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The distance learning tool 'Food Composition Study Guide' contributes to global capacity development in food composition

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Abstract

Food composition data underpin most activities in nutrition, and yet few universities and courses provide information on this topic. To address this problem, FAO/INFOODS developed a distance learning tool, the 'Food Composition Study Guide', comprising 17 modules covering all relevant topics on food composition in the form of questions, exercises and answers. It was used by 109 health and nutrition specialists and chemists in conjunction with classroom-based food composition courses, in a university setting (in a classroom-based seminar and as distance learning course), and by self-learners. The different applications were compared in terms of settings, objectives of the setting, participants, languages, modules used, modalities of use, evaluation by users, assessment of users, and lessons learnt. The Study Guide was useful for teachers to prepare lectures and to carry out courses; and for learners to acquire, deepen and elaborate their knowledge and skills in food composition. It proved successful in all settings. The Study Guide is a good means to fill the existing global training gap in food composition and can be used in universities, courses and by self-learners, either as distance learning or in classrooms. This will be enhanced through French and Spanish translation and distribution through Internet and CD.

1. Introduction

Food composition has a central role in nutrition, dietetics and food-related sciences because of its important applications: calculating nutrient intake estimations; determining nutrient requirements; in epidemiological research to establish relationships between nutrient intake and disease; calculating nutrient content for food labels; assembling institutional and therapeutic diets; including nutritionally-important plants and animals in breeding programmes; and informing consumers of good food choices. These applications have important implications for nutrition, health, and agriculture-related programmes and policies (Willet, 1998; Hagenimana, 1999; Charrondiere *et al.*, 2002; Riboli *et al.*, 2002, Englberger *et al.*, 2003; Greenfield and Southgate, 2003; IOM, 2003; Burlingame, 2004; FAO/WHO, 2004; Toledo and Burlingame, 2006; Pennington *et al.*, 2007; Vorster *et al.*, 2007).

The quality of these data and their use depends on the knowledge of the professionals in food composition (Hollman et al., 2009). However, only about 550 professionals have been trained in food composition worldwide through expensive classroom-based postgraduate courses[13, 14] while it is hardly included in curricula of universities (Greenfield and Southgate, 2003). Especially in developing countries (Schoenfeldt, 2002), there is a great need to train more professionals in food composition and new approaches are needed to reach them in an economical and efficient way. As distance learning is increasingly used for education and training of professionals (University of Bridgeport, 2010; Learning center, 2010; Codex Alimentarius, 2005; FAO, 2010 a; Rosenberg, 2001), the Food and Agriculture Organization of the United Nations (FAO) and the International Network of Food Data Systems (INFOODS) published the distance learning tool 'Food Composition Study Guide' (Charrondiere *et al.*, 2009 b, c). It allows a wide range of learners (users, compilers and analysts) to fill their specific knowledge gap at their convenience at no cost, and to evaluate themselves. In this article it will be referred to as the 'Study Guide'.

The Study Guide covers food composition in the form of questions, exercises and answers. It is based on the principles of instructional design (Smith and Ragan, 1999), Bloom's taxonomy of cognitive objectives (Bloom *et al*., 1956); INFOODS documents, including Greenfield and Southgate (2003), Klensin *et al*. (1989), Rand *et al.* (1991), Klensin (1992), FAO (2003, 2004; 2008); and EuroFIR documents (2010 b). The Study Guide content compares well with classroom-based food composition courses (Charrondiere *et al.*, 2009 a),

was peer reviewed and field tested, and is most relevant to users and compilers of food composition data, but also to analysts. The Study Guide is to be used together with the FAO/INFOODS Compilation Tool (Charrondiere & Burlingame, 2010; INFOODS, 2010 b) to apply the compilation, calculation and documentation of food composition data. In September 2009, the Study Guide was published electronically in English on the INFOODS website http://www.fao.org/infoods/publications_en.stm and allows a wide range of learners to fill their specific knowledge gap at their convenience at no cost, and to evaluate themselves.

This article describes and analyses the different usages of the Study Guide in classroom-based food composition courses, in a university setting, and by self-learners, and illustrates new approaches food composition courses.

2. Material and methods

The two volumes of the Study Guide were used (Charrondiere et al., 2009 b,c) volume 1 containing the questions and exercises, and volume 2 providing the answers and feedback. The content of both volumes is presented in 17 modules (see table 1):

The unpublished evaluation forms, oral feedback and tests from self-learners and course participants (three postgraduate food composition courses and two at the University of Vienna) were utilized to evaluate the Study Guide in the different settings. The test criteria were learning objectives, participants, language, modules used, modality of usage, and evaluation by users.

3. Results

Before field testing, all modules were peer reviewed and tested by 36 experts and professionals with knowledge on food composition. Experts found the Study Guide to be of high quality and their comments were used to rephrase and complete the questions, exercises, answers and additional information. Thereafter, the Study Guide was tested and implemented in three classroom-based international postgraduate food composition courses, in a university classroom setting as part of a nutrition curriculum, as a university-level distance learning course, and by self-learners (see table 2).

3.1 In conjunction with classroom food composition courses

The Study Guide was field tested in three classroom courses in Iran, Benin and Ghana (INFOODS, 2010 a) as an integrated part of a food composition course to reinforce understanding and performance of participants. The modules were used during all three courses, and in two courses also as an information management tool to increase the knowledge of participants beforehand. Participants completed the questions and exercises in small groups using hand-outs of the lectures and the reference documents before discussing the results in the whole group. At the time of the courses, the Study Guide was not yet published, meaning that participants did not have access to the answers. The modules created many discussions and motivated them to share their experiences and understanding. The modules were highly appreciated by participants and by instructors. The Study Guide also assisted instructors to prepare their lectures, to hold the course and to develop the final test. The final test was a subset of the modules discussed during the course and all participants passed the test by reaching 60-90 % of the points (mean 65.1, 74.3 and 78.9).

3.2 In a university setting

At the University of Vienna, Austria, two courses on “Correct use of food composition data” were given, each counting for three ECTS credits (European Credit Transfer and Accumulation System).

Sixteen students attended the 3-day classroom course which consisted of 8 hours of lectures including discussion, 9 hours of exercises, 3-4 hours of homework and a 2-hour exam. In this course, modules 4.a, 4.b and 4.c were given as homework and parts of modules 2 and 10.b were used as exercises in the classroom. The course was innovative in two ways, first through the use of the modules and secondly that every lecture was followed immediately by an exercise using real data, i.e. the 28 foods from the Austrian food frequency questionnaire (FFQ), developed by Freisling *et al.* (2009), were put into food groups, coded, and were disaggregated into more specific foods. The draft Austrian Nutrient Database (OELS) was used to identify foods to apply their nutrient values to the FFQ foods and to match the components of the OELS to those of the Compilation Tool (Charrondiere & Burlingame, 2010).

In 2009, a distance learning course was given in which the six students completed modules 1, 2, 3, 4.b, 4.c, 7, 8, 10, 11, (about 55 hours) during three months. Thereafter, a one-day optional classroom interaction between students and instructors was held, queries were discussed, main points of the modules were summarized and some exercises were done based on module 10.b.

Both courses were successful as students acquired good theoretical knowledge and skills. In the classroom-based course, students increased their knowledge on food composition significantly between the initial and final test, corresponding to 2.8 grades on average (on a scale of 0-4). The tests for both courses had multiple-choice questions, which were selected from the modules covering the subjects treated during the course. About 90% of students obtained an A or B mark (on a scale of A to D).

3.3 By self-learners

In addition in 2009, the Study Guide was used by seven self-learners at FAO, Rome, and the University of Pretoria, South Africa. They needed to acquire relevant knowledge to carry out specific tasks related to food composition or food biodiversity. They used all modules, even though most of them completed modules 4.b- 4.d, 8, 10, 12, which took them 5-12 hours for each module. After completing the relevant modules, they were able to well calculate nutrient values of recipes using different recipe calculation systems using the Compilation Tool; to collect relevant food composition data on food biodiversity from different sources and compile them into a food composition database using the Compilation Tool; and to develop and collect data for Nutrition Indicators for Biodiversity on food consumption (FAO, 2010 b). The approach of self-learning was highly beneficial for their supervisors as it saved a substantial amount of time for training and supervision while being assured that staff received the comprehensive and standardized knowledge needed to fulfil the specific tasks they were assigned.

3.4 Evaluation by users and assessment

Learners appreciated the modules because they acquired a lot of knowledge and skills, and because they were able to demonstrate that they had understood and assimilated the content of the course, even though they needed an appreciable amount of time to complete the modules.

Most course participants would have appreciated to spend more time on the modules and to have them available in their first language. The Study Guide assisted them to better understand the course content, to keep their attention high even after many course hours, and to assess their knowledge and skills acquisition. They appreciated the value of certain modules (e.g. component nomenclature, conventions and units) only when compiling and calculating food composition data. The Study Guide also assisted instructors to prepare their lectures, to hold the course and to develop the final tests which were a selection of the multiple-choice questions from the modules. These tests showed that course participants acquired a good theoretical knowledge and practical skills (60-90 % of possible points, with means of 65.1; 74.3 and 78.9) but obtained in general lower marks than university students.

4. Discussion

The Study Guide has been used successfully in different settings, i.e., during and before food composition courses, in a university setting in conjunction with a classroom-based seminar and as a distance-learning course, as well as by self-learners. The modules represent a useful tool for:

- instructors, even for those with limited experience in food composition, to better prepare lectures or to run a course
- participants of distance-learning and classroom-based courses to acquire relevant knowledge and skills while reviewing the course content and by applying the newly-acquired knowledge
- self-learners to acquire the necessary knowledge and skills to successfully carry out tasks related to food composition or food biodiversity.

The Study Guide was shown to be useful in moving away from solely lecture-based training. Learning by completing the modules is very different from listening to lectures Lecture-based classroom courses allow interaction and take less time to address subjects, but there is no time to deepen the knowledge or to apply it, and normally knowledge acquisition is not assessed[14]. The learning approach of the Study Guide is in line with non-lecture based learning styles such as ‘Learning-by-doing’ or peer education (Khan et al., 2009) or interteaching (Goto and Schneider, 2009) using learning through exercises and discussions.

The Study Guide fulfils most of the quality criteria for distance and e-learning proposed by Baker (2003) and Mihai (2009) as it was developed using instructional design (Smith and Ragan, 1999) and Bloom's taxonomy of cognitive learning (Bloom et al., 1956). However, the criteria concerning an interactive format and a quick learning experience were not fulfilled because the Study Guide is a static document in two volumes, although it includes hyperlinks to all referred documents, and as it takes 3 to 9 hours to complete one module.

The Study Guide was used as an information management tool, i.e. students complete all or selected modules of the Study Guide as a pre-requisite for the course. This allows the classroom-based course to place more emphasis on activities of the higher intellectual levels (Bloom et al., 1956), which could make it more effective, interesting and result-oriented (Morrison *et al*., 2004; Rosenberg, 2001). However, it seems necessary to obtain a firm agreement from participants of food composition courses to complete the modules beforehand. Sending the modules at least one month before the course is preferable, but experience showed that not every participant will complete all modules, mostly because of lack of time.

Future course are planned without lectures, where the Study Guide will be used as an information management tool, and during the classroom instruction participants will compile a food composition database containing local foods and recipes and/or develop a sampling plan for a food. These outputs could be the basis for a national or regional food composition database. During these courses, trainers can be instructed to carry out future courses.

Professionals with advanced knowledge in food composition appreciated the Study Guide because it is systematically structured, comprehensive, of high quality, and in some cases they declared having learned something new. In many cases, they reported having skipped the reading and answered the questions and exercises but turned to the reading material when needed. Learners with little or no knowledge read the indicated material which took them often a substantial amount of time, especially for those for whom English is not their mother tongue or working language. Some of the recommended reading materials are only available in English, even though the modules will be available in Spanish and French. Even for native English speakers, some of the reading materials were considered difficult to comprehend. However, these materials are the authoritive sources and not subject to revision by the authors of the Study Guide. However, these difficulties represent real-life situations. Some answers

were not found as such in the reading material, and learners needed to use their acquired knowledge to answer the question or exercise. Due to the difficulties encountered with the reading material and due to the fact that students seem less engaged in reading (Lee et al., 2009), it a revised version of the Study Guide in April 2010 with more references to PowerPoint presentations, which summarize the content of each module and which will be available on the INFOODS website (INFOODS, 2010 c). These presentations can also be used by lecturers to develop or customize their own lectures.

University students and self-learners (who needed to carry out specific tasks) were most motivated to complete the modules and obtained highest scores. The acquisition of knowledge and skills when completing the modules, with high or low scores, should however not be underestimated, as learners often returned to the reading material, checked the exact wording and meaning, used previous knowledge and thus deepened their understanding. Successful completion of the modules increased the learners' self-confidence in their acquisition of knowledge and understanding, and in their ability to work with food composition data.

It is also planned to test more approaches using Skype or other audio or communication tools for the personal interaction between instructors and learners. This approach, if reliable Internet connections were assured, could overcome the isolation felt by distance-course students (Owens et al., 2009), and would permit training with interaction where instructors and learners remain in their locations. These new approach could be especially useful in developing countries where there is the greatest need for capacity development in food composition (Schoenfeldt, 2002).

In addition, the Study Guide modules can be used to introduce food composition into the food science and nutrition curricula of universities, e.g., as a distance learning course, a seminar or simply in lectures. The combination of distance learning with a one-day interaction with the teacher seemed to be highly profitable for students, which is in line with the positive feedback from other distance learning courses offering interaction with the instructor (Herbert, 2006).Occasionally, teachers in universities may need to acquire the relevant knowledge of food composition beforehand, e.g., through the Study Guide. Over 35 universities worldwide already expressed their interest in using the Study Guide in their curricula (personal communication).

The Study Guide is most useful for individual knowledge and skills acquisition. However, to transform the capacity building from individuals to that of their institutions, a positive political and institutional support and funding are essential (Rosenberg, 2001; OECD, 2006), without which high quality food composition programmes and databases will not be developed and/or maintained (Greenfield and Southgate, 2003).

The Study Guide has however never been tested with self-learners who study solely on their own without any possibility to interact with a knowledgeable professional in the field.

4. Conclusion

The Study Guide offers to a wide range of individuals new possibilities to acquire the relevant knowledge and skills in food composition and thus can fill the global training gaps in food composition and food biodiversity, especially in developing countries. In addition, it allows instructors in universities and of postgraduate courses to prepare high- quality lectures and to hold courses on food composition without the assistance of international instructors. Through active communication by FAO and other channels, the translation of the Study Guide into French and Spanish, and the dissemination through CD ROMs with all course material (for those with no or limited Internet assess), it is expected that the Study Guide will be widely used in food composition courses, universities and by self-learners, either as distance learning or in classrooms.

The more nutrition professional are aware of the underlying tasks to develop an adequate, reliable and up-to-date food composition database and that the quality of nutrient intake estimation, research and policies depend on these data, the more likely it will be that more adequate food composition databases will be developed.

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References

Baker, R.K. (2003) A Framework for Design and Evaluation of Internet-Based Distance Learning Courses Phase One - Framework Justification, Design and Evaluation. Online Journal of Distance Learning Administration, 6 (2). Available at http://www.westga.edu/~distance/ojdla/summer62/baker62.html

Bloom, B. S., Engelhart, M.D., Furst, E.J., Hill, W.H. & Krathwohl, D.R. (1956) A Taxonomy of Educational Objectives. The classification of educational goals. Handbook I: Cognitive Domain. McKay, New York

Burlingame, B. (1998) Food Trade and Food Composition. Journal of Food Composition and Analysis 11, 3:199.

Burlingame, B. (2004) Fostering quality data in food composition databases: visions for the future. Journal of Food Composition and Analysis 17, 251-258

Charrondiere U.R., Vignat J., Riboli, E. (2002) Comparable Nutrient Intake across Countries is only possible through Standardization of Existing Food Composition Tables (FCT). In: Nutrition and Lifestyle: Opportunities for Cancer prevention. Eds. Riboli E and Lambert R. IARC Scientific Publications No. 156, p.39-40

Charrondiere, U.R., Burlingame, B., Berman, S. & Elmadfa, I. (2009 a) Food composition training: Distance learning as a new approach and comparison to courses in the classroom, Journal of Food Composition and Analysis 22, 421–432

Charrondiere, U.R., Burlingame, B., Berman, S. & Elmadfa, I. (2009 b) Food Composition Study Guide – questions and exercises (Volume 1). FAO, Rome. Available at: http://www.fao.org/infoods/publications_en.stm

Charrondiere, U.R., Burlingame, B., Berman, S. & Elmadfa, I. (2009 c) Food Composition Study Guide – Answers to questions and exercises (Volume 2). FAO, Rome. Available at: http://www.fao.org/infoods/publications_en.stm

Charrondiere, U.R. & Burlingame, B. (2010) Compilation Tool for food composition in Excel format for use in the absence of a food composition database management system (submitted)

Codex Alimentarius (2005) Enhancing participation in Codex activities: A FAO/WHO training package CD-Rom. Available at: http://www.fao.org/ag/agn/agns/CDcodex/index.htm

Englberger, L., Schierle, J., Marks, G., Fitzgerald, M. (2003) Micronesian banana, taro and other foods: newly recognized sources of provitamin and other carotenoids. Journal of Food Composition and Analysis 16: 3–19.

EuroFIR (2010 a) EuroFIR's E-learning modules. Making food composition data comprehensible. Accessed in 2010 at: http://www.eurofir.net/public.asp?id=9476

EuroFIR (2010 b) assessed in 2010 at: http://www.eurofir.org/eurofir/

FAO (2003) Food energy - methods of analysis and conversion factors. FAO, Rome. Available at: ftp://ftp.fao.org/docrep/fao/006/y5022e/y5022e00.pdf

FAO (2004) Report of the 'Technical workshop on Standards for food composition data interchange', Rome. FAO, Rome. Available at: ftp://ftp.fao.org/es/esn/infoods/interchange.pdf

FAO (2008) Expert Consultation on Nutrition Indicators for Biodiversity - 1. Food Composition. FAO, Rome. Available at ftp://ftp.fao.org/docrep/fao/010/a1582e/a1582e00.pdf.

FAO (2010 a)Capacity building portarl. Accessed in 2010 at: http://www.fao.org/capacitybuilding/

FAO (2010 b) Expert Consultation on Nutrition Indicators for Biodiversity - 2. Food Consumption. FAO, Rome. (in print).

FAO/WHO (2004) Vitamin and mineral requirements in human nutrition - Second edition- report of a joint FAO/WHO expert consultation. Bangkok, Thailand, 1998. FAO/WHO, Rome.

Freisling, H., Elmadfa, I., Schuh, W. & Wagner, K.-H. (2009) Development and validation of a food frequency index using nutritional biomarkers in a sample of middle-aged and older adults. Journal of Human Nutrition and Dietetics, 22, 29-39.

Greenfield, H., Southgate, D.A.T. (2003) Food Composition Data: Production, Management and Use, 2nd Edition, FAO Rome. ftp://ftp.fao.org/docrep/fao/008/y4705e/y4705e00.pdf

Goto, K., Schneider, J. (2009. Interteaching: An Innovative Approach to Facilitate University Student Learning in the Field of Nutrition. Journal of Nutrition Education and Behaviour; 41 (4):303-304

Herbert, M. (2006) Staying the Course: A Study in Online Student Satisfaction and Retention. Online Journal of Distance Learning Administration 9 (4)

Hollman PCH., Witthöft CM, Busstra MC, Elburg L; Hulshof PJM. (2009) Training aspects in the use and production of food composition databases. The EuroFIR experience. Food Chemistry; 113 (3), 842-845

Hagenimana, V.M., Oyunga, J., Low, S., Njoroge, M., Gichuki, J., Kabira, P. (1999) The effects of women farmers' adoption of orange-fleshed sweet potatoes: raising vitamin intake in Kenya. ICRW/OMNI Research Report Series, 3: 1–24.

INFOODS (2010 a) International Network of Food Data Systems. Courses and Workshops in Food Composition. Accessed in 2010 at: http://www.fao.org/infoods/training_en.stm

INFOODS (2010 b) International Network of Food Data Systems. Software. Compilation tool version 1.2.1 and User guidelines: Accessed in 2010 at: http://www.fao.org/infoods/software_en.stm

INFOODS (2010 c) International Network of Food Data Systems. Presentations. Accessed in 2010 at: http://www.fao.org/infoods/presentations_en.stm

IOM Institute of Medicine (2003) Dietary reference intakes. Guiding principles of nutrition labeling and fortification. Committee on Use of Dietary Reference Intakes in Nutrition Labeling Food and Nutrition Board . Washington DC: National Academies Press.

Khan, N.A., Nasti, C., Evans, E.M., Chapman-Novakofski, K. (2009) Peer Education, Exercising and Eating Right (PEER): an Undergraduate Faculty Teaching Partnership. Journal of Nutrition Education and Behaviour; 41 (4):68-70

Klensin, J.C. (1992) INFOODS food composition data interchange handbook. United Nations University, Tokyo. Available at: http://www.unu.edu/unupress/unupbooks/80774e/80774E00.htm or as PDF file at ftp://ftp.fao.org/es/esn/infoods/Klensin%201992INFOODSDataInterchangeHandbook.pdf

Klensin, J.C., Feskanich, D., Lin, V. Truswell, A.S., Southgate, D.A.T. (1989) Identification of Food Components for Data Interchange. United Nations University, Tokyo. http://www.unu.edu/unupress/unupbooks/80734e/80734E00.htm

Learning centre (2010) All courses in nutrition categories. Accessed in 2010 at: http://theelearningcenter.com/courses/category/nutrition

Lee, H., Contento, I.R., Koch, P., Barton, A. (2009). Factors Influencing Implementation of Nutrition Education in the Classroom: An Analysis of Observations in the Choice, Control, and Change (C3) Curriculum. Journal of Nutrition Education and Behaviour; 41 (4S):S37

Mihai, A. (2009) Teaching European Studies Online: the Challenge of Quality Assurance. European Journal of Open and Distance Learning. December

Morrison, G.R., Ross, S.M. & Kemp, J.E. (2004) Design effective instruction. *John Wiley and Sons, Inc. USA*

OECD Organisation for Economic Co-operation and development (2006). The Challenge of Capacity Development: working towards good practise. Available at: http://www.oecd.org/dataoecd/4/36/36326495.pdf

Owens, J., Hardcastle, L.A., Richardson, B. (2009) Learning From a Distance: The Experience of Remote Students. The Journal of Distance Education / Revue de l'Éducation à Distance ; 23 (3) : 53-74

Pennington, J.A., Stumbo, P.J., Murphy, S.P., McNutt, S.W., Eldridge, A.L., McCabe-Sellers, B.J., Chenard, C.A. (2007) Food composition data: the foundation of dietetic practice and research. Journal of the American Dietetic Association Dec;107(12):2105-13.

Rand, W.M., Pennington, J.A.T., Murphy, S.P. & Klensin, J.C. (1991) Compiling Data for Food Composition Data Bases. United Nations University, Tokyo. Available at: http://www.unu.edu/unupress/unupbooks/80772e/80772E00.htm

Riboli, E., Hunt, K.J., Slimani, N., Ferrari, P., Norat, T., Fahey, M., Charrondiere, U.R., Hémon, B., Casagrande, C., Vignat, J., Overvad, K., Tjønneland, A., Clavel-Chapelon, F., Thiébaut, A., Wahrendorf, J., Boeing, H., Trichopoulos, D., Trichopoulou, A., Vineis, P., Palli, D., Bueno-De-Mesquita, H.B., Peeters, P.H., Lund, E., Engeset, D., González, C.A., Barricarte, A., Berglund, G., Hallmans, G., Day, N.E., Key, T.J., Kaaks, R., Saracci, R. (2002) European Prospective Investigation into Cancer and Nutrition (EPIC): study populations and data collection. Public Health Nutrition Dec; 5(6B),1113-24.

Rosenberg, M.J. (2001) E-learning - Strategies for delivering knowledge in the digital age. McGraw-Hill Compangies, USA.

Schoenfeldt, H.C. (2002) Food Composition program of AFROFOODS. Journal of Food Composition and Analysis 15(4):473-479.

Smith, P.L., Ragan, T.J. (1999) Instructional design. John Wiley and sons, Inc. USA

Toledo, A., Burlingame, B. (2006) Special issue on Biodiversity and Nutrition: a common pathway. Journal of Food Composition and Analysis 19(6-7): 294 pp.

University of Bridgeport (2010) M.S. in Human Nutrition Online Degree Program. Accessed in 2010 at: http://www.bridgeport.edu/pages/2272.asp

Vorster H.H., Murphy, S.P., Allen, L.H., King, J.C. (2007) Application of nutrient intake values (NIVs). Food and Nutrition Bulletin 28(suppl):S116-S122.

Willett, W. (1998) Nutritional epidemiology. 2nd edition. Oxford University Press, New York, USA.

Table 1: The 17 modules of the Food Composition Study Guide

	Modules
Module 1	Basic principles of a food composition programme
Module 2	Use of food composition data
Module 3	Selection and nomenclature of foods in food composition databases
Module 4.a	Component selection
Module 4.b	Component nomenclature
Module 4.c	Component conventions and units
Module 4.d	Methods of analysing components
Module 5	Sampling
Module 6	Quality aspects of analytical data
Module 7	Resources for food composition Publishing food composition data
Module 8	Recipe and other calculations
Module 9	Food composition database management systems and data interchange
Module 10	Compilation and documentation
Module 10.a	Comparing food composition databases
Module 10.b	Case study - translating food intake into nutrient intake
Module 11	Quality considerations in data compilation
Module 12	Food biodiversity

Table 2: Comparison of different usages of the Study Guide in food composition courses, university setting and by self-learners and reviewers

	Food composition course in Iran (2008)	**Course on food composition and biodiversity in Benin (2009)**	**Course on food composition and biodiversity in Ghana (2009)**	**University of Vienna as classroom course (2008)**	**University of Vienna as distance learning course (2009)**	**Self-learners and reviewers working in food composition area (2007-9)**	**Self-learners with little or no previous knowledge in food composition (2009)**
Setting	Food composition course of 2 weeks in classroom organized by FAO.	Course on food composition and biodiversity of 2 weeks in classroom organized by FAO and Bioversity International.		3 days block seminar in classroom: 'Correct use of food composition data', counting for 3 ECTS credits. Lecturer: U.R.	Self-learning plus 1 optional day in classroom: 'Correct use of food composition	Pilot testing and peer review of modules by professionals working in food	Volunteers, students or consultants to work with food composition data and/or on

				Charrondiere and H. Freisling.	data', counting for 3 ECTS credits. Lecturer: U.R. Charrondiere.	composition.	biodiversity (FAO, Rome; University of Pretoria, South Africa).
Objectives of settings	To enable participants to generate, manage, compile and use food composition data correctly. To investigate understanding and quality of modules.			To enable participants to manage, compile and use food composition data correctly. To investigate understanding and quality of modules.		To investigate usefulness, understanding, completeness, quality and necessary improvements of modules.	To compile, calculate and use food composition data correctly and/or to work on biodiversity.
Participants	15 nutritionists, chemists and other health and nutrition specialists working in government agencies.	15 nutritionists, chemists and other health and nutrition specialists working in government agencies, NGOs, private sector and universities.	14 nutritionists, chemists and other health and nutrition specialists working in government agencies, NGOs, private sector and universities.	16 master and PhD students in nutrition of the University of Vienna.	6 master and PhD students in nutrition of the University of Vienna.	36 nutritionists, chemists and other health and nutrition specialists working in government agencies, private sector and universities.	5 nutritionists and 2 students.
Language	English	Course in French but modules in French and English	English	English	English	English	English
Modules used	Modules 1-4.c and 5 by all participants. Modules 4.d and 6 only by chemists.	Modules 1-10, 12 out of which only modules 5, 6, 12 were in French.	Modules 1-10, 12	Modules 4.a-4.c entirely. Part of module 2, 10.b.	Modules 1-3, 4.b, 4.c, 7, 8, 10, 11	Each person evaluated one to three modules	All modules, but mostly 4.b- 4.d, 8, 10, 12
Modality of usage	No module was sent before.	Participants received 10 modules 2 weeks before the course to complete them.	Participants received 8 modules 4 weeks* before the course to complete them.	Parts of the modules were used as exercises during the course, and modules 4.a-4.c were given as homework and answers were discussed the next morning. All lectures were immediately followed by a practical exercise, including from modules. Answers were not available to participants. Initial and final tests were a subset of questions from the modules used.	Students completed the modules alone (over 55 hours) and evaluated themselves. During the 1 day seminar, student's queries were clarified and a summary of important issues of each module was elaborated. Module 10.b was used to exercise food matching and compilation. Final test was a subset of questions from the modules used.	Each person completed the assigned module and gave feed-back on understanding, completeness, and correctness, and provided suggestions for improvements.	Individuals completed modules, evaluated themselves and discussed with supervisor eventual questions. Then they compiled data, calculated recipes, worked on biodiversity, or used food composition data for their thesis.
	Participants completed the modules in 8 sessions after the corresponding lectures using hand-outs of the lectures and Greenfield and Southgate (2003). In an established order, each participant presented the answer to one question, which was then discussed by the whole group. Correct answers to the modules were not available to participants. Final test was a subset of questions from the modules used.						
Evaluation	Useful to understand	Appreciated modules	Backbone of the course.	Heavy burden as homework	Self-learning represented	Provided suggestions	Useful to complete

by users	content of course but more time is needed.	which generated discussions and allowed them to review and deepen knowledge from lectures, and to apply the new knowledge. Useful to evaluate remaining knowledge gaps. More time necessary for modules during the course. They should be sent 1 month before the course to participants. Modules should all be in French.	They stimulated discussion on the issues which helped understanding and comprehension. Appreciated the exercises which allowed applying the new knowledge. Useful to evaluate remaining knowledge gaps.	but permitted to note that course content was understood.	heavy burden. More time was needed than indicated, especially for exercises and reading (course material was in English and most students were German mother tongue). Students found the 1 day revision essential to digest and collate the acquired knowledge from the different modules. The interest of some modules was understood when completing the compilation module.	for improvement and found in general that modules are comprehensive, well designed and systematic, and of high quality even though difficult for new learners. Reading material sometimes difficult to follow and to locate information.	tasks. More time needed than indicated and some questions and exercises were difficult. The interest of some modules was fully appreciated when compiling data. The biodiversity module gives a good overview on the topic. It was good to work in pairs as eventual queries could be discussed.

* 2 participants received the modules only few days before arrival because of late acceptance to the course.
ECTS = European Credit Transfer and Accumulation System