The Vienna Food Record

User-centered development of a prospective food record for application in Austrian adults

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Introduction

Assessing dietary intake is a key element of nutritional epidemiology and nutritional research [1]. Such information can be used to evaluate the intake of nutrients at population level. Subsequently, associations between dietary behavior and health effects can be identified. The risk of nutrition-related diseases can thus be estimated at the population level [2]. Individual results from dietary assessments are also used as the basis for nutrition counseling. Various methods are available for assessing dietary intake, where each has its specific strengths and weaknesses. ◆ Table 1 provides an overview of prospective and retrospective dietary assessment methods [3]. Advantages and disadvantages of these methods are often mutually exclusive. Hence, it appears to be difficult to achieve both, high validity and high user compliance. The Vienna Food Record aimed at addressing this challenge: achieving high compliance, time-efficient utilization, and acceptable validity.

Although many innovative dietary assessment instruments, including web- and cellphone-based applications, have been developed [5], paper-based methods remain popular. Prospective food records, and thereof weighed food records in particular, are considered the most accurate method of dietary intake assessment, and despite existing limitations, they have been referred to as imperfect gold standard [6]. In weighed food records, the quantity of foods consumed is determined by weighing using kitchen scales or standardized household measurements. Intake data obtained in this way is often used as reference for the validation of new assessment instruments. Prospective methods may be subject to influence dietary behavior through overreporting or underreporting [7]. However, they can minimize the uncertainty about whether consumed foods have been documented or

Abstract

The Vienna Food Record was realized by FH Campus Wien – University of Applied Sciences for the Austrian nutritional database provider *dato Denkwerkzeuge*. This prospective food record was developed in the course of two bachelor theses and was based on the methodology of the Freiburg Food Record *(Freiburger Ernährungsprotokoll)*. The aim was to create a simple, reliable, and valid food record that is adapted to the Austrian dietary behavior and does not require any interview or instruction by an expert. It was designed in order to simplify the process for those completing as well as those evaluating the record in private, scientific, clinical, and commercial settings.

The design of the Vienna Food Record took place in the course of three development phases. In the first phase, the project team evaluated the user-friendliness of the Freiburg Food Record. Moreover, food items were selected for the Vienna Food Record based on the intake frequencies of food items in Austria, as derived from the EFSA (European Food Safety Authority) Comprehensive European Food Consumption Database. In order to establish portion sizes, entries from the food composition program nut.s®, which is based on the German Food Composition Database (*Bundeslebensmittelschlüssel* [BLS] version 3.02) and the Austrian Nutritional Values Table (*Österreichische Nährwerttabelle* [ÖNWT]) were used, where available. In the second stage of development, the present prototype was applied and evaluated internally by the project staff. Finally, strengths and weaknesses were identified via a qualitative content analysis from a focus group interview, providing demands for the final revision.

The result was the Vienna Food Record: a 12-sided DIN A5 brochure with 182 pre-coded food items. Pictograms were included to support the estimation of the portion sizes. A single-page guideline explains the logging procedure and, thus, eliminates the need for an interview or instruction by an expert. After finalization of development of the Vienna Food Record, its reliability and validity were assessed against a weighed food record in a separate randomized crossover study.

Keywords: dietary intake assessment, prospective food record, Vienna Food Record, user-centered design, intake frequencies of food items, qualitative content analysis

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Prospective	Retrospective
weighed food record	diet history
food diary/estimation log	food frequency questionnaire (FFQ)
duplicate method	24-hour recall
photographic log/apps if appropriate	
advantages: more exact methods	**advantages:** non-reactive, high compliance
disadvantages: reactive, rather low compliance, time-consuming	**disadvantages:** depends on ability to recall correctly, portion sizes

Tab. 1: **Categorization of dietary intake assessment methods according to Naska et al. [3] with advantages and disadvantages according to Straßburg [4]**

whether consumed foods have been forgotten [8], since meals are immediately recorded at the time of consumption. A food record used in the German-speaking area is the Freiburg Food Record. The Freiburg Food Record is a prospective food record with precoded food and drink items and corresponding portion sizes [9]. The listed items are adapted to German consumption bahavior and language as commonly used in Germany. An acceptable level of validity and precision has been reported for the Freiburg Food Record in terms of food and nutrient outcomes [10]. However, the Freiburg Food Record is only to a limited extent suitable for use in the Austrian cultural context. The Vienna Food Record was developed in order to create a similarly valid and recent food record for Austria, based on the methodology of the Freiburg Food Record. The Vienna Food Record is intended to be suitable for use across a broad spectrum of private, scientific, clinical, and commercial applications.

Objective

The aim of this project was to develop a paper-based, prospective food record for assessing food as well as energy and nutrient intake in Austrian adults by means of a user-centered design approach. The instrument is intended to be used without any interview or instruction by an expert. It is intended to be applicable over a fully flexible period of time and to be adapted to the recent dietary behavior in the Austrian cultural context.

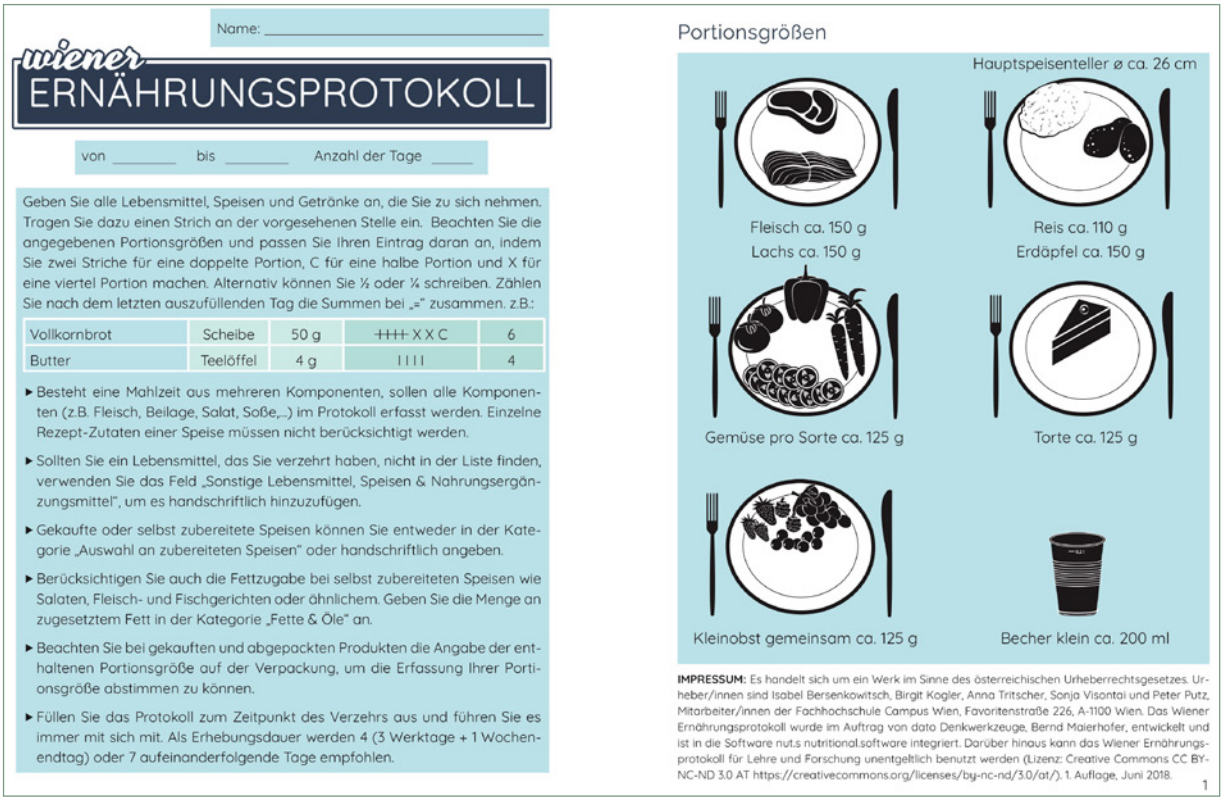
Steps in methodological development

User-centered design originated in the field of information technology, in which products are repeatedly tested for their user-friendliness during the development process [11]. From the very beginning, users are being integrated into the design process through meetings, tests, experience reports, and other methods [12]. The user-centered development of the Vienna Food Record included three evaluation phases:

In the first phase, the Freiburg Food Record was tested on two members of the project team over a period of three days, including one weekend day. In this regard, the interest focused on user-friendliness and transferability to the Austrian context. Thereafter, an initial draft of the Vienna Food Record was created using InDesign CS5®. The layout was adapted to match the corporate design of the contracting entity, *dato Denkwerkzeuge*. The food items were selected based on the EFSA (European Food Safety Authority) Comprehensive European Food Consumption Database [13]. Herein, the Austrian data on chronic consumption for adults aged 18–64, FoodEx Level 4 [14], originally comes from the Austrian Study on Nutritional Status 2010–2012 [15]. A cut-off value was selected arbitrarily, so that any food category consumed by at least 10% of the target group was included. In order to establish portion sizes, data from the food composition program nut.s® was used in the first instance, where the German Food Database (*Bundeslebensmittelschlüssel* [BLS] version 3.02) and the Austrian Nutritional Values Table (*Österreichische Nährwerttabelle* [ÖNWT]) are the data sources. If no appropriate portion size was available here, portion sizes were taken from the Freiburg Food Record. For food categories that had no corresponding entry in the Freiburg Food Record either, the mean portion size amongst those displayed in the Austrian version of the picture book published by the International Agency for Research on Cancer (IARC) was used as a data source to estimate portion sizes.

The second evaluation phase compromised a project staff internal examination of the structural logic of the food record, the wording of the food groups, and the portion sizes.

Within the third phase of the user-centered development, external users underwent a log-



Name: _____

wiener
ERNÄHRUNGSPROTOKOLL

von _____ bis _____ Anzahl der Tage _____

Geben Sie alle Lebensmittel, Speisen und Getränke an, die Sie zu sich nehmen. Tragen Sie dazu einen Strich an der vorgesehenen Stelle ein. Beachten Sie die angegebenen Portionsgrößen und passen Sie Ihren Eintrag daran an, indem Sie zwei Striche für eine doppelte Portion, C für eine halbe Portion und X für eine viertel Portion machen. Alternativ können Sie ½ oder ¼ schreiben. Zählen Sie nach dem letzten auszufüllenden Tag die Summen bei „=" zusammen. z.B.:

Vollkornbrot	Scheibe	50 g	~~++++~~ X X C	6
Butter	Teelöffel	4 g	I I I I	4

- Besteht eine Mahlzeit aus mehreren Komponenten, sollen alle Komponenten (z.B. Fleisch, Beilage, Salat, Soße,...) im Protokoll erfasst werden. Einzelne Rezept-Zutaten einer Speise müssen nicht berücksichtigt werden.
- Sollten Sie ein Lebensmittel, das Sie verzehrt haben, nicht in der Liste finden, verwenden Sie das Feld „Sonstige Lebensmittel, Speisen & Nahrungsergänzungsmittel", um es handschriftlich hinzuzufügen.
- Gekaufte oder selbst zubereitete Speisen können Sie entweder in der Kategorie „Auswahl an zubereiteten Speisen" oder handschriftlich angeben.
- Berücksichtigen Sie auch die Fettzugabe bei selbst zubereiteten Speisen wie Salaten, Fleisch- und Fischgerichten oder ähnlichem. Geben Sie die Menge an zugesetztem Fett in der Kategorie „Fette & Öle" an.
- Beachten Sie bei gekauften und abgepackten Produkten die Angabe der enthaltenen Portionsgröße auf der Verpackung, um die Erfassung Ihrer Portionsgröße abstimmen zu können.
- Füllen Sie das Protokoll zum Zeitpunkt des Verzehrs aus und führen Sie es immer mit sich mit. Als Erhebungsdauer werden 4 (3 Werktage + 1 Wochenendtag) oder 7 aufeinanderfolgende Tage empfohlen.

Portionsgrößen

Hauptspeisenteller ø ca. 26 cm

Fleisch ca. 150 g
Lachs ca. 150 g

Reis ca. 110 g
Erdäpfel ca. 150 g

Gemüse pro Sorte ca. 125 g

Torte ca. 125 g

Kleinobst gemeinsam ca. 125 g

Becher klein ca. 200 ml

IMPRESSUM: Es handelt sich um ein Werk im Sinne des österreichischen Urheberrechtsgesetzes. Urheber/innen sind Isabel Bersenkowitsch, Birgit Kogler, Anna Tritscher, Sonja Visontai und Peter Putz, Mitarbeiter/innen der Fachhochschule Campus Wien, Favoritenstraße 226, A-1100 Wien. Das Wiener Ernährungsprotokoll wurde im Auftrag von data Denkwerkzeuge, Bernd Maierhofer, entwickelt und ist in die Software nut.s nutritional.software integriert. Darüber hinaus kann das Wiener Ernährungsprotokoll für Lehre und Forschung unentgeltlich benutzt werden (Lizenz: Creative Commons CC BY-NC-ND 3.0 AT https://creativecommons.org/licenses/by-nc-nd/3.0/at/). 1. Auflage, Juni 2018.

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Fig. 1: **Front and back cover pages of the Vienna Food Record** (with double-sided printing)

ging application phase, followed by a focus group interview. In this phase, the prototype of the Vienna Food Record was tested by six subjects (two students of dietetics, two students of physiotherapy, one nutritionist, and a representative of the contracting entity) over the course of three days, including one day of weekend. During this period, the subjects kept a diary on the use of the food record, and at the end, they completed a questionnaire. The questionnaire contained questions about the comprehensibility of the record, its layout, the selection and ordering of food categories, the portion sizes, and the effort required to keep the record. The evaluation of the questionnaire was drawn upon to create the interview guidelines to be used in the focus group. This was composed of 14 main questions and 15 secondary questions. The order of the questions was only partially defined in advance, in order to leave the interviewer free to respond flexibly to the situation at hand. The questions were formulated in an open manner in order to avoid influencing the participants' responses. The group discussion was transcribed and then its content was analyzed through coding and categorization of the statements using the MAXQDA® software.

Because the goal was user-friendliness not only for those completing the records, but also for those evaluating them, a standardized, time-efficient evaluation routine was developed. Each item was assigned a BLS or ÖNWT code. If no nutritional values were available for a certain food group, a new database entry was created, accounting for the percentage share of components. The EFSA Comprehensive European Food Consumption Database was used again as source of data [13]. The consumption frequencies listed in there, enabled to estimate percentage shares for the weighting of individual group components. For 15 items, no evidence of percentage shares could be found. In these cases, the database entry was created with a balanced distribution of component parts.

Results

Handling

The Vienna Food Record is designed as a 12-sided DIN A5 brochure, where the cover page and back page stand out from the rest of the record. The designed logo, a space for the user's name and period of use, and the written guideline and portion size pictograms were placed here (◆ Figure 1).

The ten inner pages contain the tables, the pre-coded items and portion sizes. On each line, there is a space to record the individual consumption frequency, which is indicated using symbols such as tally strokes. ◆ Figure 2 shows page 2 of the finalized Vienna Food Record.

Guidelines for use

The Vienna Food Record does not require any spoken instructions. Since problems with the recording assembled dishes were reported in the focus group interview, the guideline about this was expanded with a concrete example: *"If a meal is made up of several components, all of the components (e.g. meat, sides, salad, sauce, etc.) should be recorded. Individual ingredients in the recipe do not need to be taken into account."*

Estimation of portion sizes

The accuracy of the results of a food diary depends not only on the will and compliance of users, but also on their ability to correctly estimate portion sizes [16]. Six pictograms were developed using Adobe Illustrator® and were placed on the back of the protocol to support the estimation of portion sizes (◆ Figure 1). Since the protocol contains pre-defined portion sizes that are not always consumed in their entirety, the guideline states that in addition to recording whole portions with a simple tally stroke, half portions may be recorded with a C, and quarter portions with an X. The C is supposed to be reminiscent of a semicircle, and the X a square divided into four parts.

Food items and logging

Following the three evaluation phases, a total of 182 food items were categorized into 16 groups, such as beverages, fruit, or meat products. To ensure that users could get their bearings intuitively, the categories were arranged in line with the chronology of an average day's eating. Therefore, the categories that tend to be consumed early in the day were placed at the beginning of the record, and those categories that tend to be consumed later were usually put nearer to the end. In order to cover the eventuality that the 182 items do not include the desired food, there are 11 open fields provided on the penultimate page where users can make their own entry.

Evaluation routine

Thanks to the evaluation routine, it is not necessary to search for foods or dishes in the food composition program nut.s® when running the evaluation of the Vienna Food Record. It is enough to simply enter the consumption frequencies in a table. ◆ Figure 3 provides an overview of this process. With this evaluation routine, the calculation has been standardized and optimized in terms of time efficiency. This

LEBENSMITTEL	PORTION		ANZAHL	=
Getränke				
Leitungswasser	Glas	200 ml		
Leitungswasser	1/2 l	500 ml		
Mineralwasser	Glas	200 ml		
Mineralwasser	1/2 l	500 ml		
Kaffee schwarz	Tasse	190 ml		
Tee	Tasse	190 ml		
Limonade	Glas	200 ml		
Limonade light	Glas	200 ml		
Fruchtsaft	Glas	200 ml		
Energy Drink	Dose	250 ml		
Energy Drink light	Dose	250 ml		
Bier	Seidel	330 ml		
Radler	Seidel	330 ml		
Most	Glas	200 ml		
Cider	Glas	200 ml		
Wein	1/8 l	125 ml		
Sekt	1/8 l	125 ml		
Likör	Glas	2 cl		
Klare Spirituosen	Glas	2 cl		

Fig. 2: **First inner page of the Vienna Food Record** (with double-sided printing)

allows for efficient calculation of nutritional measures and it optimizes the precision and consistency of the results. Thanks to the process optimization, the time required for the evaluation of a Vienna Food Record (irrespective of the duration of logging) was reduced to 10 minutes.

Further investigation showed that the Vienna Food Record has an acceptable level of validity as an instrument for recording energy and nutrient intakes in Austrian adults. Pearson's correlation coefficients (r) (as a measure of agreement of the Vienna Food Protocol with a weighed food record as a reference method) averaged at 0.60 and ranged from 0.15–0.80 [17].

Discussion

Achieving user-friendliness requires an interactive and cyclical process made up of design and evaluation [18]. In the course of the development of the Vienna Food Record, its strengths and weaknesses were evaluated in three different phases and taken into account in the subsequent revisions. With 182 pre-coded items, the Vienna Food Record is comparable to the Freiburg Food Record (which has 172) in this respect [10] and with the food frequency questionnaires (FFQ) used in the Food4Me study (which has 157) [19]. By contrast, the prospective food record of the Dan-

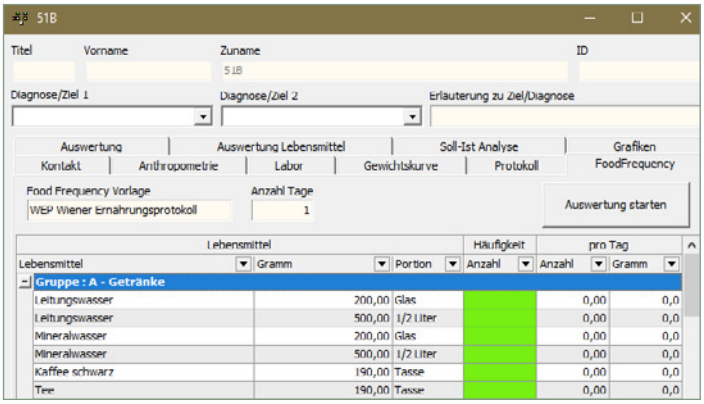

Fig. 3: **Avaluation routine in nut.s nutritional.software®**

ish National Survey of Diet and Physical Activity was created with about 400 pre-coded items [20]. FFQs with a higher number of items were shown to have a stronger correlation with the reference method [21]. For this reason, like the two other prospective records mentioned above, the Vienna Food Record allows entries to be made in free fields in addition to the pre-coded items.
In this context, the ease of use was only recorded by those keeping the food record. They evaluated whether completing the food record was simple, interesting, or time-consuming, whether it reflected their eating behavior, and whether they could imagine doing it again in the future. In four out of five cases, the second-best score was achieved on average [22]. This largely corresponds to the results of the comparable usability survey about the FFQ of the Food4Me study, in which the amount of time required was rated neutral and the remaining four categories were rated positively [23]. The recording of user-friendliness from the evaluators' perspective represents an implication for future research.

It can be summarized that the Vienna Food Record bridges the gap between ease of use and an acceptable level of validity. The user-centered design ensures a high level of acceptance, and satisfactory results were achieved in the validity study.

Limitations

The Vienna Food Record is optimized for use in Austrian adults and it is therefore not intended for use in cross-national studies. The calculations for the entries in the free fields for "miscellaneous foods" are not based on the standardized evaluation routine, but rather on the subjective decision of those performing the evaluation. Prospective methods can influence dietary behavior [4].
Data taken from the EFSA Comprehensive European Food Consumption Database is based on the Austrian Nutrition Report 2012. Nutritional behavior may have changed since then. The Vienna Food Record is currently available as paper-based format only.

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The Vienna Food Record was developed for *dato Denkwerkzeuge*, Bernd Maierhofer, and it is embedded in the software package nut.s nutritional.software®. Protcols can of course be transferred manually into other food composition programs.
The Vienna Food Record is freely available for non-commercial teaching and research (license: Creative Commons CC BY-NC-ND 3.0 AT, → https://creativecommons.org/licenses/by-nc-nd/3.0/at/). The printable versions are available online together with additional information at → www.wiener-ernaehrungsprotokoll.at.

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Conflict of Interest
The Vienna Food Record was developed for dato Denkwerkzeuge, Bernd Maierhofer.
Beyond that, the authors declare no conflict if interest.

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