was 0.5722.

For sporadic users of food supplements who received the calcium scenario,
the best suited model was family (partial $R^2=0.4288$, $p < 0.0001$), followed by
friends (partial $R^2=0.0448$, $p < 0.0332$). The total $R^2$ of the two variables to predict
subjective norm for calcium use among sporadic users was 0.4736. Doctor and
family were the two most important variables in the prediction of subjective norm
among sporadic users who received the bee pollen scenario. Doctor entered the
model with a partial $R^2=0.4463$ ($p < 0.0001$), and the variable family contributed
an additional partial $R^2=0.0380$ ($p < 0.0450$). The total predictability of these two
variables on subjective norm was $R^2$ equal to 0.4843.

Two variable models were the most appropriate to predict subjective norm
among regular users of food supplements. For those who received the calcium
scenario, doctor and family were the two most significant variables ($R^2$ for doctor =
0.4619, $p < 0.0001$; $R^2$ for family = 0.1141, $p < 0.0001$). The overall model to
predict subjective norm for calcium use among regular food supplement users was
$R^2$ equal to 0.5760. The two most important variables in the model to predict
subjective norm for bee pollen use among regular food supplement users were
family ($R^2=0.6559$, $p < 0.0001$) and friends ($R^2=0.0144$, $p < 0.0599$). The model
$R^2$ for family and friends in the prediction of subjective norm for this group was
0.6704, indicating that family members play an important role in a student’s decision
to take bee pollen.

The Theory of Reasoned Action, as applied to this research, used attitude
and subjective norm together to predict behavioral intention to take either calcium
or bee pollen supplements by the three groups of supplement users (non-users,
sporadic users and regular users). The relation of these components in the prediction of behavioral intention can be seen by the correlation coefficients in Figures 9 and 10 for non-users, Figures 11 and 12 for sporadic users and Figures 13 and 14 for regular users of food supplements. Attitude was a significant predictor of behavioral intention to take calcium or bee pollen for all supplement use groups. Subjective norm was significant in all of the calcium scenarios, but for bee pollen, subjective norm was significant only among regular users of food supplements. Subjective norm was not predictive of behavioral intention to take bee pollen for either supplement non-users or sporadic users. Overall, the impact of attitude was much stronger than that of subjective norm in the prediction of behavioral intention. This was reflected by the regression weights ($w_1$ and $w_2$) which serve as estimates of the relative contribution of these two components to behavioral intention. In general, the model performed well in predicting college students' behavioral intention to take either calcium or bee pollen supplements.

Finally, to evaluate the differences among all components of the model relative to supplement use group and type of food supplement each student was exposed to, general linear modeling (GLM) was used. The results for all model components are presented in Table 22. For the aggregate variable Belief, which represents a composite of all belief products, significant differences were seen both among supplement users and non-users and also by type of supplement. This variable was calculated by adding student's belief products for each of the individual belief statements and dividing by 6. The possible range for the aggregate Belief was $+21$ to $-21$. In general, students held positive beliefs about calcium supplements and neutral beliefs about bee pollen supplements. Supplement non-users, however, had negative beliefs bee pollen supplements. Students who received the
Figure 9. Path coefficients for predicted calcium supplement use by Non-Users in the Pima Community College food supplement use survey.

Beliefs $\rightarrow$ Attitude $r = 0.61$

Relative importance $w_1 = 0.73$

Attitude $\rightarrow$ Relative importance $r = 0.58$

Relative importance $\rightarrow$ Subjective norm $w_2 = 0.45$

Subjective norm $\rightarrow$ Intention to take calcium $r = 0.46$

Norm $\rightarrow$ Subjective norm $r = 0.77$

$r = $ Pearson Correlation Coefficients between individual model components

$R = $ Multiple Correlation Coefficient

$w_1, w_2 = $ regression weights indicating strength of association
Figure 10. Path coefficients for predicted bee pollen supplement use by Non-Users in the Pima Community College food supplement use survey.

Beliefs $r = 0.64$ \rightarrow \text{Attitude} \\
\text{Relative importance} \quad w_1 = 0.71 \quad w_2 = 0.00 \quad r = 0.50 \rightarrow \text{Intention to take bee pollen} \\
\text{Norm} \quad r = 0.74 \rightarrow \text{Subjective norm} \\

$r = $ Pearson Correlation Coefficients between individual model components
$R = $ Multiple Correlation Coefficient
$w_1, w_2 = $ regression weights indicating strength of association
Figure 11. Path coefficients for predicted calcium supplement use by Sporadic Users in the Pima Community College food supplement use survey.

Beliefs $r = 0.63 \rightarrow$ Attitude

Relative importance $w_1 = 0.44 \rightarrow$ Intention to take calcium $R = 0.47$

Norm $r = 0.67 \rightarrow$ Subjective norm $w_2 = 0.34 \rightarrow$ Intention to take calcium $r = 0.39$

$r = $ Pearson Correlation Coefficients between individual model components
$R = $ Multiple Correlation Coefficient
$w_1, w_2 = $ regression weights indicating strength of association
Figure 12. Path coefficients for predicted bee pollen supplement use by Sporadic Users in the Pima Community College food supplement use survey.

Beliefs $r = 0.69$ → Attitude $r = 0.70$

Relative importance $w_1 = 0.97$

Norm $r = 0.68$ → Subjective norm $w_2 = 0.00$

Intention to take bee pollen $R = 0.70$

$r = $ Pearson Correlation Coefficients between individual model components
$R = $ Multiple Correlation Coefficient
$w_1, w_2 =$ regression weights indicating strength of association
Figure 13. Path coefficients for predicted calcium supplement use by Regular Users in the Pima Community College food supplement use survey.

Beliefs → r = 0.54 Attitude → r = 0.49 Relative importance

Norm → r = 0.75 Subjective norm → r = 0.51

R = 0.58 Intention to take calcium

\( r = \) Pearson Correlation Coefficients between individual model components

\( R = \) Multiple Correlation Coefficient

\( w_1, w_2 = \) regression weights indicating strength of association
Figure 14. Path coefficients for predicted bee pollen supplement use by Regular Users in the Pima Community College food supplement use survey.

Beliefs $r = 0.69$ \rightarrow \text{Attitude}

Relative importance $w_1 = 0.67 \rightarrow \text{Intention to take bee pollen}$

Norm $r = 0.79$ \rightarrow \text{Subjective norm}

$w_2 = 0.30$

$r = 0.48$

$R = 0.51$

$r = 0.39$

$r = \text{Pearson Correlation Coefficients between individual model components}$

$R = \text{Multiple Correlation Coefficient}$

$w_1, w_2 = \text{regression weights indicating strength of association}$
promotional pamphlets on calcium had much higher aggregate belief scores (5.54 ± 7.28) than students who received bee pollen promotions (0.00 ± 6.79). These differences were statistically significant (p < 0.0001). Non-users had the lowest overall aggregate belief scores (1.25 ± 7.41), and they were significantly different (p < 0.001) from either of the two food supplement use groups (sporadic users averaged 3.46 ± 7.33; regular users averaged 4.03 ± 7.63).

The variable Attitude showed significant differences between students who had received the calcium promotion and those who received the bee pollen promotion. For this variable, the possible range in scores was +3 to -3. Overall, students reported positive attitudes toward calcium supplements (1.10 ± 1.29) and neutral attitudes toward bee pollen (0.33 ± 1.15). Non-users had the lowest attitude score about supplementation (0.54 ± 1.28) compared to sporadic users (0.89 ± 1.37) and regular users (0.80 ± 1.21). Attitudes of non-users toward calcium supplementation were significantly lower than responses from either user group, but for bee pollen non-users attitudes were only significantly different from sporadic users. Neither was significantly different from regular users (p < 0.05).

The null hypothesis (H0) stated that there is no statistical difference in attitudes about calcium or bee pollen supplements when comparing college students who use supplements and those who do not. This null hypothesis should be rejected since there were statistically significant differences between belief products for calcium and bee pollen as well as statistically significant differences between users and non-users of food supplements. The belief products were significantly correlated to attitude, and statistically significant differences between attitudes for calcium and bee pollen as well as between non-users and users of food supplements were also seen.
Table 22. Comparison of means and standard deviations for model components by type of promotional pamphlet (calcium or bee pollen) and by supplement use group (Non-User, Sporadic User, and Regular User) in the Pima College food supplement use survey.

<table>
<thead>
<tr>
<th>Model Component</th>
<th>Non-Users mean + SD1</th>
<th>Sporadic Users mean + SD1</th>
<th>Regular Users mean + SD1</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Calcium</td>
<td>Bee Pollen</td>
<td>Calcium</td>
</tr>
<tr>
<td>Belief2</td>
<td>n=93</td>
<td>n=90</td>
<td>n=59</td>
</tr>
<tr>
<td></td>
<td>3.35 ±</td>
<td>-0.93 ±</td>
<td>6.21 ±</td>
</tr>
<tr>
<td></td>
<td>7.72 a</td>
<td>6.43 c</td>
<td>6.21 b</td>
</tr>
<tr>
<td>Attitude3</td>
<td>0.84 ±</td>
<td>0.24 ±</td>
<td>1.29 ±</td>
</tr>
<tr>
<td></td>
<td>1.36 a</td>
<td>1.12 c</td>
<td>1.25 b</td>
</tr>
<tr>
<td>Norm4</td>
<td>3.35 ±</td>
<td>0.71 ±</td>
<td>4.40 ±</td>
</tr>
<tr>
<td></td>
<td>7.72 a</td>
<td>3.54 b</td>
<td>5.28 a</td>
</tr>
<tr>
<td>Subjective Norm3</td>
<td>0.60 ±</td>
<td>0.12 ±</td>
<td>0.83 ±</td>
</tr>
<tr>
<td></td>
<td>1.04 a</td>
<td>1.07 b</td>
<td>1.38 a</td>
</tr>
<tr>
<td>Behavioral Intention3</td>
<td>-0.68 ±</td>
<td>-1.82 ±</td>
<td>0.29 ±</td>
</tr>
<tr>
<td></td>
<td>2.13 a</td>
<td>1.58 c</td>
<td>1.88 b</td>
</tr>
</tbody>
</table>

1 Different letters across rows signify statistical differences (p < 0.05).
2 Belief = aggregate score representing all of the belief products; belief products have a possible range of +21 to -21.
3 Attitude, Subjective Norm and Behavioral Intention have possible ranges of +3 to -3.
4 Norm = aggregate score representing all normative belief products; normative belief products have a possible range of +21 to -21.
The variable Norm was another aggregate score obtained by averaging the normative belief products for responses about the influence of family, friends and doctors in the decision to take either calcium or bee pollen supplements. The variable Norm has a possible range of +21 to -21. The only significant differences (p < 0.0001) for this variable were between students receiving promotional pamphlets on calcium and bee pollen. There were no differences among the students in the different supplement use groups. Students believed that their normative referents would encourage them to take calcium (3.99 ± 5.36) but that they would neither encourage or discourage their taking bee pollen supplementation (0.52 ± 3.96).

This trend was also evident in the responses for the variable Subjective Norm. The range in scores for this variable was +3 to -3. Students responded that most people who were important to them would endorse calcium supplementation (0.83 ± 1.29), but that they were less likely to endorse bee pollen supplementation (0.10 ± 1.09). This difference was statistically significant (p < 0.0001). Again, no differences were seen among food supplement non-users, sporadic users and regular users in the variable subjective norm.

The null hypothesis (H₀₃) stated that there is no statistical difference in subjective norm related to the use of calcium or bee pollen supplements when comparing college students who use food supplements and those who do not. The null hypothesis was accepted since there were no significant differences among the three supplement use groups (non-users, sporadic users and regular users) for either norm or subjective norm. The only differences found were between calcium and bee pollen.
Attitude and subjective norm were used to predict the last component of the model, behavioral intention to take either calcium or bee pollen supplements. This variable had a range from +3 to -3. Students' behavioral intention to take calcium supplements was significantly higher (-0.07 ± 2.04) than that for bee pollen (-1.41 ± 1.76), however, both were negative. This means that the students in the Pima College food supplement survey did not intend to take either of the two supplements based on exposure to the pamphlets, but of the two, they would take calcium before they would take bee pollen. Non-users of food supplements were the least likely to take either (-1.24 ± 1.96). Sporadic users and regular users were more inclined to take the supplements than non-users, but the overall behavioral intention was still negative (-0.39 ± 2.01 and -0.41 ± 2.00, respectively). For the variable behavioral intention, regular users and sporadic users of food supplements had significantly higher scores than non-users (p < 0.0001).

The null hypothesis (H₀₄) stated that there is no statistical difference in behavioral intention related to the use of calcium or bee pollen supplements when comparing non-users, sporadic users and regular users of food supplements. This hypothesis should be rejected since statistically significant differences were found for behavioral intention among the three supplement use groups and also between students who responded to the two scenarios.

The model was also evaluated for any demographic influences, and none were found. No significant differences were observed for any of the model variables by age, sex, race, college major, or division in college (lower or upper division).
DISCUSSION

The purposes of this research were to examine the patterns of vitamin and mineral supplement use among college student Non-Users, Sporadic Users and Regular Users of food supplements, to investigate the differences in beliefs about food supplements among these students, to evaluate any differences among the students with respect to nutrition seeking behavior, and to use the Theory of Reasoned Action to predict the students' intent to use either calcium or bee pollen supplements based on exposure to promotional pamphlets.

Food Supplement Usage

Recent surveys of the population indicate the popularity of food supplements. There is wide variation, however, in the time frame used to define vitamin and mineral supplement use. Some studies ask only if the respondent takes food supplements regularly or occasionally (Sobal and Muncie, 1985). Others request supplement use information over the past year (Schutz et al., 1982). Still others request "current" food supplement use (Stewart et al., 1985). By using ill-defined definitions of food supplement use, researchers are bound to obtain vastly different data on rates of food supplement usage. Depending on the definitions used, rates as low as 22.8 percent of the population (Block et al., 1988) or as high as 88 percent (Harrill and Bowski, 1981) have been obtained.

To be more specific in determination of supplement use habits of students in the Pima Community College food supplement use survey, students were requested to indicate the food supplements used within the previous three months. This information was collected to get a more accurate picture of supplement use among these students. Overall, 62 percent of the students responding to the survey reported food supplement use within the three months prior to taking the survey.
This rate of food supplement use is comparable to food supplement usage reported among college-aged students in several other studies: 63 percent among medical students (Sobal and Muncie, 1985), 54 percent among college students in Alabama (Vickery et al., 1985), 51 percent among married college students in Minnesota (Bootman and Wertheimer, 1980), and 80 percent among young adults in Colorado (Harrill and Bowski, 1981).

Regular users of food supplements comprised 37 percent of the total sample. Since many other studies requested information only on "regular" supplement use, it is not surprising that other surveys support this level of food supplement use among young adults. The NHANES II data, a large nationwide survey requesting "regular" supplement use, reported vitamin and mineral supplement use in the range of 28.9 to 38.1 percent (Koplan et al., 1986). Stewart et al. (1985) reported supplement use among young adult males of 35.3 percent and 38.8 percent for females. Sowers and Wallace (1986) reported a supplementation rate of 36 percent among young women in Iowa.

As reported in previous research, the most popular supplements were multivitamins and multiple vitamins plus minerals (Harrill and Bowski, 1981; Stewart et al., 1985; Schulz, 1988). This was found to be true for both regular users and sporadic users in this sample. The use of vitamin C is also well documented in the literature (Schutz et al., 1982; Bowerman and Harrill, 1983; Schulz, 1988).

The number of previous studies documenting use of more unconventional food supplements is limited. Harrill and Bowski (1981) and Schutz et al. (1982) documented the use of yeast, sea salt, lecithin, protein powder, alfalfa, wheat germ and kelp among adults. While protein powders/amino acids, yeast and lecithin were among those used by students in this sample, garlic, aloe vera, fish oil, bee pollen
and chlorophyll were also cited. The discrepancy illustrates the faddish nature of miscellaneous food supplement usage. In recent years, promotional campaigns have been launched by the health food industry for garlic and fish oils to reduce risk for coronary heart disease. Aloe vera, dubbed the "first aid plant" has also enjoyed recent promotion at conventions and in health food stores as an overall enhancement of good health.

That regular and sporadic users of food supplements believe more misinformation about vitamins and minerals is also supported in the literature. Schulz (1988) reported that college students took food supplements as "nutritional insurance," to compensate for stress, to increase energy, vitality or strength, and to avoid illness. Schutz et al. (1982) listed several perceived benefits of food supplement use from their research: to prevent colds and other illness, to increase energy, to make up for what is not in food, and for tiredness. These myths seem to be commonly held among users of food supplements. It was not surprising, therefore, to find significant differences in beliefs about these so called health benefits of vitamin and mineral supplements among the supplement users in the current survey of college students.

The results of the present study are similar to several others in terms of sources of nutrition information. Maracom (1981) reported that the most credible source for health and nutrition information was the family physician. Respondents in this survey listed physicians among sources they occasionally or frequently use. These data are supported by Schwartz (1975), Schutz (1982) and Schulz (1988), but they also found non-professional sources, such as magazines, books, family members and health food stores, were used more often than health professionals as sources of nutrition information. This was also seen in the present study. The degree to which
regular users of food supplements seek nutrition information indicates that they are interested in nutrition, however, the sources most used probably provide misinformation rather than facts about nutrition based on scientific research.

**The Theory of Reasoned Action**

In previous research where the Theory of Reasoned Action was used to predict food supplement use, the two most important determinants of behavioral intention were that nutrition supplements improve health and that they were not a waste of money (Cotugna, 1989). These were not the most important determinants of behavioral intention in the current study. Improved physical vitality and scientific basis were among the strongest correlates with attitude among the college students tested. The reason for the differences may be that Cotugna evaluated an elderly population living in federally subsidized senior citizen housing. It makes sense that a low-income elderly population would be most concerned about improved health and cost of vitamin/mineral supplements whereas college students would be most interested in improved physical vitality and scientific basis for supplementation.

The beliefs about food supplements entered into the model for this research (food supplements would improve resistance to disease, improve physical vitality, help insure a good diet, be a waste of money, lead to side effects, and that their use was based on science) were all highly correlated with the student's attitudes about calcium or bee pollen supplements with the exception of beliefs about side effects. A possible explanation is that the students did not perceive that either supplement was likely to cause side effects and therefore, the side effect issue did not play a significant role in their attitudes toward supplements. The other belief statements were highly correlated with attitude. Since supplement users hold strong beliefs about the health benefits of vitamin and mineral supplementation, it was not
surprising to find a significant difference in attitudes between students who take food supplements and those who do not.

Cotugna (1989) also found that subjective norm was a significant predictor of intention to take nutrition supplements, but that the impact of this variable was less than that of attitude as measured by the regression weights. This finding is only somewhat supported by the current research. The regression weights for subjective norm were lower than those for attitude in the prediction of behavioral intention to take food supplements for non-users and sporadic users. In fact, the regression weights for subjective norm were zero for non-users and sporadic users responding to the bee pollen scenario. It appears that food supplement non-users and sporadic users had little intention to take bee pollen supplements and therefore trusted their own attitudes in the decision without consulting others. Because young adults often perceive themselves to be quite knowledgeable about a variety of topics, it is very likely that their own attitudes about vitamin and mineral supplement use would determine their behavioral intention to take calcium or bee pollen with little regard to family, friends or physicians.

Regular food supplement users did not follow this pattern. For regular users responding to the calcium scenario, subjective norm proved to be more important in their decision than attitude. This indicates that for calcium, the regular users of food supplements were substantially influenced by family, friends and physicians over their own attitudes. Subjective norm also played a part in their behavioral intention to take bee pollen, but to a lesser degree. Overall, regular users of food supplements tended to be more influenced by others' opinions than either non-users or sporadic users. These results mimic those found for the elderly in Cotugna's
sample, who were likely to rely on the advice of physicians in their decision to take food supplements.

Much of the previous research on vitamin and mineral supplementation has been devoted to identifying specific demographic variables that are associated with differing levels of food supplement use. Factors such as age, sex, race, geographic region of the country, marital status, family income, socioeconomic status, and education level have all been used to classify food supplement use (Harrill and Bowski, 1981; Stewart et al., 1985; Koplan et al., 1986; Block et al., 1988). Others have tried to associate food supplement use with social psychological variables, dogmatism scales and other personality characteristics (Saegert and Young, 1982), physical activity scales (Schulz, 1988), body image, and perceived dietary adequacy (Vickery et al., 1985). Ajzen and Fishbein (1980) refer to these characteristics as "external variables," and while these characteristics may be related to behavior, Ajzen and Fishbein maintain that they affect behavior only indirectly. This is supported by the current research, since no differences were found for any of the model variables by age, sex, race, college major, or division in college.

Summary of Hypotheses and Exploratory Questions

H₀₁: There is no statistical difference in beliefs about nutrition supplements when comparing college students who use supplements and those who do not.

Rejected: there were statistically significant differences among the supplement use groups (Tables 7 and 9).

H₀₂: There is no statistical difference in attitudes about calcium or bee pollen supplements when comparing college students who use supplements and those who do not.
Rejected: there were statistically significant differences between belief products for calcium and bee pollen as well as statistically significant differences between users and non-users of food supplements (Table 15). The belief products were significantly correlated with attitude (Table 16), and statistically significant differences between attitudes for calcium and bee pollen as well as between non-users and users of food supplements were also seen (Table 22).

H03: There is no statistical difference in subjective norm related to the use of calcium or bee pollen supplements when comparing college students who use supplements and those who do not.
Failed to reject: there were no significant differences among the three supplement use groups for either norm or subjective norm. The only differences found were between calcium and bee pollen (Tables 20 and 22).

H04: There is no statistical difference in behavioral intention related to the use of calcium or bee pollen supplements when comparing college students who use supplements and those who do not.
Rejected: statistically significant differences were found for behavioral intention among the three supplement use groups and also between students who responded to the two scenarios (Table 22).

E1: Which components of the Theory of Reasoned Action are the best predictors of supplement use behavior?
Among the college students tested, attitude was a better predictor of behavioral intention to take food supplements than subjective norm (Figures 9-14).
individual beliefs most highly correlated with the variable attitude were that calcium
or bee pollen supplements would improve disease resistance and improve physical
vitality, and that use of the supplements was based on science (Table 16).

E2: What is the rate of nutrition supplementation among study subjects at Pima
College in Arizona?
The students in this survey were classified according to self-reported food
supplement use within 3 months prior to taking the survey. The sample consisted of
37.9% non-users, 25.3% sporadic users and 36.8% regular users.

Is their current use of food supplements correlated with their susceptibility to
nutrition misinformation as determined by response to promotional
pamphlets?
Differences in beliefs, attitudes and behavioral intention to take bee pollen and
calcium supplements were observed between users and non-users of food
supplements (Table 22).

E3: Do supplement users and non-users in the study population differ in terms of the
sources from which they seek nutrition information?
Yes, regular users are more likely than sporadic users or non-users to seek nutrition
information from books. Sporadic and regular users were more likely than non-
users to rely on chiropractors and health food stores for nutrition information, but
these sources were used by relatively few students (Table 11).
Limitations

The sample used in this research differed from the general population and even differed from other college students. Students at Pima Community College are generally older than other college students and come from more diverse ethnic backgrounds. The costs of attending the college are lower than those at four year institutions and therefore, the socioeconomic status of the students who attend the school is likely to be lower than students attending more expensive schools. Since this was not a random sample, the results of this study are not generalizable to any other groups without replication in larger, more representative samples.

Secondly, only two food supplements were examined in the experimental phase of the study. While calcium and bee pollen were chosen for this research because they represented food supplements on opposite ends of the food supplement use continuum, they are not representative of all the food supplements students encounter in advertising promotions. Therefore, the results found in this research for these specific food supplements may not be generalized to other food supplements.

Information on food supplements used, frequency of use and purchase place were all self reported. Self reports are always subject to bias, but since there was such a high response rate in the classrooms where the survey was administered, such bias should have been minimized. Since the survey was personally administered by the researcher, there were no effects of non-response bias usually associated with mail or telephone surveys.

The questionnaire itself performed well for these students. Reliability for the statements in Vitamins and Minerals and in the Health Beliefs sections of the questionnaire was very high, and the questions within each section were highly
correlated with one another. Students were able to discriminate adequately using the 5-point Likert scales. Few students listed any additional food supplements when asked to check all the supplements they have taken in the three months prior to completing the survey, indicating that the list was adequately comprehensive. No income or socioeconomic status questions were asked in the demographic section, and this would need to be included if the questionnaire were to be adapted for other populations. For the section on sources of nutrition information, a separate response column for "Never" should be included in any future modification of the instrument. The scenario section of the questionnaire also performed well, by yielding high correlations among model variables.

If the questionnaire were to be adapted for other population groups, the salient beliefs and normative referents would have to be retested for appropriateness. The Theory of Reasoned Action states that these beliefs and norms need to be verified for each population group. However, since they have been used successfully by Cotugna (1989) for her sample of low-income elderly subjects, and they have been used successfully among college students in this sample, it is likely that these variables would be appropriate for other populations as well.

**Future Research**

Any further research efforts using the questionnaire developed for this research should incorporate the changes noted above. In addition, a more representative sample of the population should be evaluated. Random selection should be used to obtain study subjects rather than a convenience sample. This would require mailing the questionnaire, so a larger number of surveys would have to be administered.
Subsequent research might also include an evaluation of actual behavior. For example, the survey could be administered using a promotion of a supplement for a particular population at need (i.e. prenatal vitamins for a pregnant woman or calcium tablets for a population of post-menopausal women). The supplements could then be provided to the women, or simply prescribed, and at the end of the pregnancy or the end of the study period, the actual supplement use behavior could be evaluated for correlation with intention.

Another study that would provide interesting insight into food supplement use behaviors is the role of locus of control. The current study found that significant others played a role in the behavioral intention of regular users to use calcium or bee pollen, but that these normative referents had much less impact on the behavioral intention of non-users of sporadic users. If this is indeed a true difference between regular food supplement users and other supplement use groups, one would expect to find that regular users had higher external locus of control.

Other research lies in the area of nutrition education program testing and development. The value of the Theory of Reasoned Action lies in its ability to pinpoint specific beliefs or individuals exhibiting strong influence on the intention to take food supplements. By evaluating separate age groups and different populations, effective nutrition education programs can be developed. From this research, it can be seen that regular and sporadic users of food supplements believe significantly more myths about nutrition than non-users. If after testing in a randomly selected population more representative of all college students similar results were found, educational efforts could be targeted toward specific errors in the beliefs of these students, such as refuting common misconceptions like vitamins and minerals increase pep and energy, reduce stress and prevent the common cold.
The vehicle for these education efforts should be made by using the sources for nutrition most used by students: popular books, magazines, and other media sources. Scientifically based nutritional recommendations must be emphasized in materials most used by young adults if any changes are to be made.

The research has potential impacts on other health professionals as well. Physicians could be an effective source for nutrition information. Physicians would have to be educated about the appropriate use of vitamin and mineral supplementation as well as the potential dangers of megadosing and of taking other miscellaneous food supplements used by many supplement users. Too many health professionals ignore the potential health risks of vitamins and minerals (and other over-the-counter preparations), and fail to recognize the tremendous cost the use of these products has for consumers. Pharmacists are in the unique position of being accessible to many people for advice, but they are burdened with the dilemma of promoting food supplements by selling them in their stores, or providing consumers with accurate nutrition information. Nutritionists, dietitians, and home economists fail to meet the needs of young adults, largely because of their inaccessibility to individuals in this age group. More research needs to be done to determine who people use for nutrition information. Then these professionals can be provided with scientifically based nutrition information. This means that educational programs need to be tailored to specific groups.
APPENDIX 1. PIMA COMMUNITY COLLEGE FOOD SUPPLEMENT USE

SURVEY FOR CALCIUM

VITAMIN, MINERAL AND FOOD SUPPLEMENT USE

COLLEGE STUDENT'S VIEWS ABOUT VITAMIN, MINERAL AND FOOD SUPPLEMENT USE

Your contribution to this effort is very greatly appreciated. Be assured that all of your responses will be completely confidential. If you want to answer any questions in more detail or qualify your answers, please feel free to make comments in the margins or attach a separate sheet. Thank you for your assistance with this research project.
Many people have differing views about vitamin and/or mineral supplementation. Please indicate how much you agree or disagree with the following statements:

**Do you agree or disagree?**
(Circle your answer)

Q-1 I believe that extra vitamins provide pep and energy.  
STRONGLY DISAGREE NEUTRAL AGREE

Q-2 If people feel tired and run down, they probably need more vitamins or minerals.  
STRONGLY DISAGREE NEUTRAL AGREE

Q-3 People who eat a variety of foods every day can get all the vitamins and minerals they need.  
STRONGLY DISAGREE NEUTRAL AGREE

Q-4 I feel most people should take supplemental vitamins or minerals to insure that they get proper nutrition.  
STRONGLY DISAGREE NEUTRAL AGREE

Q-5 People can protect their health if they take more vitamins than provided for in the RDAs.  
STRONGLY DISAGREE NEUTRAL AGREE

Q-6 Which statement best describes your feelings about diet and vitamin/mineral supplement use? (Circle your answer)

1 SUPPLEMENTS ARE MORE IMPORTANT THAN A BALANCED DIET
2 A BALANCED DIET IS MORE IMPORTANT THAN SUPPLEMENTS
3 A BALANCED DIET AND SUPPLEMENTS ARE EQUALLY IMPORTANT
# HEALTH BELIEFS

Some people feel that food supplements help them prevent or cure diseases, others do not. To what extent do you agree or disagree with the following:

<table>
<thead>
<tr>
<th>Question</th>
<th>Agree or Disagree?</th>
</tr>
</thead>
<tbody>
<tr>
<td>Q-1 Vitamin C can prevent colds.</td>
<td>STRONGLY DISAGREE DISAGREE NEUTRAL AGREE AGREE</td>
</tr>
<tr>
<td>Q-2 Many mental disorders are caused by vitamin deficiencies.</td>
<td>STRONGLY DISAGREE DISAGREE NEUTRAL AGREE AGREE</td>
</tr>
<tr>
<td>Q-3 Food supplements can help reduce stress.</td>
<td>STRONGLY DISAGREE DISAGREE NEUTRAL AGREE AGREE</td>
</tr>
<tr>
<td>Q-4 Diseases such as cancer can be caused by a lack of vitamins and minerals.</td>
<td>STRONGLY DISAGREE DISAGREE NEUTRAL AGREE AGREE</td>
</tr>
</tbody>
</table>

Q-5 To what extent do you feel food supplements benefit your health? (Circle your answer)

1 THEY ARE A GREAT BENEFIT TO MY HEALTH
2 THEY ARE OF SOME BENEFIT TO MY HEALTH
3 THEY ARE OF LITTLE BENEFIT TO MY HEALTH
4 THEY ARE OF NO BENEFIT TO MY HEALTH

Please answer the following questions related to your personal food supplement use habits.

Q-6 In the last 3 months, have YOU taken any physician prescribed vitamin or mineral supplements? (Circle your answer)

1 YES
2 NO

Q-7 In the last 3 months, how frequently did YOU take food supplements?

1 NEVER (If never, please skip Q-8 and Q-9)
2 LESS THAN ONCE A MONTH
3 ABOUT ONCE A MONTH
4 TWO TO THREE TIMES PER MONTH
5 ABOUT ONCE A WEEK
6 TWO TO THREE TIMES PER WEEK
7 DAILY
8 MORE THAN ONCE PER DAY
Q-8 Please indicate on the chart below the types of vitamin and/or mineral supplements YOU have taken any time during the last 3 months. (Check all that apply)

<table>
<thead>
<tr>
<th>Multiple Vitamins/Minerals:</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>_____ MULTIPLE VITAMINS</td>
<td>MULTIPLE VITAMINS PLUS IRON</td>
</tr>
<tr>
<td>_____ MULTIPLE VITAMINS PLUS MINERALS</td>
<td>PRENATAL MULTIPLE VITAMINS/MINERALS</td>
</tr>
<tr>
<td>_____ B COMPLEX</td>
<td>B COMPLEX</td>
</tr>
<tr>
<td>_____ GERITOL</td>
<td>PLUS IRON</td>
</tr>
<tr>
<td>_____ OTHER COMBINATION SUPPLEMENTS (Please specify)</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Single Vitamins/Minerals:</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>_____ VITAMIN A</td>
<td>VITAMIN D</td>
</tr>
<tr>
<td>_____ VITAMIN E</td>
<td>VITAMIN K</td>
</tr>
<tr>
<td>_____ VITAMIN C</td>
<td>Niacin</td>
</tr>
<tr>
<td>_____ VITAMIN B6</td>
<td>VITAMIN B12</td>
</tr>
<tr>
<td>_____ CALCIUM</td>
<td>IRON</td>
</tr>
<tr>
<td>_____ ZINC</td>
<td>POTASSIUM</td>
</tr>
<tr>
<td>_____ OTHER VITAMINS (Please specify)</td>
<td></td>
</tr>
<tr>
<td>_____ OTHER MINERALS (Please specify)</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Other Food Supplements:</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>_____ ALOE VERA</td>
<td>FISH OIL</td>
</tr>
<tr>
<td>_____ AMINO ACIDS/</td>
<td>GARLIC</td>
</tr>
<tr>
<td>PROTEIN POWDER</td>
<td>GERMANIUM</td>
</tr>
<tr>
<td>_____ ANY GLANDULAR</td>
<td>LECITHIN</td>
</tr>
<tr>
<td>_____ BARLEYGREEN</td>
<td>SEA SALT</td>
</tr>
<tr>
<td>_____ BEE POLLEN</td>
<td>SPIRULINA</td>
</tr>
<tr>
<td>_____ CHLOROPHYLL</td>
<td>YEAST</td>
</tr>
<tr>
<td>_____ COENZYME Q-10</td>
<td></td>
</tr>
<tr>
<td>_____ OTHERS (Please specify)</td>
<td></td>
</tr>
</tbody>
</table>

Q-9 If in Q-7 you indicated that YOU use food supplements, please indicate the place where you most frequently purchase them. (Circle your answer)

1  SUPERMARKET OR GROCERY STORE
2  DRUG STORE
3  HEALTH FOOD STORE
4  DOOR-TO-DOOR DISTRIBUTOR
5  MAIL ORDER/CATALOGUE
6  OTHER (Please specify) ____________________________
ABOUT YOURSELF

Next, we would like to ask some questions about you. Be assured that this information is completely confidential and will be used ONLY in a way that will help us understand what different undergraduate students do in support of maintaining good health through nutrition.

Q-1 Your sex: (Circle one)
   1 FEMALE 2 MALE

Q-2 What is your present age? _______ YEARS

Q-3 What is your ethnic origin? (Circle one)
   1 ASIAN 4 WHITE/CAUCASIAN
   2 BLACK 5 OTHER (specify) ____________________
   3 HISPANIC 6 DO NOT CARE TO SPECIFY

Q-4 What is your major in college? ___________________________________________

Q-5 According to units completed in your major, how would you classify yourself today? (Circle your answer)
   1 LOWER DIVISION (FRESHMAN OR SOPHOMORE)
   2 UPPER DIVISION (JUNIOR OR SENIOR)

Q-6 People learn about food and nutrition from many different sources. Please indicate how often you seek such information from each of the following:

How often do you seek nutrition information from each source?
(Place an X in the place that best describes your answer)

<table>
<thead>
<tr>
<th>Source</th>
<th>Rarely</th>
<th>Occasionally</th>
<th>Frequently</th>
</tr>
</thead>
<tbody>
<tr>
<td>Books</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Chiropractors</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Family Members</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Friends</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Grocery Stores</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Health Food Stores</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Home Economists</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Newspaper/Magazines</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Nutritionists/Dietitians</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pharmacists</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Physicians (MDs)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Television/Radio</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Other (specify)</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
CALCIUM SUPPLEMENTATION

Please read the enclosed pamphlet entitled *Calcium: You Never Outgrow Your Need for It* and answer the questions that follow. When you answer the questions, make an X in the place that best describes your opinion about calcium supplements and health. Please make your marks in the middle of the spaces.

Q-1 The information presented in this pamphlet is based on sound scientific principles.

LIKELY: _______  _______  _______  _______  _______  _______  _______  UNLIKELY
extremely  quite  slightly  neither  slightly  quite  extremely

Q-2 Based on the information in this pamphlet, I intend to take calcium supplements during the next three months.

LIKELY: _______  _______  _______  _______  _______  _______  _______  UNLIKELY
extremely  quite  slightly  neither  slightly  quite  extremely

Q-3 My taking calcium supplements is

GOOD: _______  _______  _______  _______  _______  _______  _______  BAD
extremely  quite  slightly  neither  slightly  quite  extremely

WISE: _______  _______  _______  _______  _______  _______  _______  FOOLISH
extremely  quite  slightly  neither  slightly  quite  extremely

HELPFUL: _______  _______  _______  _______  _______  _______  _______  HARMFUL
extremely  quite  slightly  neither  slightly  quite  extremely

Q-4 My taking calcium supplements during the next 3 months will help make me more resistant to disease later in life.

LIKELY: _______  _______  _______  _______  _______  _______  _______  UNLIKELY
extremely  quite  slightly  neither  slightly  quite  extremely

Q-5 My taking calcium supplements during the next 3 months will improve my physical vitality.

LIKELY: _______  _______  _______  _______  _______  _______  _______  UNLIKELY
extremely  quite  slightly  neither  slightly  quite  extremely

Q-6 My taking calcium supplements during the next 3 months will help insure a good diet.

LIKELY: _______  _______  _______  _______  _______  _______  _______  UNLIKELY
extremely  quite  slightly  neither  slightly  quite  extremely
Q-7 My taking calcium supplements during the next 3 months will be a waste of money.

LIKELY: ______: ______: ______: ______: ______: ______: UNLIKELY

Q-8 My taking calcium during the next 3 months may lead to undesirable side effects.

LIKELY: ______: ______: ______: ______: ______: ______: UNLIKELY

Q-9 For me, having increased resistance to disease is

GOOD: ______: ______: ______: ______: ______: ______: BAD

Q-10 For me, improving my physical vitality is

GOOD: ______: ______: ______: ______: ______: ______: BAD

Q-11 For me, insuring that I have a good diet is

GOOD: ______: ______: ______: ______: ______: ______: BAD

Q-12 For me, spending money on calcium supplements is

WISE: ______: ______: ______: ______: ______: ______: FOOLISH

Q-13 For me, avoiding side effects from food supplements is

IMPORTANT: ______: ______: ______: ______: ______: ______: UNIMPORTANT

Q-14 For me, taking food supplements based on scientific information is

IMPORTANT: ______: ______: ______: ______: ______: ______: UNIMPORTANT

(continued on back page)
Q-15 Most people who are important to me think that my taking calcium supplements is

GOOD: ______: ______: ______: ______: ______: ______: ______: ______: ______: ______: ______: ______: ______: ______: ______: BAD

extremely  quite  slightly  neither  slightly  quite  extremely

Q-16 My family thinks that my taking calcium supplements is

GOOD: ______: ______: ______: ______: ______: ______: ______: ______: ______: ______: ______: ______: ______: ______: ______: BAD

extremely  quite  slightly  neither  slightly  quite  extremely

Q-17 My friends think that my taking calcium supplements is

GOOD: ______: ______: ______: ______: ______: ______: ______: ______: ______: ______: ______: ______: ______: ______: ______: BAD

extremely  quite  slightly  neither  slightly  quite  extremely

Q-18 My doctor thinks that my taking calcium supplements is

GOOD: ______: ______: ______: ______: ______: ______: ______: ______: ______: ______: ______: ______: ______: ______: ______: BAD

extremely  quite  slightly  neither  slightly  quite  extremely

Q-19 Generally speaking, I do what my family thinks I should do.

LIKELY: ______: ______: ______: ______: ______: ______: ______: ______: ______: ______: ______: ______: ______: ______: ______: UNLIKELY

extremely  quite  slightly  neither  slightly  quite  extremely

Q-20 Generally speaking, I do what my friends think I should do.

LIKELY: ______: ______: ______: ______: ______: ______: ______: ______: ______: ______: ______: ______: ______: ______: ______: UNLIKELY

extremely  quite  slightly  neither  slightly  quite  extremely

Q-21 Generally speaking, I do what my doctor thinks I should do.

LIKELY: ______: ______: ______: ______: ______: ______: ______: ______: ______: ______: ______: ______: ______: ______: ______: UNLIKELY

extremely  quite  slightly  neither  slightly  quite  extremely

Thank you for your time and cooperation in completing this questionnaire.
Your effort is greatly appreciated.
The brochure, *Calcium: You Never Outgrow Your Need for It* 1987, © 1984, is available from the National Dairy Council, Rosemont, IL 60018-4233. Single copies may also be obtained from regional offices of the National Dairy Council.
Your contribution to this effort is very greatly appreciated.
Be assured that all of your responses will be completely confidential.
If you want to answer any questions in more detail or qualify your answers, please feel free to make comments in the margins or attach a separate sheet.
Thank you for your assistance with this research project.
VITAMINS AND MINERALS

Many people have differing views about vitamin and/or mineral supplementation. Please indicate how much you agree or disagree with the following statements:

Do you agree or disagree?
(Circle your answer)

Q-1 I believe that extra vitamins provide pep and energy.
   STRONGLY DISAGREE DISAGREE NEUTRAL AGREE AGREE

Q-2 If people feel tired and run down, they probably need more vitamins or minerals.
   STRONGLY DISAGREE DISAGREE NEUTRAL AGREE AGREE

Q-3 People who eat a variety of foods every day can get all the vitamins and minerals they need.
   STRONGLY DISAGREE DISAGREE NEUTRAL AGREE AGREE

Q-4 I feel most people should take supplemental vitamins or minerals to insure that they get proper nutrition.
   STRONGLY DISAGREE DISAGREE NEUTRAL AGREE AGREE

Q-5 People can protect their health if they take more vitamins than provided for in the RDAs.
   STRONGLY DISAGREE DISAGREE NEUTRAL AGREE AGREE

Q-6 Which statement best describes your feelings about diet and vitamin/mineral supplement use?
   (Circle your answer)

1 SUPPLEMENTS ARE MORE IMPORTANT THAN A BALANCED DIET
2 A BALANCED DIET IS MORE IMPORTANT THAN SUPPLEMENTS
3 A BALANCED DIET AND SUPPLEMENTS ARE EQUALLY IMPORTANT
HEALTH BELIEFS

Some people feel that food supplements help them prevent or cure diseases, others do not. To what extent do you agree or disagree with the following:

Do you agree or disagree? (Circle your answer)

| Q-1 Vitamin C can prevent colds. | STRONGLY AGREE | STRONGLY DISAGREE | NEUTRAL | AGREE | DISAGREE |
| Q-2 Many mental disorders are caused by vitamin deficiencies. | STRONGLY AGREE | STRONGLY DISAGREE | NEUTRAL | AGREE | DISAGREE |
| Q-3 Food supplements can help reduce stress. | STRONGLY AGREE | STRONGLY DISAGREE | NEUTRAL | AGREE | DISAGREE |
| Q-4 Diseases such as cancer can be caused by a lack of vitamins and minerals. | STRONGLY AGREE | STRONGLY DISAGREE | NEUTRAL | AGREE | DISAGREE |

To what extent do you feel food supplements benefit your health? (Circle your answer)

1 THEY ARE A GREAT BENEFIT TO MY HEALTH
2 THEY ARE OF SOME BENEFIT TO MY HEALTH
3 THEY ARE OF LITTLE BENEFIT TO MY HEALTH
4 THEY ARE OF NO BENEFIT TO MY HEALTH

Please answer the following questions related to your personal food supplement use habits.

Q-6 In the last 3 months, have YOU taken any physician prescribed vitamin or mineral supplements? (Circle your answer)

1 YES
2 NO

Q-7 In the last 3 months, how frequently did YOU take food supplements?

1 NEVER (If never, please skip Q-8 and Q-9)
2 LESS THAN ONCE A MONTH
3 ABOUT ONCE A MONTH
4 TWO TO THREE TIMES PER MONTH
5 ABOUT ONCE A WEEK
6 TWO TO THREE TIMES PER WEEK
7 DAILY
8 MORE THAN ONCE PER DAY
Q-8 Please indicate on the chart below the types of vitamin and/or mineral supplements YOU have taken any time during the last 3 months. (Check all that apply)

### Multiple Vitamins/Minerals:
- [ ] MULTIPLE VITAMINS
- [ ] MULTIPLE VITAMINS PLUS IRON
- [ ] PRENATAL MULTIPLE VITAMINS/ MINERALS
- [ ] B COMPLEX
- [ ] GERITOL
- [ ] OTHER COMBINATION SUPPLEMENTS (Please specify)

### Single Vitamins/Minerals:
- [ ] VITAMIN A
- [ ] VITAMIN E
- [ ] VITAMIN C
- [ ] VITAMIN B_6
- [ ] CALCIUM
- [ ] ZINC
- [ ] OTHER VITAMINS (Please specify)
- [ ] OTHER MINERALS (Please specify)

### Other Food Supplements:
- [ ] ALOE VERA
- [ ] AMINO ACIDS/ PROTEIN POWDER
- [ ] ANY GLANDULAR
- [ ] BARLEYGREEN
- [ ] BEE POLLEN
- [ ] CHLOROPHYLL
- [ ] COENZYMES Q-10
- [ ] OTHERS (Please specify)

Q-9 If in Q-7 you indicated that YOU use food supplements, please indicate the place where you most frequently purchase them. (Circle your answer)
1. SUPERMARKET OR GROCERY STORE
2. DRUG STORE
3. HEALTH FOOD STORE
4. DOOR-TO-DOOR DISTRIBUTOR
5. MAIL ORDER/CATALOGUE
6. OTHER (Please specify)
ABOUT YOURSELF

Next, we would like to ask some questions about you. Be assured that this information is completely confidential and will be used ONLY in a way that will help us understand what different undergraduate students do in support of maintaining good health through nutrition.

Q-1 Your sex: (Circle one)
   1 FEMALE          2 MALE

Q-2 What is your present age? ______ YEARS

Q-3 What is your ethnic origin? (Circle one)
   1 ASIAN          4 WHITE/CAUCASIAN
   2 BLACK          5 OTHER (specify) ________________
   3 HISPANIC       6 DO NOT CARE TO SPECIFY

Q-4 What is your major in college? ________________________________

Q-5 According to units completed in your major, how would you classify yourself today? (Circle your answer)
   1 LOWER DIVISION (FRESHMAN OR SOPHOMORE)
   2 UPPER DIVISION (JUNIOR OR SENIOR)

Q-6 People learn about food and nutrition from many different sources. Please indicate how often you seek such information from each of the following:

<table>
<thead>
<tr>
<th>Source</th>
<th>Rarely</th>
<th>Occasionally</th>
<th>Frequently</th>
</tr>
</thead>
<tbody>
<tr>
<td>Books</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Chiropractors</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Family Members</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Friends</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Grocery Stores</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Health Food Stores</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Home Economists</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Newspaper/Magazines</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Nutritionists/Dietitians</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pharmacists</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Physicians (MDs)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Television/Radio</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Other (specify)</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
BEE POLLEN SUPPLEMENTATION

Please read the enclosed pamphlet entitled *The Jim Devlin Natural Health Program* and answer the questions that follow. When you answer the questions, make an X in the place that best describes your opinion about bee pollen supplements and health. Please make your marks in the middle of the spaces.

Q-1 The information presented in this pamphlet is based on sound scientific principles.

<table>
<thead>
<tr>
<th>LIKELY</th>
<th>extremely</th>
<th>quite</th>
<th>slightly</th>
<th>neither</th>
<th>slightly</th>
<th>quite</th>
<th>extremely</th>
</tr>
</thead>
<tbody>
<tr>
<td>UNLIKELY</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Q-2 Based on the information in this pamphlet, I intend to take bee pollen supplements during the next three months.

<table>
<thead>
<tr>
<th>LIKELY</th>
<th>extremely</th>
<th>quite</th>
<th>slightly</th>
<th>neither</th>
<th>slightly</th>
<th>quite</th>
<th>extremely</th>
</tr>
</thead>
<tbody>
<tr>
<td>UNLIKELY</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Q-3 My taking bee pollen supplements is

<table>
<thead>
<tr>
<th>GOOD</th>
<th>extremely</th>
<th>quite</th>
<th>slightly</th>
<th>neither</th>
<th>slightly</th>
<th>quite</th>
<th>extremely</th>
</tr>
</thead>
<tbody>
<tr>
<td>BAD</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>WISE</th>
<th>extremely</th>
<th>quite</th>
<th>slightly</th>
<th>neither</th>
<th>slightly</th>
<th>quite</th>
<th>extremely</th>
</tr>
</thead>
<tbody>
<tr>
<td>FOOLISH</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>HELPFUL</th>
<th>extremely</th>
<th>quite</th>
<th>slightly</th>
<th>neither</th>
<th>slightly</th>
<th>quite</th>
<th>extremely</th>
</tr>
</thead>
<tbody>
<tr>
<td>HARMFUL</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Q-4 My taking bee pollen supplements during the next 3 months will make me more resistant to disease.

<table>
<thead>
<tr>
<th>LIKELY</th>
<th>extremely</th>
<th>quite</th>
<th>slightly</th>
<th>neither</th>
<th>slightly</th>
<th>quite</th>
<th>extremely</th>
</tr>
</thead>
<tbody>
<tr>
<td>UNLIKELY</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Q-5 My taking bee pollen during the next 3 months will improve my physical vitality.

<table>
<thead>
<tr>
<th>LIKELY</th>
<th>extremely</th>
<th>quite</th>
<th>slightly</th>
<th>neither</th>
<th>slightly</th>
<th>quite</th>
<th>extremely</th>
</tr>
</thead>
<tbody>
<tr>
<td>UNLIKELY</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Q-6 My taking bee pollen supplements during the next 3 months will help insure a good diet.

<table>
<thead>
<tr>
<th>LIKELY</th>
<th>extremely</th>
<th>quite</th>
<th>slightly</th>
<th>neither</th>
<th>slightly</th>
<th>quite</th>
<th>extremely</th>
</tr>
</thead>
<tbody>
<tr>
<td>UNLIKELY</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Q-7 My taking bee pollen supplements during the next 3 months will be a waste of money.

LIKELY
extremely quite slightly neither slightly quite extremely
UNLIKELY

Q-8 My taking bee pollen during the next 3 months may lead to undesirable side effects.

LIKELY
extremely quite slightly neither slightly quite extremely
UNLIKELY

Q-9 For me, having increased resistance to disease is

GOOD
extremely quite slightly neither slightly quite extremely
BAD

Q-10 For me, improving my physical vitality is

GOOD
extremely quite slightly neither slightly quite extremely
BAD

Q-11 For me, insuring that I have a good diet is

GOOD
extremely quite slightly neither slightly quite extremely
BAD

Q-12 For me, spending money on bee pollen supplements is

WISE
extremely quite slightly neither slightly quite extremely
FOOLISH

Q-13 For me, avoiding side effects from food supplements is

IMPORTANT
extremely quite slightly neither slightly quite extremely
UNIMPORTANT

Q-14 For me, taking food supplements based on scientific information is

IMPORTANT
extremely quite slightly neither slightly quite extremely
UNIMPORTANT

(continued on back page)
Q-15 Most people who are important to me think that my taking bee pollen supplements is


Q-16 My family thinks that my taking bee pollen supplements is


Q-17 My friends think that my taking bee pollen supplements is


Q-18 My doctor thinks that my taking bee pollen supplements is


Q-19 Generally speaking, I do what my family thinks I should do.


Q-20 Generally speaking, I do what my friends think I should do.


Q-21 Generally speaking, I do what my doctor thinks I should do.


Thank you for your time and cooperation in completing this questionnaire.
Your effort is greatly appreciated.
The brochure, *The Jim Devlin Natural Health Program*, © 1988 is available from Jim Devlin Enterprises, Inc. 7360 E. Acoma Drive, Scottsdale, AZ 85260-3118.
LIST OF REFERENCES


Jarvis, William T. undated. Food faddism, cultism, and quackery. Course materials, Loma Linda University.


