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Abstract

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Keywords

diet, nutrition assessment, computer, self-assessment, software program

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An Overview of Computerized Dietary Assessment Programs for Research and Practice in Nutrition Education

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ABSTRACT

Computerized dietary assessment programs are often used for nutrition education research and practice. This article provides an informal overview of 29 dietary assessment programs mentioned in the literature covered by MEDLINE 1996-2003, along with the components and capabilities of these programs derived from additional sources as needed. According to the literature, advantages of using computers for dietary assessment include standardisation of the questioning sequence, fast and easy processing, immediate results, and increased flexibility. Disadvantages include the need for typing skills and computer literacy as well as potential bias in the responses if an interviewer is required.

Keywords: Dietary assessment, nutrition assessment, computerized diet assessment, computerized nutrition assessment

INTRODUCTION

This paper addresses the use of computer technology for dietary assessment. Two commonly employed techniques are discussed: 1) Computer-assisted dietary assessment in which a health professional, practitioner or researcher uses a computer to assist with dietary assessment and 2) Computer-assisted self-assessment in which a respondent uses the computer to complete their own assessment. Computerised assessment refers to both.

There are a number of cognitive advantages to using computers for dietary assessment, rather than non-computerized approaches (1). These include enhanced communication through pictures, standardisation of the questioning sequence (2), decreased bias toward socially undesirable questions (3) and the ability to collect data in a neutral environment (in the case of self-assessment) (1). Disadvantages include the need for typing skills and computer literacy as well as potential bias in the responses if an interviewer is required (4). Speech recognition and touch screen technology may enhance computerised assessment (5) as they are incorporated into newer programs.

Computerised assessment can maximize effectiveness of dietary advice because it provides automatic feedback, tailored to the individual. Feedback may be personalised by drawing relevant recommendations from an ordered message archive (word processor) to form a letter (6). Automated feedback of this nature has been shown to be more effective than generalized feedback in diabetes management (16). Tailored feedback can have both motivating and reinforcing effects (6). Feedback may take the form of graphs or tables representing the

adequacy of a person's nutritional intake, health risks associated with low or high intakes identified by the assessment, and related nutrition recommendations and recipes. Some even generate related shopping lists (7). Tailored feedback should provide recommendations based on an individual's usual eating habits, food preferences and stage of change (8).

Not all computerised dietary assessment programs have an advice component. In many cases the program simply reports results of the dietary assessment which the dietitian or nutritionist uses to formulate advice or to assess change in dietary intake. In contrast, most computerised assessment programs include some form of 'memory enhancement' features to help respondents remember all details of their usual diet. Probe questions (9) and audio/visual aids tend to be employed in assessment programs (1). In older programs where audio or visual effects are not available to prompt the respondent's memory, food descriptions, probe questions and prompts may be presented in text format. Meal-based questions have been shown to result in more accurate reporting than questions regarding individual foods (1, 9).

With newer computerized programs, clients may select a food from photographs integrated into the program and drag the image of that food to a plate (10) representing the foods as they are eaten together. Approaches such as these enable respondents to focus on the timing, setting and task to be remembered (9). Manual methods of assessment limit the accuracy of reporting actual consumption (11) unless direct visual representations of the food and plate waste can be conducted (12).

Portion sizes visualised through realistic images (7, 13) can aid recall of dietary habits (generic memory) and casual encounters with food (episodic memory) (1). Older computer packages often rely on picture books, models and household measuring cups and spoons (provided by

the researcher or interviewer) for portion size estimation. Newer packages incorporate 3-dimension visuals to assist in estimating of serving size. This approach is more effective and preferred by respondents over the use of 2-dimensional visuals (14).

Computerized assessment programs are often judged on ease of data entry; ability to preview single nutrients while entering food names; optional expression of food portion by weight, volume, or household measure; whether food lists can be edited, and ability to compare results to a variety of dietary standards. The ease of averaging multiple days of intake and exporting data for statistical analyses may be important as well (15).

In research, missing data may require the investigator to utilize multiple sources of information on food composition including databases other than the one included with the computer program, articles from the scientific literature, and information from food manufacturers (15). Spelling errors and errors in identification of specific foods may also create problems, especially with self-administered computer-assisted dietary assessment.

LITERATURE SEARCH FOR COMPUTERIZED DIETARY ASSESSMENT PROGRAMS

Computerized self-assessment programs have been well-received by respondents, especially when key skills such as ‘point and click’ are demonstrated in advance and professional support is provided throughout the self-assessment (3). Where computer programs have been used in dietary self-assessment for diabetes management programs comprehension of assessment results was greater than in prior interventions that did not include computer self-assessment

(10). Lack of computer knowledge and skills can result in negative experiences with computerised dietary self-assessment programs (10) but it appears that the main limitation is the user's ability to report accurately on their health rather than their ability to use the computer (16).

We conducted a systematic search through MEDLINE (Version 6.2.0) 1996-2003 for English language manuscripts describing computer use in dietary assessment. Key search terms used alone and in combination included Diet*, Computer*, Diet History and Automation. In the next step, we developed an overview of the features of each computer program identified through the literature search, using information contained in the articles, a review of the computer programs themselves, and/or a review of manufacturers' descriptions of the computer programs. The goal was to outline the programs and features available rather than to provide a critical analysis of their relative quality or usefulness.

The review was conducted by the authors based on their dietetic and research experience. No attempt was made to establish the reliability of observations concerning program features.

RESULTS OF THE LITERATURE SEARCH AND REVIEW OF PROGRAM FEATURES

Twenty-nine computerised assessment programs were identified and the core features of each program were noted (Table 1). Of these, 13 were based on a food record, 8 on a diet history, 5 on a food frequency questionnaire, and 5 on a 24 hr recall. These figures do not equate to 29 because some programs support more than one type of assessment. Two programs were also

identified for nutrition education (17, 18), 1 program for nutrition intervention using weighed food records (19, 20) and 2 programs used a manual form of assessment followed by computer analysis of scan cards (21, 22). These 5 programs were not included in the analysis.

The programs varied depending on whether they analysed for foods (by group) or nutrients and the means by which nutrients values were obtained. The number of items included in the foods databases also varied substantially, from 70 to over 23,000 foods, including brand names. Words, models and/or pictures of foods were used to facilitate the identification of foods and serving sizes, either as a component of or in addition to the program. The presence of the interviewer was program specific. Programs were generally designed to be used by a health professional (17, 23, 24) or by members of a specific study population (25, 26) in a self-administered situation. Some did not specify the intended user. Design features included in each computer program related to the purpose of the program. For example, the USDA automated multiple pass method system features probe questions designed to elicit in-depth information for research quality data. This level of detail may not be needed in all situations.

DISCUSSION

Some limitations apply to this overview and should be considered. Features of computer programs available to the authors were assessed directly. Features of computer programs not available to the authors were assessed indirectly through information obtained from the literature and from descriptions provided by the manufacturer. This approach restricted the number of features assessed. In addition, the use of MEDLINE as the only database for the search may have resulted in incomplete capture of relevant social science literature often

excluded from MEDLINE. For example, an independent search of the Journal of Nutrition Education and Behavior online, using the search term Computer*, yielded 9 articles published in 2002 but JNEB was only available on MEDLINE starting in 2002.

IMPLICATIONS FOR RESEARCH AND PRACTICE

This review of literature identified a wide range of programs and features for computerised assessment. It should be noted that the type of research or target of the education program including the subjects' literacy, age and ethnicity should be considered when selecting an appropriate computer program, as well as the type of assessment required. The results of computer-assisted dietary assessment and computer-assisted self-interviewing can have a significant impact on the potential outcomes of the program

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Table 1: Attributes of computer programs

Program	Form of Assessment	Food List(s)	Interviewer Present	Data Analysis		Other
				Nutrients and Other Food Components	Data Export Required for Analysis	
CARDIA Diet History Questionnaire (DARCC) [AMERICA] (27)	Diet History	700 foods listed by food groups	Yes	Macronutrients	Yes	• Food models used • Cue cards used • 6 different screens (fat use, fat choice, foods eaten, food details, preparation, and additions) • 5 frequency options
Computer Assisted Learning System (CALS)	Food Frequency	Foods listed under 11 food	No	Other (Cholesterol and Saturated Fat	Not specified	• Dietary goals and recommendations

* (28)	Questionnaire	groups		index)		generated
Computer Assisted Self Interviewing (CASI) * (1)	Diet History	Foods listed under 20 food groups sorted by meal context	Yes (computerised)	Not specified	Not specified	• Prompts used • Visual cues of food images used
Computerised self-administered FFQ * (11)	Food Frequency Questionnaire	85 foods listed by food groups	Yes (assist only)	Micronutrients	No	• Foods eaten less than once per month are omitted • Food models and reference materials used to estimate portion size • Provides for telephone follow up if needed
Counselling Nutrition Data System version 2.6	1-day Food Record and	>23000 foods listed by	Yes	Micronutrients	Not Specified	• Prompts for food combinations

[AMERICA](15)	Diet History	alphabetical order				
Cybernetic Dietician v2.06 (29)	24 hour recall	2400 foods listed by food groups	No	Macronutrients	No	• Generates comparison to recommended intakes
Desktop Diet v1.2 (30)	Food Record	>7000 foods listed by alphabetical order	No	Macronutrients	No	• Exercise and medication logs included • Nutrition, Health and Fitness components included • Graphical representations of body for reference
Diet Balancer for Windows (15, 31, 32)	Food Record	5000 foods listed under 42 food groups	No	Micronutrients	Not specified	• Food search option not available, foods selected from list only
Dietary Data Collection	Diet History	9500 foods	Not specified	Not specified	No	• Recipe modification

(DDC) * (33)		listed under 50 food groups				allowed within program
Diet Improvement & Nutritional Evaluation (DINE) (13, 28, 34-38)	3-day Food Record	10000 foods listed by alphabetical order under 17 food groups	No	Micronutrients	Not specified	• Dietary recommendations generated • Limited serving sizes from which to choose • Addition of recipes completed by the user • Generates a diet score based on a comparison of nutrient intake to an "ideal" intake
DietMax Plus for Windows (15)	Food Record	7100 foods listed by alphabetical order	Yes	Micronutrients	No	• No food search options, foods selected from list only • Increase and decrease

						portion size by mouse
Dietary Interview Software for Health Examination Studies (DISHES 98) [GERMANY] (24)	Diet History	Foods listed by alphabetical order	Yes	Not specified	Yes	• Foods not listed on main screens can be added from other databases • Household measures used for portion sizes • Only one loop of frequency estimates • No difference between weekday and weekend questioning
Dutch DISHES [HOLLAND] (2)	Diet History	Foods listed by alphabetical order	Yes	Yes	No	• Includes maximum possible amount of food and drinks consumed • Foods and food models used to estimate portion

						size
Electronic Diary (ED) * (39)	4-day Food Record	180 foods listed under food groups	Yes	Macronutrients	Yes	• Foods entered in set pattern by time of day
EPIC-SOFT (European Prospective Investigation into Cancer and Nutrition Study software) [EUROPE](24, 40-42)	24 hr recall	1500-2200 foods listed under 17-23 food groups (location specific)	Yes	Micronutrients	Yes	• 150 recipes included • Color photographs and household measures used to estimate portion size • Portion book adapted to suit each country • Open ended questions used
Food Processor Plus [AMERICA](15)	Food Record	>12000 foods listed by alphabetical order	Not specified	Micronutrients (including fatty acids)	No	• Includes food exchange lists

Food/Analyst Plus (15)	Food Record	22500 foods listed by alphabetical order	Not specified	Micronutrients (including fatty acids)	No	
Food Works [AUSTRALIA](23)	Food Record and Diet History	>4500 foods listed by alphabetical order	Yes	Micronutrients (including fatty acids)	No	• Allows addition of personal recipes and menu plans
Health and Diet (43)	Food Record	2000 foods listed by alphabetical order	No	Not specified	Not specified	• Tailored recommendations generated
Health Habits and History Questionnaire (HHHQ) [AMERICA](44, 45)	Food Frequency Questionnaire	97 food listed under 20 food groups	Yes	Micronutrients	No	• Serving sizes for small medium and large only • Includes exchange lists for meal planning

Life in New Zealand, Electronic Dietary Data Acquisition System (LINZ LEDDAS) [NEW ZEALAND] (46)	24 hour recall	Foods listed by alphabetical order	Yes	Not specified	Yes	• Automatic prompting system • Pass 1: Quick list of foods • Pass 2: Detailed description of foods • Pass 3: Review of list of all foods eaten
Iron-FFQ [NEW ZEALAND] (3)	Food Frequency Questionnaire	206 foods listed by 17 food groups	Yes (assist)	Other (Iron containing foods and those affecting iron absorption)	Yes	• Assesses list of foods containing nutrients/foods that modify iron absorption • Food portions in common measures • 3-D models for meat and cheese included with

						program along with portions of beans for estimating portion serving size • Probes for high iron foods
Nutri-Calc (43)	Food Record	3400 foods listed by alphabetical order	No	Not specified	Not specified	• Tailored recommendations generated
Nutrient Analysis System 2 Plus 8 version 1.0 (15)	3-day Food Record	8000 foods listed under food groups	Not specified	Micronutrients (including fatty acids)	Not specified	• Food groups limited to 40 foods per group
Nutrition Data System (NDS) [AMERICA] (15, 47, 48)	Diet History and 24 hr recall	Foods listed by alphabetical order	Yes	Not specified	No	• Food portion images and household measures used • Pass 1: Quick list 24hr

						recall • Pass 2: each food from recall probing questions for type, amount, additions and preparation method • Pass 3: review of food list, details of foods and amounts
Nutritional Software Library IV (15)	Food Record	>18000 foods listed by alphabetical order	Not specified	Micronutrients	Not specified	• Tailored recommendations generated
Nutritionist IV version 3.5 (15)	Food Record	>12000 foods listed by alphabetical	Not specified	Micronutrients (including fatty acids)	Not specified	• Tailored recommendations generated

		order				
OsteoCalc (44)	Food Frequency Questionnaire	70 food items listed by alphabetical order	No	Micronutrients	No	• Assesses list of foods providing calcium, vitamin D & caffeine • 4 frequency ranges – daily, weekly, monthly, yearly • Portion sizes listed in text only on screen
USDA Automated Multiple Pass Method [AMERICA] (49-51)	24hr recall	500+ foods listed by food group	No	Not specified	Yes	• USDA Food Model Booklet used to estimate portion size • Pass 1: recall list of all foods and drinks consumed • Pass 2: probe questions

						for forgotten foods from 9 specific categories • Pass 3: time/name of meal • Pass 4: probe questions for detailed information about the foods and amounts • Pass 5: Additional foods consumed
* Only generic names used in literature						

Table 2: Sources of Additional Information

Program Name	**URL or email address**
CARDIA Diet History Questionnaire (DARCC)	www.cardia.dopm.uab.edu/doc/d10144.pdf
Counselling Nutrition Data System	ncc@epi.umn.edu
Cybernetic Dietician	www.satoripublishing.com/CyberDiet *
Desktop Diet	www.electricdreams.ca/desktopdiet/index.htm *
Diet Balancer for Windows	www.xkee.com/home-education/diet-balancer *
Diet Improvement & Nutritional Evaluation (DINE)	www.dinesystems.com/Products/Products.asp
DietMax Plus for Windows	www.pdapointer.com/view/download.php?downloadID=2853&platform=linux
Dietary Interview Software for Health Examination Studies	www.rki.de/gesund/daten/dishes/dishes.htm *
Food Processor Plus	www.esha.com *
Food/Analyst Plus	www.hoptechno.com/faplus.htm
Food Works	www.xyris.com.au *

Health Habits and History Questionnaire (HHHQ)	http://appliedresearch.cancer.gov/DietSys/outdated/full8.pdf
Life in New Zealand, Electronic Dietary Data Acquisition System (LINZ LEDDAS)	http://physed.otago.ac.nz/linz/linz24.asp
Nutri-Calc	www.foodref.co.uk *
Nutrition Data System (NDS)	www.ncc.umn.edu/swfeatur.htm *
Nutrition in Medicine (NIM)	www.medeorinteractive.com/frmSet.htm
Nutritional Software Library IV	www.computrition.com/products/nsl.html
Nutritionist IV	www.nutritionistpro.com *
USDA Automated Multiple Pass Method	www.barc.usda.gov/bhnrc/foodsurvey/home.htm
* Website offers free trial	

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