

INSTRUCTIONAL DESIGN AND ASSESSMENT

A 4-Week Nutrition and Therapeutics Course in an Undergraduate Pharmacy Program

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Submitted August 21, 2012; accepted April 12, 2013; published September 12, 2013.

Objective. To determine the effectiveness of an intensive 4-week nutrition course in increasing the knowledge of undergraduate pharmacy students.

Design. A Nutrition and Therapeutics elective course was developed that covered the *Australian Guide to Healthy Eating*, as well as nutrition labeling, food composition, functional foods, diabetes, cardiovascular disease, nutrition and cancer, osteoporosis, nutrient-drug interactions, nutritional supplements, weight management, and infant feeding. The course was taught using lectures, student-focused tutorials featuring evidence-based practice, problem-based learning exercises, case-based scenarios, media examples, video clips from the lay press, and articles from the professional/scientific literature.

Assessment. A self-administered, validated questionnaire on dietary recommendations, sources of nutrients, choosing everyday foods, and diet-disease relationship was administered prior to and after completion of the course. Students' scores in all 4 areas improved significantly; however, their knowledge of the national dietary recommendations, sources of nutrients, and everyday foods high in nutrients was below that of members of the community.

Conclusions. Nutritional education courses can increase the nutrition knowledge of undergraduate pharmacy students. The need for pharmacists to advise patients regarding nutritional supplements continues to increase the need for incorporating nutrition courses within curriculum.

Keywords: nutrition, pharmacy students, therapeutics

INTRODUCTION

The National Health and Medical Research Council of Australia developed the *Australian Guide to Healthy Eating* to provide a framework for all Australians to attain a healthy lifestyle. The *Guide* is intended to help average Australians plan the types and amount of food they and their children should eat in order to meet their nutritional needs each day based on age, gender, and activity level. It provides recommended ranges of intake based on eating a variety of foods from each of 5 food groups (bread and cereals, vegetables and legumes, fruit, dairy foods, and meat and meat alternatives), eating foods that do not fit into the 5 food groups only occasionally or in small amounts, eating plenty of plant foods and moderate amounts of animal foods, and drinking plenty of water. For each of the 5 food groups, the guide recommends a standardized number of servings and provides examples of what constitutes a serving.¹

If pharmacists are to provide information on nutritional supplements, vitamins, and minerals, they too must have a good understanding of the *Australian Guide to Healthy Eating*. Australian pharmacists have unanimously expressed a keen interest in assuming a more influential role in providing health-related information to patients, particularly with regard to weight management.² Excess weight predisposes individuals to develop metabolic abnormalities and increases their risk of multiple, chronic, diet-related diseases.³ Two-thirds of the Australian population is overweight or obese, which significantly increases the risk of suffering from coronary heart disease, Type 2 diabetes, some cancers, knee and hip problems, and sleep apnea.⁴ The total annual cost of obesity in Australia, including health system costs, productivity declines, and caregivers' costs was estimated at around \$58 billion in 2008. In addition, 18% of the Australian population were diagnosed with cardiovascular diseases estimated to cost \$5.4 billion, [ABS, Australian] while a further 4% were diagnosed with type 2 diabetes at an additional cost of \$42 billion.⁵ These and a number of other diet-disease states provide opportunities for pharmacists to counsel patients simultaneously on medications

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and diet and suggest lifestyle modifications. For example, patient adherence to the *Australian Guide to Healthy Eating and Weight Loss* may result in improved blood pressure, and blood glucose and lipid profiles, which in turn may lead to reductions in medication dose and use and improve overall health and life expectancy.

In consultations conducted as part of a study by our university, gaps in practicing pharmacists' nutrition knowledge were identified, particularly in new graduates. To ensure that future pharmacy graduates did not have these deficiencies, the faculty of health science at the University of South Australia introduced a Nutrition and Therapeutics course into the undergraduate pharmacy program. The aim of this study was to evaluate the effectiveness of this new course and to determine whether students in the final year of an undergraduate pharmacy degree program were sufficiently knowledgeable to effectively provide information about healthy eating and basic nutrition to the general public in future clinical practices.

DESIGN

The University of South Australia offered a Nutrition and Therapeutics elective course to students enrolled in the fourth year of a 4-year undergraduate pharmacy program. The course was offered as an intensive, 4-week, face-to-face course that covered the *Australian Guide to Healthy Eating*, as well as nutrition labeling, food composition, functional foods, diabetes, cardiovascular disease, nutrition and cancer, osteoporosis, nutrient drug interactions, nutritional supplements, weight management, and infant feeding. The course consisted of 16 hours of lectures and 16 hours of student-focused tutorials that featured evidence-based practice, problem-based learning exercises, case-based scenarios, media examples and journal articles, video clips from the lay press, and articles from the professional/scientific literature to fuel informed debate. The tutorial class size was limited to 28 students. This course was offered 3 times during 2010 and multiple tutorial groups were conducted in each practice experience. The course reflected 180 hours of student learning, much of which occurred outside the classroom: reading the 50 journal articles, preparing for workshops and tutorial classes, conducting supermarket surveys, and producing a health literacy animation/video to communicate the relationship between diet and disease to the lay public. No other courses were offered over this 4-week period. The staff members who taught this course were either dietitians or registered nutritionists. The University of South Australia's Human Ethics Committee approved the study.

EVALUATION AND ASSESSMENT

One hundred sixty students enrolled in the Nutrition and Therapeutics elective course were invited to complete

a self-administered, paper-based General Nutrition Knowledge Questionnaire (GNKQ-Aust). The GNKQ was developed in the United Kingdom by Parmenter and Wardle⁶ to measure general nutrition knowledge. The Australian version had been validated in a sample of members of an Australian community⁷ The GNKQ-Aust consisted of 113 questions that assessed understanding of general nutrition-related terminology; awareness of current dietary recommendations (13 items), knowledge of food sources related to nutrients (70 items), the use of dietary information to make dietary choices (10 items), and an awareness of the relationship between diet and disease (20 items). Each correct answer to a question was worth 1 point. The questions were compatible with the *Dietary Guidelines for All Australians* (adult version),⁸ and the Australian fruit and vegetable campaign "Go for 2 & 5," which recommended consumption of 2 servings of fruit and 5 servings of vegetables daily.⁹ Multiple-choice responses to each question varied, such as "more, same, less, don't know," "yes, no, not sure," "high, low, not sure," "agree, disagree, not sure," or 4 different food options. The 8 items about diet-disease relationships and the 2 items about recommended fruit and vegetable intake required written responses.⁷

Each participant's responses were manually coded numerically and converted to a corrected score, as defined by Parmenter and Wardle.⁶ All questions were equally weighted with a maximum of 13 points awarded for knowledge of dietary recommendations, 70 for sources of nutrients, 10 for choosing everyday foods, and 20 for the diet-disease relationships, for a possible total score of 113. A higher score reflected a higher level of knowledge. The data from each student's questionnaire were entered into SPSS, Version 18.0 (SPSS, Inc., Chicago, IL). The effect of the Nutrition and Therapeutics course on improving nutrition knowledge was analyzed using a one-way ANOVA. If a respondent did not answer an item no answer was recorded for that response.

Of the 160 pharmacy students enrolled in the fourth-year Nutrition and Therapeutics course (corresponding to the 3 course offerings over the year), 139 students completed the pre-intervention questionnaire and 102 students completed the post-intervention questionnaire. The pre- and post-questionnaires were unmatched. One hundred three of the 139 pre-intervention respondents were female and 86 of the 139 were less than 24 years of age (Table 1). Almost all of the students were single (n=96) and approximately two-thirds were international students from Vietnam, India, the United Kingdom, Malaysia, or China. Forty-eight percent of students worked part time in a pharmacy (n=49).

Respondents' overall baseline nutrition knowledge scores ranged from 33 to 78 out of a possible 113 points

Table 1. Demographics of Undergraduate Pharmacy Students in a Nutrition and Therapeutics Course (N = 139)

Characteristic	No. (%)
Gender	
Male	36 (25)
Female	103 (75)
Age, years	
18 - 24	120 (87)
25-34	19 (13)
>35	0
Marital status	
Single	129 (94)
Married/living as married	10 (6)
Residency	
Domestic students	49 (36)
International students	88 (64)
Parents of children	
Yes	5 (4)
No	134 (96)

and improved from 45 to 85 after completion of the Nutrition and Therapeutics course ($p < 0.001$). The nutrition knowledge in relation to dietary recommendations, scores of nutrients, choosing everyday foods, and diet-disease relationships all improved significantly ($p < 0.001$, $p = 0.001$, $p = 0.003$, $p = 0.046$, respectively). Baseline scores for each section of the questionnaire varied from 45% to 52% and improved to 51% 64% after completing the intensive course (Table 2).

While the pharmacy students' baseline scores for nutrition knowledge with respect to diet-disease relationships were comparable to those found within the general Australian community (46% vs 47% of the maximum score),⁷ the students' nutrition knowledge for the remaining parameters (dietary recommendations, scores for identifying food sources of nutrients, choosing everyday foods) (approximately 50% of the maximum total score) was well below that observed within the Australian community (Table 2). After completing the course, students' knowledge of dietary recommendations, ability to identify food sources of nutrients, and ability to choose everyday foods improved but still did not exceed those of the general community (51% to 64% of the maximum score). These results did not vary by the students' age or whether the students were domestic or international students, or worked part time in a pharmacy. However, there was an association between gender and higher scores in the category "choosing everyday foods" ($p = 0.028$), with female students being better able to identify everyday foods after completing the training program, scoring on average 5.6 out of 10, compared to male students who scored 4.6 out of 10.

Before beginning the course, students had some knowledge of the Australian dietary guidelines. The majority of students knew the recommendations that Australians eat more fruit and vegetables, and more high-fiber foods ($>90\%$; $p > 0.05$). After completing the course, students' ability to identify dietary-related diseases as a result of elevated salt and fat intakes significantly increased ($p < 0.005$ and $p < 0.001$, respectively). In addition, female students' knowledge of the correct number of daily servings of dairy products significantly increased by 10%.

Prior to completing the course, students' general knowledge of the sources of nutrients from foods was generally below that of the general Australian community (40% vs 47%). Two thirds of the students were able to identify that foods such as ice cream were high in sugar, and the percentage significantly improved with education ($p = 0.002$). Similarly, after training, over three quarters of the students were able to identify that processed luncheon meat was not a healthy alternative to red meat (increase of 26%, $p = 0.002$). However, the general nutrient composition of commonly consumed foods such as tomato sauce was generally poor even after training, with just over 50% of the students able to identify that tomato sauce was high in added sugar.

Feedback from students on completion of the course was positive. Students who provided feedback via open-ended questions usually wrote that they found the course "interesting and engaging" and that it just left them wanting more. However, students did comment on the "overwhelming" amount of reading required (50 peer-reviewed evidence-based studies). Student evaluations of the course at the end of the year were favorably and above average for the division within the University.

DISCUSSION

A 4-week intensive Nutrition and Therapeutics course offered to fourth-year undergraduate pharmacy students in an Australian University significantly improved students' overall nutritional knowledge and their ability to identify some sources of nutrients and diet-disease relationships, and to choose appropriate everyday foods. These outcomes are in accordance with similar studies conducted in Canada and the United States.^{10,11}

However, we were concerned by students' overall lack of general nutritional knowledge, knowledge of dietary recommendations contained in the Australian Guide to Healthy Eating, and ability to identify sources of nutrients and choose appropriate everyday foods were below those observed for the general Australian community. This was also observed in a Canadian study where undergraduate pharmacy students' knowledge of the Canadian Food

Table 2. Mean and Range of Correct Scores for the General Nutrition Knowledge Questionnaire Before and After Training

	Baseline Results (n= 139) ^a			Results After Nutrition Training (n= 102) ^b			Difference Between Group Means		Community Sample, Mean ^d
	Min	Max	Mean (SD)	Min	Max	Mean (SD)	Mean Difference	P ^c	
Dietary recommenda-tions (max.13)	1	12	6.8 (3.1)	2	13	8.3 (3.1)	1.5	<0.001	8.9
Sources of nutrients (max.70)	12	59	35.6 (11.2)	22	59	40.3 (8.9)	4.7	0.001	47.5
Choosing everyday foods (10)	1	9	4.7 (1.7)	2	9	5.4 (1.4)	0.6	0.003	6.7
Diet disease relationships (20)	2	18	9.2 (3.7)	3	18	10.1 (3.7)	1.0	0.046	9.4
Nutrition knowledge score (113)	33	78	56.3 (9.7)	45	84	64.1 (7.9)	7.8	<0.001	72.4

^a Baseline line results before taking the nutrition and therapeutics course (n=139).

^b Results for pharmacy students after completing the nutrition and therapeutics course at an Australian University.

^c Main effect of time by a one-way AVOVA. All values are reported as mean (SD).

^d Results reported for an Australian Community (Reported in: Hendrie GA, Cox DN, CoveneyJ. Validation of the general nutrition knowledge questionnaire in an Australian community sample. *Nutrition & Dietetics*. 2008;65(1):72-77.

Guide was poor and their self-reported dietary intake did not meet food guide recommendations.¹¹ In a second study, pharmacy students correctly identified folic acid as preventing birth defects, although just under half the students were unable to correctly identify either the recommended level of supplement intake or good food sources of folic acid.¹²

There were several explanations for the unexpected results observed in the current study. Most importantly, the course was not designed specifically to provide the knowledge tested in the general nutrition knowledge questionnaire (GNKQ-Aust). The course, however, did cover in detail key topics that a pharmacist needs to know, such as infant feeding, nutritional supplements, nutrient drug interactions, and weight loss and associated products available in a pharmacy, all of which were not directly evaluated by the GNKQ-Aust. Hence, the questionnaire may not have been the most appropriate tool to evaluate the overall effectiveness of the course. However, the course did cover chronic diseases and the role of nutrition in their prevention and treatment, including practical aspects of appropriate food selection. Also, the *Australian Guide to Healthy Eating* was integrated into the relevant content of the course; and the GNKQ-Aust did measure the change in students' nutrition knowledge for these aspects of the course. Pharmacists require good, evidence-based, general nutrition knowledge beyond that of the general community in order to provide reliable general nutrition advice on healthy eating to members of the public, and the questionnaire was able to determine an increase in this knowledge.

In designing the course, we made several assumptions about the baseline knowledge of students enrolled in

the pharmacy program. Most studies reported that more than 70% of medical or pharmacy students regularly use CAM products¹³ and this use did not appear to be influenced by friends, colleagues, or family background.^{14,15} Furthermore, almost half the students worked part time in pharmacies as assistants; it was assumed these students would have some knowledge of the products they were selling and possibly taking themselves. We also assumed that these students would be interested in health prevention and have baseline nutrition knowledge equal to or higher than that of the general Australian community. We now realize that our assumptions regarding students' baseline knowledge were incorrect.

Given that 57% of the students were International students, their knowledge of the *Australian Guide to Healthy Eating* plausibly could have been lower than that of domestic students; however, this was not the case. There were no significant differences between domestic and international students' knowledge of dietary recommendations, sources of nutrients, choosing everyday foods, and diet disease relationships.

There are several limitations to the study. As discussed, the GNKQ-Aust may not have been the most appropriate tool to evaluate the effectiveness of the course. The poor results could also reflect poorly chosen assessment tasks or teaching methodology. However, dissatisfaction with these items was not articulated in any of the student course evaluations with students.

As a result of this evaluation, the course was redesigned in 2012 to ensure that undergraduate students attain an adequate baseline nutrition knowledge, particularly given the increasing demand for community pharmacists to have

a positive role in providing nutritional information as part of primary health care teams.^{10,16,17} Specific changes made to the curriculum include a range of tutorial activities aimed to build confidence in implementing the *Australian Guide to Healthy Eating* such as reading food labels, a supermarket-based activity in comparing the nutritional composition of different food products within the same food group, and a “swap it” activity. *The Australian Guide to Healthy Eating* has also been embedded into modules on dietary-related diseases such as diabetes, cardiovascular disease, osteoporosis, and vitamin D deficiency. Furthermore, an additional module on health literacy has been included in the course to increase students’ ability to convey information on nutritional supplementation in relation to dietary-related diseases for a range of people (including minority groups). We hope that, by completing the course, students will gain an appreciation that nutritional science is a young and rapidly evolving science and that continual updating of this knowledge should be part of their ongoing professional lifelong learning.

CONCLUSION

Nutritional education courses can have a positive role in increasing the nutrition knowledge of undergraduate pharmacy students as was evidenced in our study by a significant increase in students’ knowledge of dietary recommendations, sources of nutrients, ability to choose every day foods, and overall nutrition knowledge after completing such a course. However, care needs to be taken in establishing the baseline nutrition knowledge of students when designing such a course. As nutrition is a minor component in pharmacy programs in both Australia and the United Kingdom, and given the increasing demand for CAM products in pharmacies around the world, there is a need for pharmacy educators and accreditation bodies to consider nutrition as a key component in all undergraduate pharmacy education programs.

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