# Environmental Knowledge Of College Nutrition Students

S Koutoubi, M Harrington, S Murdoch, S Garrett

**Citation**

S Koutoubi, M Harrington, S Murdoch, S Garrett. *Environmental Knowledge Of College Nutrition Students*. The Internet Journal of Nutrition and Wellness. 2006 Volume 3 Number 2.

**Abstract**

Objectives: To assess the environmental knowledge of college nutrition students in regards to: Global Warming, Genetically Modified Organisms (GMOs), Sustainable Food Systems, and United States (U.S.) Organic Standards.

Methods: 72 college nutrition students, juniors and seniors completed a self-administered survey of demographics and environmental knowledge at the beginning and at the end of the school year. Mann-Whitney U Test and Fisher's Exact Test were used and significance was determined by a $p< 0.05$.

Results: The overall environmental knowledge among college nutrition students was low. Overall knowledge comparing juniors at the beginning of the school year to seniors at the end of the school year was statistically significantly higher ($p < 0.005$). When comparing Juniors-Beginning to Seniors-Ending, there was statistically significant increase in environmental knowledge in the GMOs ($p< 0.027$), Sustainable Food Systems ($p< 0.027$), and Organic Standards ($p< 0.031$) sections.

Conclusions: Environmental knowledge among college nutrition students was low. Based on our findings, more emphasis should be placed on promoting environmental knowledge in college curriculums.

Name of the department and institution or hospital where the work was done: Bastyr University.

The source of any support received: This research was supported in part by Bastyr University.

## INTRODUCTION

Most environmental experts agree that Planet Earth has a finite number of resources to sustain its inhabitants. [1,2] When irresponsible stewardship of the planet occurs, not only does the environment suffer but the people's health is also affected. [3,4,5,6] The areas of Global warming, Genetically Modified Organisms (GMOs), Sustainable Food Systems, and United States (U.S.) Organic Standards impact the health of the planet and its inhabitants. [1, 6,7,8,9] Effective nutritionists can educate people not only on nutrition, but can also demonstrate to them how to live a more Earth-friendly lifestyle through their food choices; thus becoming responsible stewards of their home, Earth. [1,2, 10,11,12,13] Surveys have been conducted that analyze students' awareness towards environmentalism but did not necessarily address the interconnection between nutrition and environment, resulting in gaps in this type of research. [14,15,16,17,18] Because genetically modified (GM) foods have recently become abundant in our food supply, surveys assessing people's perceptions/knowledge of GM foods have taken place. [19,20,21,22,23,24,25,26] However, none of these surveys specifically addressed college nutrition students' perceptions or knowledge of GM foods. The main objective of this study is to assess the environmental knowledge of college nutrition students in regards to: global warming, GMOs, sustainable food systems, and U.S. organic standards. The specific objectives are: 1) assess overall combined (juniors and seniors) environmental knowledge, 2) compare Beginning (Fall 2003) mean percentages correct responses to Ending (Spring 2004) percentages for junior and senior nutrition students, and 3) compare Beginning (Fall 2003) mean percentages correct responses of junior nutrition students to Ending (Spring 2004) percentages of senior nutrition students.

## METHODS

### SUBJECT RECRUITMENT AND SELECTION

Seventy-two undergraduate students enrolled in the Bachelor of Science in Food Science and Human Nutrition at

Washington State University as of Fall, 2003, were recruited from the junior/senior level nutrition classes. Students were excluded from the study if they: 1) had a degree in environmental science, 2) had previously taken an environmental science course within the last 3 years, or 3) were currently taking an environmental science course. This process was repeated at the end of the 2004 spring semester. An incentive was provided to each subject for participation. Subjects signed an informed-consent form approved by the Bastyr University Institutional Review Board (IRB) prior to participation in the study.

## DATA COLLECTION

### ENVIRONMENTAL KNOWLEDGE QUESTIONNAIRE (EKQ)

All subjects self-reported the socio-demographic, and the Environmental Knowledge Questionnaire (EKQ), developed by the investigator and consisted of 16 true/false/don't know questions. The questionnaire addressed 4 topics: global warming, GMOs, sustainable food systems, and U.S. organic standards. Some of the EKQ questions were adapted from other sources. [27,28] . The EKQ was pilot tested and validated by administering it to 11 students at Bastyr University.

## DATA ANALYSIS

### ANALYSIS OF ENVIRONMENTAL KNOWLEDGE QUESTIONNAIRE (EKQ):

The EKQ was coded and analyzed by the investigator. For each question that a participant answered correctly, a numerical value of one (1) was assigned. For each question that the participant answered incorrectly, a numerical value of zero (0) was assigned. No value was assigned to each question that a participant answered Don't Know. Thus, if a participant answered all questions correctly, the total score would be sixteen (16).

**Figure 1**

| Knowledge | Percent (%) Answered Correctly (n) |
|---|---|
| Excellent | 81% and Higher (13 – 16) |
| Good | 56% - 80.9% (8.96 -12.9) |
| Low Knowledge | < 56% (< 8.96) |

## STATISTICAL ANALYSIS

Results were expressed as means ± standard deviation (SD). Significance was determined at a p< 0.05. Data was analyzed using the SPSS (version 12.0). The Mann-Whitney U Test and Fisher's Exact Test were used to compare the mean percentages correct between the groups. Based on a power analysis of 85 Percent, the sample size was determined to be 72. [17,29]

## RESULTS

### ENVIRONMENTAL KNOWLEDGE QUESTIONNAIRE (EKQ)

The EKQ mean percentage of correct responses for juniors and seniors was 48, indicating low environmental knowledge. There was statistically significantly higher (p ? 0.005) environmental knowledge when comparing the overall knowledge between Juniors-Beginning (Fall, 2003) to Seniors-Ending (Spring, 2004) (Table 1).

**Figure 2**

Table 1: Mean Percentage (%) of Correct Answers of Environmental Knowledge

| Variable | n (%) | Mean % Correct +/- (SD) | p-value |
|---|---|---|---|
| Overall | 72 (100) | 48 (17.4) | n/a |
| Class Level | | | 0.005[a]** |
| Juniors | 36 (50) | | |
| Beginning | 18 (25) | 40 (16.9) | 0.839[b] |
| Ending | 18 (25) | 41 (15.9) | |
| Seniors | 36 (50) | | |
| Beginning | 18 (25) | 57 (17.6) | 0.743[c] |
| Ending | 18 (25) | 55 (12.4) | |

[a]Based on the Mann-Whitney U Test comparing Juniors at Beginning to Seniors at Ending
[b]Based on the Mann-Whitney U Test comparing Juniors at Beginning to Juniors at Ending
[c]Based on the Mann-Whitney U Test comparing Seniors at Beginning to Seniors at Ending
**p < 0.01

When comparing Juniors-Beginning to Seniors-Ending, there was statistically significant improvement in knowledge in the following sections: GMOs (p < 0.027), Sustainable Food Systems (p < 0.027), and Organic Standards (p < 0.031). There was no statistically significant improvement in knowledge in regards to the Global Warming section (Table 2). Although it was not statistically significant, the subjects' knowledge in the GMOs section increased from 36 mean percentage correct at the Juniors-Beginning level to 51 mean percentage correct at the Seniors-Ending level. Regarding

the Sustainable Food Systems section, the subjects' knowledge increased from 51 mean percentage correct to 78 mean percentage correct. Regarding the Organic Standards section, the subjects' knowledge increased from 40 mean percentage correct to 58 mean percentage correct (Table 2).

**Figure 3**

Table 2: Mean Percent Correct and Incorrect Responses of Environmental Questionnaire

| Section | n | Mean % Correct (SD) | Mean % Incorrect[a] (SD) | p-value[b] |
|---|---|---|---|---|
| **Global Warming** | **72** | | | 0.757 |
| **Juniors** | **36** | | | |
| Beginning | 18 | 31 (26.5) | 69 (26.5) | |
| Ending | 18 | 25 (24.3) | 75 (24.3) | |
| p-value[c] | | 0.542 | | |
| **Seniors** | **36** | | | |
| Beginning | 18 | 36 (27.4) | 64 (27.4) | |
| Ending[d] | 18 | 32 (26.9) | 67 (25.7) | |
| p-value[c] | | 0.832 | | |
| **GMOs** | **72** | | | 0.027* |
| **Juniors** | **36** | | | |
| Beginning | 18 | 36 (17.6) | 64 (17.6) | |
| Ending | 18 | 35 (28.6) | 65 (28.6) | |
| p-value[c] | | 0.815 | | |
| **Seniors** | **36** | | | |
| Beginning | 18 | 54 (28.8) | 46 (28.8) | |
| Ending | 18 | 51 (18.1) | 49 (18.1) | |
| p-value[c] | | 0.815 | | |
| **Sustainable Food Systems** | **72** | | | 0.027* |
| **Juniors** | **36** | | | |
| Beginning | 18 | 51 (34.8) | 49 (34.8) | |
| Ending | 18 | 57 (29.5) | 43 (29.5) | |
| p-value[c] | | 0.65 | | |
| **Seniors** | **36** | | | |
| Beginning | 18 | 72 (30.8) | 28 (30.8) | |
| Ending | 18 | 78 (24.1) | 22 (24.1) | |
| p-value[c] | | 0.791 | | |
| **Organic Standards** | **72** | | | 0.031* |
| **Juniors** | **36** | | | |
| Beginning | 18 | 40 (25.9) | 60 (25.9) | |
| Ending | 18 | 46 (21.4) | 54 (21.4) | |
| p-value[c] | | 0.406 | | |
| **Seniors** | **36** | | | |
| Beginning | 18 | 64 (26.0) | 36 (26.0) | |
| Ending | 18 | 58 (21.0) | 42 (21.0) | |
| p-value[c] | | 0.521 | | |

[a]Mean % Incorrect = Mean % Incorrect plus Mean % Don't Know

[b]Based on the Mann-Whitney U Test comparing Juniors at Beginning to Seniors at Ending.

[c]Based on the Mann-Whitney U Test comparing each class level, Beginning to Ending.

[d]Total sum of Correct and Incorrect percentages does not equal 100% because one subject did not respond to a question in this section. *$p < 0.05$.

There was no statistical significance in the knowledge of

individual questions at both class levels, Juniors-Beginning to Juniors-Ending and Seniors-Beginning to Seniors-Ending (Table 3).

**Figure 4**

Table 3: Environmental Knowledge of College students.

| Variables | Juniors (n=36) | | Seniors (n=36) | |
|---|---|---|---|---|
| | Beginning | Ending | Beginning | Ending |
| | % (n) | % (n) | % (n) | % (n) |
| 1. Depletion of the ozone layer is a major cause of global warming | | | | |
| Correct (False) | 11 ( 2) | 6 ( 1) | 11 ( 2) | 6 ( 1) |
| Incorrect (True) | 89 (16) | 94 (17) | 89 (16) | 94 (17) |
| 2. Uranium is considered a fossil fuel. | | | | |
| Correct (False) | 39 ( 7) | 17 ( 3) | 44 ( 8) | 33 ( 6) |
| Incorrect (True) | 61 (11) | 83 (15) | 56 (10) | 61 (11) |
| 3. Of the following greenhouse gases: carbon Dioxide, chlorofluorocarbons, methane, and nitrous oxide; carbon dioxide contributes the most to global warming. | | | | |
| Correct (True) | 56 (10) | 50 ( 9) | 44 ( 8) | 50 ( 9) |
| Incorrect (False) | 44 ( 8) | 50 ( 9) | 56 (10) | 50 ( 9) |
| 4. Most of the electricity in the United States is generated by hydroelectric power. | | | | |
| Correct (False) | 17 ( 3) | 28 ( 5) | 44 ( 8) | 39 ( 7) |
| Incorrect (True) | 83 (15) | 72 (13) | 56 (10) | 61 (11) |
| 5. An example of hybridization is the process of inserting a bacterium gene into a potato cell causing the potato cell to express a specific desired trait from the bacterium. | | | | |
| Correct (False) | 28 ( 5) | 22 ( 4) | 44 ( 8) | 39 ( 7) |
| Incorrect (True) | 72 (13) | 78 (14) | 56 (10) | 61 (11) |
| 6. The main purpose of promoters, as used in genetically engineered plants, is to enhance the expression of certain genes. | | | | |
| Correct (True) | 44 ( 8) | 61 (11) | 67 (12) | 67 (12) |
| Incorrect (False) | 56 (10) | 39 ( 7) | 33 ( 6) | 33 ( 6) |
| 7. An example of a trait that has been genetically engineered in some plants such as soybeans, is the ability to tolerate certain herbicides. | | | | |
| Correct (True) | 61 (11) | 56 (10) | 67 (12) | 83 (15) |
| Incorrect (False) | 39 ( 7) | 44 ( 8) | 33 ( 6) | 17 ( 3) |
| 8. Of all the following crops: papaya, soybeans, sugar beets, and wheat; wheat has been the most widely planted genetically engineered crop in the United States. | | | | |
| Correct (False) | 11 ( 2) | 0 ( 0) | 39 ( 7) | 17 ( 3) |
| Incorrect (True) | 89 (16) | 100 (18) | 61 (11) | 83 (15) |
| 9. One characteristic of a sustainable food system is to maximize profits with little consideration as to the environmental impact. | | | | |
| Correct (False) | 56 (10) | 61 (11) | 72 (13) | 78 (14) |
| Incorrect (True) | 44 ( 8) | 39 ( 7) | 28 ( 5) | 22 ( 4) |
| 10. A community food system is one in which sustainable food production, processing, distribution are and consumption are integrated to enhance the environmental, economic, and social and nutritional health of a particular place. | | | | |
| Correct (True) | 72 (13) | 83 (15) | 94 (17) | 94 (17) |
| Incorrect (False) | 28 ( 5) | 17 ( 3) | 6 ( 1) | 6 ( 1) |
| 11. Sustainable food systems emphasize using less Highly toxic chemicals and less fossil fuel energy during food production processes. | | | | |
| Correct (True) | 50 ( 9) | 56 (10) | 67 (12) | 67 (12) |
| Incorrect (False) | 50 ( 9) | 44 ( 8) | 33 ( 6) | 33 ( 6) |
| 12. An example of a sustainable food system is importation of Chilean grapes to the U.S. | | | | |
| Correct (False) | 28 ( 5) | 28 ( 5) | 56 (10) | 72 (13) |
| Incorrect (True) | 72 (13) | 72 (13) | 44 ( 8) | 28 ( 5) |
| 13. The Environmental Protection Agency (EPA) established the U.S. Organic Standards under the National Organic Program. | | | | |
| Correct (False) | 17 ( 3) | 11 ( 2) | 44 ( 8) | 17 ( 3) |
| Incorrect (True) | 83 (15) | 89 (16) | 56 (10) | 83 (15) |
| 14. According to the U.S. Organic Standards established under the National Organic Program, sewage sludge is not permitted in organic food production. | | | | |
| Correct (True) | 56 (10) | 72 (13) | 56 (10) | 67 (12) |
| Incorrect (False) | 44 ( 8) | 28 ( 5) | 44 ( 8) | 33 ( 6) |
| 15. Genetic engineering is a permitted technology under the U.S. Organic Standards as established under the National Organic Program. | | | | |
| Correct (False) | 50 ( 9) | 44 ( 8) | 67 (12) | 61 (11) |
| Incorrect (True) | 50 ( 9) | 56 (10) | 33 ( 6) | 39 ( 7) |
| 16. According to the U.S. Organic Standards established under the National Organic Program, when the label "made with organic ingredients" is used, the food product must contain100 percent organic ingredients. | | | | |
| Correct (False) | 39 ( 7) | 56 (10) | 89 (16) | 89 (16) |
| Incorrect (True) | 61 (11) | 44 ( 8) | 11 ( 2) | 11 ( 2) |

## DISCUSSION

This study measures and compares the environmental knowledge of junior and senior year college nutrition

students in regards to: Global Warming, GMOs, Sustainable Food Systems, and U.S. Organic Standards. Overall, juniors and seniors had low environmental knowledge.

Global Warming: In the Global Warming section, both juniors and seniors demonstrated the lowest knowledge (< 37 mean percentage correct) at the beginning and at the end of the school year. The results of our study confirmed the findings from other research. Talay et al., (2004) surveyed 651 Ankara University students in the final year of various degree programs and found that students in the health sciences were significantly unaware of issues such as those of sustainable development, organic farming and solid waste pollution. [18] Other studies found similar results. [23,31] In a survey conducted by Khalid (2003), senior undergraduate science teacher majors had misconceptions about the greenhouse effect and ozone depletion and 56% of students incorrectly perceived that "holes in the stratospheric ozone will increase the greenhouse effect" (Khalid, 2003, p. 39). [31]In our study, 94 percent of both juniors and seniors incorrectly agreed that "depletion of the ozone layer is a major cause of global warming." In a 2001 survey conducted by the National Environmental Education & Training Foundation (NEETF) and RoperASW, out of 1,503 randomly selected Americans, only 36 percent knew that most of our electricity is generated by burning oil, coal and wood. [26]In our study, 72 percent of the juniors and 61 percent of the seniors incorrectly responded that "most of the electricity in the United States is generated by hydroelectric power."

Genetically Modified Organisms: Our results indicated a low knowledge of GMOs at the end of the school year. Other studies assessing college students' GMOs knowledge have found similar results. Sohan et al. (2002) found college students in general, to have low knowledge of biotechnology. [25]Wingenbach et al. (2002) surveyed 330 U.S. college students pursuing various science degrees regarding their knowledge and perceptions of biotechnology issues as reported in the mass media [23]. Students achieved 30 percent correct responses, "thus illustrating lack of knowledge" (Wingenbach et al., 2002, p. 7). [23]Weisenfeld et al. (2003) surveyed 270 German college students and found that students did not rate their knowledge on science and genetic engineering as being good and they were insecure regarding the presence of genetically engineered products in the market. [24]

Sustainable Food Systems: In our study, students in this section had the highest mean percentage correct at the end of the school year. Various studies have been done on specific aspects of sustainability that both concurred and not concurred with our findings. One study done by Borsari, Vidrine, and Doherty, (2002) did not concur with the findings of our study. [32] They assessed 160 senior college students' preparedness towards sustainability in U.S. and European undergraduate agricultural programs. Comparing U.S. students to European students in regard to the accurate concept for the term 'local food system,' U.S. students had low-frequency scores (75 percent of the frequency were below the mean), whereas 75 percent of the European students had frequency values above the mean. [32]One reason students in our study may have done well in this section is the environment at WSU. For example, a non-profit organization, Center for Sustainable Agriculture and Natural Resources has been established at WSU that promotes sustainability which may have an impact on WSU nutrition students' awareness on this subject. In another study, Wilkins, Bowdish, and Sobal (2002) examined the use of the terms "seasonal" and "local" among college students in two different classes, a nutrition class and an economics class. [33] They found that nutrition students were more familiar with the terms "seasonal" and "local" than the economics students. [33]These findings concur with our results. In a study by Davis, Edmister, Sullivan, and West (2003) the concept of sustainability was assessed among some college students. They found that the college students were aware of the ecological component of sustainability but were not aware of its economic and social components. [34]

Organic Standards: Our results indicated that juniors had low knowledge of Organic Standards at both the beginning and at the end of the school year. Seniors demonstrated good knowledge at the beginning of the school year and at the end of the school year. There are few studies in the literature concerning the subject of U.S. Organic Standards. The USDA Organic Standards have just been recently finalized (December, 2000). [35] In a study by Sandalidou and Baourakis (2002), customer satisfaction was assessed among 131 Grecian organic olive consumers. [36] They found that out of five attributes, health, price/quality, packaging, specific olive oil characteristics, and promotion; the consumers considered health as the most important attribute. To Sandalidou and Baourakis, this showed "how sensitive customers are in terms of nutrition" (p. 398). [36]

This study population was formed from a modest sample of college students. Although Juniors-Ending and Seniors-

Beginning are two separate groups, there was an increase in overall environmental knowledge when comparing Juniors-Ending to Seniors-Beginning. It was beyond the scope of this study to investigate the reasons for this increase in knowledge. The results of our study may not be generalized to all college students or to another population and may require confirmation among a population of randomly selected young adults outside a university setting.

## CONCLUSIONS AND IMPLICATIONS FOR RESEARCH AND PRACTICE

In the present study, the combined junior and senior college nutrition students' overall environmental knowledge was low. Although overall environmental knowledge was low, there was a statistically significant increase in overall environmental knowledge when comparing juniors at the beginning of the school year with that of seniors at the end of the school year. Nutritionists have the responsibilities of educating the public on how their food choices can benefit not only their health but the health of planet. Based on our findings and other given research, more specific assessment of college nutrition students' environmental knowledge is needed and more emphasis should be placed on promoting environmental literacy in college curriculums.

## ACKNOWLEDGMENTS

This research was supported in part by Bastyr University.

## CORRESPONDENCE TO

SAMER KOUTOUBI, MD., PhD Associate Professor School of Nutrition and Exercise Science Bastyr University 14500 Juanita Drive, NE Kenmore, WA 98028 Tel. 425-602-3280 Fax. 425-823-6222 Email: skoutoub@bastyr.edu

### References

1. Gussow JD, Clancy KL. Dietary Guidelines for Sustainability. J Nutr Educ 1986;18:1-5.
2. Horrigan L, Lawrence RS, Walker P. How Sustainable Agriculture Can Address the Environmental and Human Health Harms of Industrial Agriculture. Environ Health Perspect 2002;110:445-456.
3. Bertazzi PA, Consonni D, Bachetti S, Rubagotti M, Baccarelli A, Zocchetti, Pesatori AC. Health Effects of Dioxin Exposure: A 20-Year Mortality Study. Am J Epidemiol 2001;153:1031-1044.
4. Sissell K. EPA orders Solutia to clean dioxin seep. Chem Week 2002;164:37.
5. United States Census Bureau. No. 385: Threatened and Endangered Wildlife and Plant Species: 2003. Available at: http://www.census.gov/prod/2004pubs/03statab/geo.pdf. Accessed may 21, 2004.
6. Wing S, Cole D, Grant G. Environmental Injustice in North Carolina's Hog Industry. Environ Health Perspect 2000;108:225-231.
7. Gussow JD. Dietary guidelines for sustainability: Twelve years later. J Nutr Educ 1999;31:194-200.
8. Bucchini L, Goldman LR. Starlink Corn: A Risk Analysis. Environ Health Perspect 2002;110:5-13.
9. World Health Organization (WHO). Climate Change and Human Health - Risks and Responses. Available at: http://www.who.int/globalchange/climate/en/ccSCREEN.pdf . Accessed July 16, 2004
10. Hopkins CA, McKeown R. Education for Sustainable Development. Forum Appl Res Public Policy 1999;14:25-29.
11. Metress J. Nutritional Ecology in the College Curriculum. Community College Frontiers Winter 1978;6:11-12.
12. Uhl C, Anderson A. Green Destiny: Universities Leading the Way to Sustainable Future. BioScience 2001;51:36-42.
13. Filho WL. Dealing with Misconceptions on the Concept of Sustainability. Int J Sustainability Higher Educ 2000;1:9-19.
14. Bradley JC, Waliczek TM, Zajicek JM. Relationship between environmental knowledge and attitude of high school students. J Environ Edu 1999;30:17-21.
15. Gambro JS, Swizky HN. A national survey of high school students' environmental knowledge. J Environ Edu 1996;27:28-33.
16. Thompson Jr. JC, Gasteiger EL. Environmental Attitude Survey of University Students: 1971 vs. 1981. J Environ Edu 1985;17:13-22.
17. Robinson M, Crowther D. Environmental science literacy in science education, biology & chemistry majors. Am Biol Teach 2001;63:9-14.
18. Talay I, Gunduz S, Akpinar N. On the status of environmental education and awareness of undergraduate students at Ankara University, Turkey. Int J Environment and Pollution 2004;21:293-308.
19. Teisl MF, Halverson L, O'Brien K, Roe B, Ross N, Vayda M. Focus Group Reactions to Genetically Modified Food Labels. AgBioForum 2002;5:6-9.
20. Burton M, Pearse D. Consumer Attitudes Towards Genetic Modification, Functional Foods, and Microorganisms: A Choice Modeling Experiment for Beer. AgBioForum 2002;5:51-58.
21. Hill R, Stanisstreet M, Boyes E. What ideas do students associate with 'biotechnology' and 'genetic engineering'? Sch Sci Rev 2000;81:77-83.
22. Heffernan JW, Hillers VN. Attitudes of consumers living in Washington regarding food biotechnology. J Am Diet Assoc 2002;102:85-88.
23. Wingenbach GJ, Rutherford TA, Dunsford DW. Selected College Students' Knowledge and Perceptions of Biotechnology Issues Reported in the Mass Media. J Appl Commun 2002;86:7-23.
24. Weisenfeld U, Nissen D, Gassert K. The role of knowledge and information in innovation: the case of genetic engineering. Int J Technol Manag 2003;26:640-654.
25. Sohan DE, Waliczek TM, Briers GE. Knowledge, Attitudes, and Perceptions Regarding Biotechnology among College Students. J Nat Resour Life Sci Educ 2002;31:5-11.
26. Kitto SL, Griffiths LG, Pesek JD. A long-term study of knowledge, risk, and ethics for students enrolled in an introductory biotechnology course. J Anim Sci 2003;81:1348-1353.
27. National Environmental Education & Training Foundation (NEETF) and RoperASW. Knowledge of Energy Issues and Problems. In: Americans' Low "Energy IQ:" A Risk to Our Energy Future. Washington,

DC: NEETF; 2002. p. 1-12.
28. Garrett S, Feensta G. Growing a Community Food System. Pullman: Western Regional Extension Publication, 1999.
29. UCLA Department of Statistics. Statistics Calculators: Normal Power Calculations. Available at: http://calculators.stat.ucla.edu/powercalc/normal/n-2-equal/n-2-eq-var-samp.php. Accessed May 22, 2002.
30. Holl KD, Daily GC, Daily SC, Ehrlich PR, Bassin S. Knowledge of and attitudes toward population growth and the environment: university students in Costa Rica and the United States. Environ Conserv 1999;26:66-74.
31. Khalid T. Pre-service High School Teachers' Perception of Three Environmental Phenomena. Environmental Education Research 2003;9:35-50.
32. Borsari B, Vidrine MF, Doherty S. Assessing students' preparedness towards sustainability in US and European undergraduate agricultural curricula. Am J Altern Agric 2002;17:188-194.
33. Wilkins JL, Bowdish E, Sobal J. University students' perceptions of seasonal and local foods. J Nutr Educ 2002;32:261-268.
34. Davis SA, Edmister JH, Sullivan K, West CK. Educating sustainable societies for the twenty-first century. Int J Sustainability Higher Educ 2003;4:169-179.
35. United States Department of Agriculture (USDA). USDA News Release: Glickman Announces National Standards for Organic Food. Available at: http://www.usda.gov/news/releases/2000/12/0425.htm. Accessed: July 17, 2004.
36. Sandalidou E, Baourakis G. Customers' perspectives on the quality of organic olive oil in Greece. Br Food J 2002;104:391-406.

## Author Information

**Samer Koutoubi, M.D., Ph.D.**
School of Nutrition and Exercise Science, Bastyr University

**Maria L. Harrington, MS**
School of Nutrition and Exercise Science, Bastyr University

**Scott D. Murdoch, Ph.D., R.D.**
School of Nutrition and Exercise Science, Bastyr University

**Steven Garrett, Ph.C., M.S., R.D.**
WSU Extension/Puyallup, Washington State University