The Dutch national food consumption survey 2003. Methodological issues

by

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Abstract

Background: *Dietary monitoring is an important tool for food policy evaluation and development. The methodologies of previous Dutch surveys were less optimal for answering current food policy questions.*

Aim and method: *In order to gain experiences with a new approach, in 2003 a food consumption survey was conducted among 750 Dutch young adults (aged 19-30) using two independent computerized 24-hour dietary recalls administered by telephone.*

Results: *Despite the low response of the survey, the study population was representative with regard to age, level of education, and region. Subjects living in areas with high population densities were slightly underrepresented, which could be corrected for in the data. Consumption of vegetables and fruits among Dutch young adults was grossly inadequate. Intake of saturated fats was still too high, whereas average intake of trans fatty acids was almost at the recommended level.*

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Conclusion: *This dietary assessment method seems promising as part of a revised dietary monitoring system for the Netherlands. The computerized 24-hour dietary recall method has the advantage that food consumption data with a great level of detail can be collected and stored. The use of a telephone approach made it possible to collect data on two independent days in an efficient way. Therefore, the resulting food consumption data allow for answering more questions than with the previous methodology. Such questions have to do with food safety and estimates of the fraction of the population adhering to dietary recommendations. The new approach has to be developed further for other population groups.*

Keywords: *24-hour recalls, dietary monitoring, food consumption, telephone interviews, young adults*

Introduction

Dietary monitoring is an important tool for food policy evaluation and development. For this reason, a system of dietary monitoring is in operation in the Netherlands since 1987. Within the system three nationwide surveys were conducted in 1987/1988, 1992, and 1997/1998. The three surveys were similar in design. A sample of households participating in a consumer panel was invited to participate and about 6000 persons aged 1 year and over were recruited. Dietary intake was assessed using a diet record method on two consecutive days. The person responsible for cooking reported in a household diary the foods consumed at home for each individual of the household. Foods eaten out of home were recorded by the individual household members in a personal diary. Additional information was obtained with a food frequency questionnaire (1).

The methodologies of the three previous surveys are less optimal for answering current food policy questions (2). Information on dietary intake over two consecutive days is a limitation to estimate the distribution of usual dietary intake of the population (3). This distribution is needed to assess the percentage of subjects who usually adhere to dietary recommendations or that usually exceed safe upper limits of intake. Moreover, for many food safety questions information on the consumed foods is needed in more detail than generally available in the former food consumption survey data. In addition, households were generally reduced in size, and dietary patterns became more individual. As a result the efficiency of working with household based sampling rather than individual sampling for dietary monitoring has decreased. For these reasons, the Dutch Ministry of Health, Welfare and Sport decided in 2003 that a new approach in national dietary monitoring was needed based

on individual sampling and assessing diet by 24-h dietary recalls on two independent (non-consecutive) days. This decision is in line with the European recommendations of the EFCOSUM-group (4).

In order to gain experiences with the new approach, a small dietary monitoring study had to be conducted in autumn 2003. It was decided to focus the survey on the intake of energy, fat, saturated fatty acids, trans fatty acids, and the consumption of vegetables and fruit of young adults only. The experiences had to be evaluated with the perspective of obtaining information to answer future questions on diet adequacy and food safety. In the current paper, some methodological issues of the 2003 survey are described and evaluated in the context of future diet monitoring.

Methods and materials

The 2003 National Food Consumption Survey was conducted by TNO Quality of Life (see www.tno.nl) and the Dutch National Institute of Public Health and the Environment (RIVM; see www.rivm.nl), in collaboration with GfK panel services (see www.gfk.nl) for data collection.

Recruitment

The target population consisted of men and women aged 19-30 years living in the Netherlands. Power calculations showed that about 700 men and women were needed for the survey, and nett response was expected to be about 50%. In October 2003, a stratified sample of 1511 persons aged 19-30 that participate in consumer panels, was invited to participate. The panel did not include persons that were institutionalized (because of a reduced freedom in food choice). Subjects with lower education level were overrepresented in the sample, as the non-response was expected to be higher compared to other groups. About one month later, a second group of 283 persons – mainly men – was additionally invited to participate because of a lower than expected response. The invitation letter included a postal questionnaire, with questions on socio-demographic characteristics, smoking, alcohol consumption, physical activity, a concise food frequency questionnaire with questions on ever or never consumption of 28 selective foods and a standardized food frequency question on vegetable and fruit intake (the same information was collected in the Dutch 2nd National Study [8]), pregnancy, lactation, willingness to participate in two dietary interviews by telephone within the next two months and if so, contact information. Because the response rate was lower than expected, additional recruitment by telephone among a part of the subjects that either did not return the questionnaire

or those that did return the questionnaire but indicated not te be interested in the dietary interview was carried out (n=226). Subjects who indicated to be interested received a thanking letter, an incentive bonus (credit points which can be exchanged for presents that can be selected from a catalogue), and a picture booklet (for the assessment of portion sizes) that had to be kept next to the telephone. Subjects not fluent in Dutch, pregnant and lactating women, and those without phone (either mobile or regular) were not contacted for the dietary assessment.

Dietary assessment

For each participant the dietary survey consisted of two independent 24-h dietary recalls, with 7-14 days in between on different days of the week. At the group level, the aim was that all days of the week were equally represented to ensure that systematic differences in dietary intake by days of the week would not distort the results. For Sundays through Fridays the 24-h dietary recalls were conducted the day after, for Saturdays the recalls were carried out on Mondays. The recalls were conducted as a computer assisted interview using EPIC-SOFT. EPIC-SOFT is computer software for highly standardized 24-h recalls using a multiple pass approach. The phases of the 24-h recall consist of a) general questions related to the respondents and the day of recall, b) a quick list to identify in general terms all foods and drinks during 8 consumption moments, c) a check for information on time/occasion, forgotten foods and food details, d) detailed description and quantification of all reported foods and drinks, e) a check for energy and macronutrient intake, and finally f) questions on the use of dietary supplements. EPIC-SOFT was originally developed for the EPIC-study (5). Fifteen trained dieticians conducted the interviews by telephone during the period October through December 2003. On average, one interview took about 30 minutes. The dieticians were recruited from an employment agency specialized in the nutrition field. They had to be registered and experienced in computer use. The dieticians were trained during two days before the start of the study, this was followed by a practice period in their own environment, and finally a 2 day pilot study. During the field work period two follow-up training days were organized.

Quality of dietary assessment

In order to check if the dieticians kept to the interview protocol, every dietician also interviewed one fake respondent without knowing which respondent was fake. The fake respondent reported a standard diet that included some particularly difficult aspects. The fake respondent kept a check list for quality control of the interviews.

In addition, several controls on the quality were performed on the data. Firstly, the precision of the mean intakes of energy, fat, saturated fat, trans fatty acids, vegetables and fruit was calculated since beforehand it was specified that the study should have sufficient power to estimate mean intake of energy and nutrients with at least 5 percent precision for each gender, and mean intake of vegetables and fruits with 10-15 percent precision for men and women combined. Secondly, the ratio of energy intake to basal metabolic rate (EI/BMR) was calculated to check for underestimation of energy intake. Basal metabolic rate was estimated by Schofield equations (6) using heigth, age and gender of the subjects. When data for two days of dietary intake are collected, the average ratio of EI/BMR is expected to be 1.53 or higher in sedentary living populations. Finally, we tested whether systematic differences among interviewers in intakes of energy, fat, saturated fat, trans fatty acids, vegetables and fruit existed. If these differences could not be explained by subject characteristics such as gender, physical activity, length and weight, this would indicate that one or more interviewers produced dietary intake data that were over- or underestimations of true intake.

Data treatment and statistical methods

Socio-demographic characteristics of respondents and non-respondents were tested for differences using chisquare tests. This was also done for the comparison of respondents with the general Dutch population in the same age range. Lifestyle characteristics of the research populations were compared with characteristics in other monitoring studies (7-11).

Energy and nutrient intake was calculated using an extended version of the Dutch food composition table of 2001 (12). Average intake over two days was calculated for each person. Moreover, the distribution of usual intake was derived because for the evaluation of the proportion of subjects that adhere to the dietary recommendations, usual intake rather than intake over a few days is of importance. The usual intake distribution can be obtained from the actual measured intake by removing the intraindividual (=day-to-day) variation as developed by Nusser (13) using C-SIDE software (14). Subsequently, based on the usual intake, the percentage of subjects that met the dietary recommendations was estimated. Dietary data were weighed for small deviances of socio-demographic characteristics and days of the week.

Differences in energy ratios between gender, BMI class, first or second recall, and interviewers were tested using F-tests. Similarly, the main outcomes were tested for differences among interviewers using F-tests (nutrients) or Kruskall-Wallis tests (food groups).

P-values below 0.05 were considered statistically significant. All statistics were conducted using SAS, version 8.2.

Results

Response

Of the 1794 persons (1511 original sample and 283 additional sample) that were invited to participate in the study, 66% returned the postal questionnaire and 76% of those that returned the questionnaire gave permission to be contacted for the two dietary interviews by telephone. This was less than expected (Table 1). In fact the response rate was even lower at first, but this was counteracted by additional recruitment by telephone among a part of the persons that either did not return the questionnaire or indicated in the questionnaire that they did not want to collaborate in the dietary part of the study: 136 out of 226 persons agreed to participate in this way. The response to the two dietary recalls of about 95% was however higher than expected. The overall net response was 750 men and women, which is 42% of the invited persons.

TABLE 1.

Expected and actual response (%) in the Dutch 2003 diet monitoring survey among young adults aged 19-30 years

	Actual response		Expected response
	N	%	%
Sent postal questionnaires	1794	100	100
Returned postal questionnaires	1183	65.9	75
Positive reply to question on further participation	894	75.6	80
Attempted to be contacted for 1st recall	823	–	–
1st 24-h recall	778	94.5	90
2nd 24-h recall	750	96.4	90
Overall nett response	**750**	**42.0**	**about 50**

The response among men (36%), especially the younger men, was lower than among women (51%). Similarly, response among higher educated persons was higher (44%) than among persons with low education (37%).

The size of the obtained study population (n=750) was sufficient to estimate mean intake of energy and nutrients of interest with a standard

error of 5% or less and average consumption of fruit and vegetables with a standard error of 15% or less (Table 2). Only for the estimation of the average fruit consumption the standard error was over 10% of the mean consumption within the gender strata.

TABLE 2.
Precision (expressed as %) of mean intake of main dietary variables in the Dutch 2003 diet monitoring survey among young adults aged 19-30 years

	Men and women	Men	Women
Energy intake	2.4	3.0	2.7
Fat	1.4	2.0	2.1
Saturated fatty acids	1.8	2.7	2.5
Trans fatty acids	3.3	4.8	4.8
Fruit	8.3	12.4	11.0
Vegetables	4.9	7.0	6.8

Representativeness of the study population

The study population of young adults did not differ from the general Dutch population in the same age range with respect to age group, gender, region, education, and prevalence of living in a household with two working adults and young children (as an indicator for experiencing a large pressure of time and high workload). However, subjects from densely populated areas were underrepresented in the study population (15% versus 22% in the general population). Therefore the results are weighed (Table 3).

The main issue is whether the study population is representative with regard to life style, particularly for food consumption. Therefore a comparison was made between heigth, weight, and some lifestyle characteristics of the study population and those characteristics in other Dutch monitoring studies in similar age groups. Some differences were observed with regard to heigth (men were on average 2 cm taller than reported by Statistics Netherlands (10)) and weight (women had a mean BMI of 24.6 kg/m^2 versus 23.5 kg/m^2 reported in the Regenboog-project (11)), consumption of vegetables (33% of men reported vegetable consumption once or more per day versus 26% in the 2nd National Study (8)), fruits (17% of men and 21% of women reported to eat 2 or more fruits per day versus 11 and 28% respectively in the 2nd National Study), alcohol (23% of women reported not to use alcoholic beverages versus 17% by Statistics Netherlands) and physical activity (69% of the women indicated to be active on 5-7 days per week versus 58% in the 2nd National Study).

TABLE 3.

Sociodemographic characteristics of (non-)respondents of the Dutch food consumption survey 2003 and general population 19-30 years of age

	General population*	Respondents (complete data)		Non-respondents (no data or incomplete data)	
		n = 750		n = 1014°	
	%	abs	%	abs	%
Gender[a]					
– women	52	398	53	388	38
– men	48	352	47	626	62
Gender * age group[a]					
– women 19-24 y	23	169	23	181	18
– women 25-30 y	29	229	31	207	20
– men 19-24 y	22	153	20	354	35
– men 25-30 y	27	199	27	272	27
Region					
– 3 largest cities	18	122	16	146	14
– West (other)	29	227	30	291	29
– North	11	87	12	116	11
– East	20	154	21	213	21
– South	23	160	21	248	24
Education[a]					
– low	25	170	23	293	29
– intermediate	47	363	48	444	44
– high	29	217	29	277	27
Population density[b]					
– very high	22	111	15	161	16
– high	28	208	28	271	27
– intermediate	20	154	21	208	21
– low	19	164	22	220	22
– very low	11	113	15	154	15
Household composition					
– 2 incomes and kids	15	109	15	140	14
– other	85	641	85	874	86

* Source GfK MiniCensus
° 30 Pregnant and lactating women were not considered as non-respondents.
[a] statistical difference between respondents and non-respondents
[b] statistical difference between respondents and general population.

Main dietary results

The transformation from actual to usual intake by removing day-to-day variation in consumption was successful for most variables of interest, except for fruit intake which had an irregular distribution. For fruit consumption inclusive nut intake this problem did not occur, since more participants consume fruits or nuts on a given day than only fruits. For this reason we present data on usual fruit intake including nuts which will

be a little higher than fruit intake excluding nuts. Figure 1 presents the percentage of the young men and women that meet dietary recommendations for the main variables of interest based on usual intake. Overall, the results for vegetables, fruit and saturated fat were dramatic, as less than 10% of the population met the dietary recommendations. None of the women met the vegetable recommendation of 150 grams daily. Almost 60% of the men met the recommendations for trans fatty acids and total fat; whereas 27 and 54% of the women met the recommendation for trans fatty acids and total fat, respectively.

Figure 1.
Percentage of men and women that adhere to dietary recommendations with regard to vegetables & fruits, fatty acids, and total fat. The Dutch 2003 diet monitoring survey among young adults aged 19-30 years.
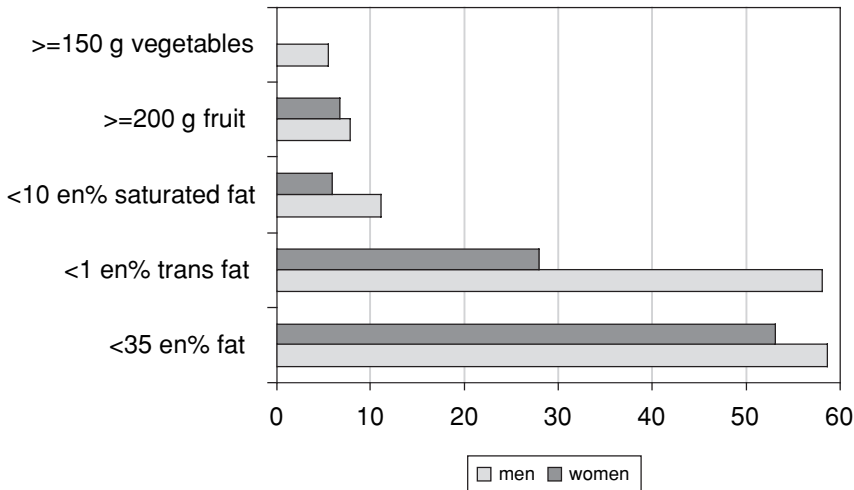

Quality control of 24-h recall data

The person that acted as fake respondent scored 14 out of 15 interviewers with respect to working according to the interview guidelines. One interviewer had not been able to contact the fake respondent. Apart from some small deviations the guidelines for conducting the 24-h dietary recalls were followed and the evaluations were quite positive. However, when intake of energy, fatty acids, vegetables and fruit was calculated for those interviews there were rather large differences in energy intake as compared to the standard menu (on average a 9% overestimation).

The ratio of energy intake and basal metabolic rate was on average 1.38 for the total population (Figure 2). This is about 11% lower than the expected level of 1.54 for an inactive population (15). The mean energy ratio was lower for women than for men (1.28 versus 1.48), and for participants with overweight compared to those with favourable weight (1.19 versus 1.47). No significant differences in energy ratio were observed between the first and second recall, across the weeks of data collection, and across interviewers. Nor were significant differences among interviewers observed for intake of energy, total fat, saturated fatty acids, trans fatty acids, vegetables and fruit (data not shown).

Figure 2.
Ratio of energy intake and expected basal metabolic rate in (subgroups of) the Dutch 2003 diet monitoring survey among young adults aged 19-30 years
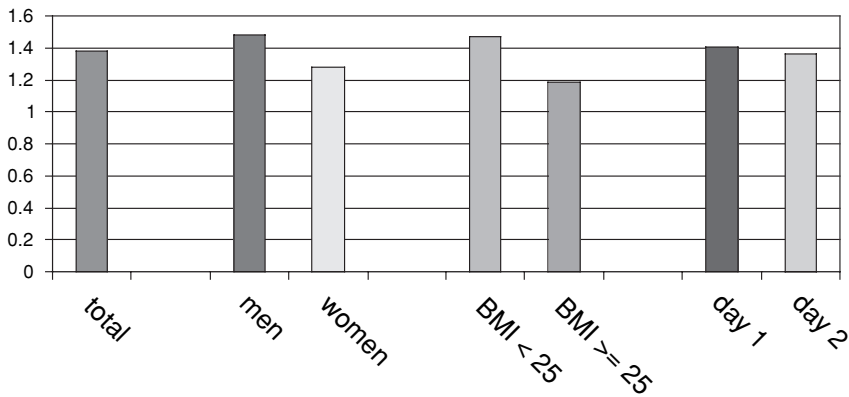
Discussion

The collection of two independent 24-h dietary recalls with EPIC-SOFT among young adults was a valuable experience for future dietary monitoring in the Netherlands. The diet of almost all subjects in this age group was too poor with regard to fruit and vegetable consumption, and far too rich in saturated fat. With regard to total fat and trans fatty acids the situation was better although not optimal.

Recruitment

The overall response of the survey of 42% was rather low. This was especially due to non-response in first steps of the survey, i.e. postal invitation and questionnaire. There were indications for a better response when a telephone approach was used to recruit subjects. This approach

may be further explored for future dietary monitoring. Moreover, response is expected to be higher in older adults. It cannot be excluded that response would have been higher in a household based sampling frame because of social control of the family members. In the previous national survey, that was household-based in design, but also differed in dietary methodology, overall response was 68.5%, and response among men and women aged 19-22 was only slightly lower with 62 and 57% respectively (1).

Despite the low response the study population is representative with regard to age, level of education, and region. Subjects living in areas with high population densities were slightly underrepresented, which could be adjusted for in the data. There were indications that the data in general may not be fully representative with respect to lifestyle for especially young Dutch women. The indications are however difficult to interpret because other monitoring studies may also be imperfect with regard to representativeness for the general Dutch population and the age groups compared were not exactly the same. In addition, the impact of these differences on the dietary results is estimated to be small using linear intrapolation, except for fruit consumption. Anyway, it is recommended to search for ways to improve overall response with special attention to response of groups that are now underrepresented.

The research sample was drawn from a market research panel of consumers, which made it possible to recruit the subject in a short period of time, and to adjust for deviances in representativeness during the recruitment phase using the available background information on the panel members. Usually a higher response is obtained in such a setting because the panel members have the intention to participate in this type of questionnaires. It can however not be excluded that panel members are in some respect a selective group compared to the general population, even if they have the same sociodemographic characteristics. The extent to which the representativeness of the study sample is affected with respect to general characteristics that are related to food choice and food consumption is unknown.

Dietary assessment

The telephone interviews made it logistically efficient to collect interview data on independent days. This is a requirement to obtain the distribution of usual intake from the actual intake data. The distribution of usual intake is needed to estimate the prevalence of adhering to dietary recommendations as has been illustrated in this paper, or the prevalence of exceeded safe upper levels of intake. Conducting interviews by telephone does not allow to use voluminous quantification tools

like large picture books or models like glasses and plates. This could have influenced the recalled portion sizes. Moreover, telephone interviews seem to take less time than face-to-face interviews. If the duration of the interview is related to the quality of data collected this would be a drawback (16). However, from the literature it can be concluded that the quality of 24-h dietary recalls conducted by telephone is comparable to face-to-face interviews (16-21).

The collected 24-h recall data contain a great level of detail because all information is systematically stored. Although the present study did not yet produce results on food safety aspects, it seems that this level of detail is especially valuable in this respect. For example, in order to estimate exposure to specific artificial sweeteners, information on drinks, sweets etcetera should be available at the brand name level. The large level of detail has at the same time the implication that it is labour intensive and therefore costly to check and adjust all collected data. Ways to gain more efficiency in this respect are required for the future.

For practical and financial reasons the survey was conducted in a three month period. This will have influenced the results of intakes that have a seasonal variation. In the 1997/1998 survey that was performed over a whole year, seasonal variation was only observed for vegetable consumption among young women and was not observed for the other main variables. Among young women, vegetable consumption in autumn was 20 grams lower than in other seasons (unpublished data). Therefore, it is recommended to conduct data collection of food consumption surveys throughout the year. Several methods of quality control were employed in the current study. A posteriori, we conclude that the use of a fake respondent was useful to check interview techniques and translation of reported foods and quantities into the EPIC-SOFT programme. The findings of the fake interviews were however difficult to interpret in terms of consequences for the survey results, since the standard menu reported contained some special difficult aspects, and pertained to only one day menu. In future surveys, this method can be used for the training of the interviewers. During the survey other more realistic ways of quality control may be implemented, such as taping random samples of the conducted interviews (22). The other employed indicators for quality of the data did not suggest a poor quality of the dietary intake data. Underestimation of energy intake of about 11% was also observed previously in the Dutch part of the EPIC study (23). The level of underestimation is slightly higher than observed in the previous Dutch national food consumption survey. This is in line with the increase in underestimation over time that was present in the Dutch national food consumption data of the period 1987/1988-1997/1998 (1). The increase may be due to the

rise in BMI, and the higher prevalence of underreporting among persons with overweight. Continuous attention to quality of the obtained data is needed in future studies, especially with respect to underreporting, and differences among interviewers.

Interviewers as well as interviewees were favourable with regard to the 24-h recall interviews. From the EPIC study it is known that the methodology also works in older adults (23). However, the use of the methodology in children, the elderly, and ethnic groups needs to be further explored and developed since dietary data for the whole population and relevant subgroups are required. Such advice was already given in the EFCOSUM study (4). In addition, if this approach would be used in more countries, the comparability of the results would improve. However, as the methodologies of the previous surveys are different, calibration with previously employed diet records is necessary in order to make time trend analyses possible.

In conclusion, the computerized 24 hour dietary recall method has the advantage that food consumption data with a great level of detail can be collected and stored. The use of a telephone approach made it possible to collect data on two independent days in an efficient way. The resulting food consumption data are therefore able to answer more questions than was the case before. Such questions have to do with food safety, and estimates of the fraction of the population adhering to dietary recommendations. The new approach has to be tested and developed for other population groups like children, the elderly and ethnic groups. Calibration with the previously employed dietary records will also make time trend analyses possible. This dietary assessment method seems promising as part of a revised dietary monitoring system for the Netherlands.

Acknowledgements

Samenvatting

Achtergrond: Een voedingspeilingsysteem is belangrijk voor het evalueren en ontwikkelen van het voedingsbeleid. De tot nu toe gehanteerde methoden in de Nederlandse voedselconsumptiepeilingen zijn minder geschikt voor het beantwoorden van de huidige beleidsvragen op het gebied van voeding.

Doel en opzet: Om ervaring op te doen met een nieuwe opzet, is er in 2003 een voedselconsumptiepeiling uitgevoerd onder 750 Nederlandse jongvolwassenen in de leeftijdsgroep

19-30 jaar. Twee onafhankelijke 24-uursvoedingsnavragen werden uitgevoerd door middel van een computergestuurd telefonisch interview.

Resultaten: Ondanks de lage respons van de studie was de onderzoekspopulatie wel representatief voor de betreffende Nederlandse populatie wat betreft leeftijd, opleiding en regio. Personen uit stedelijke gebieden waren ondervertegenwoordigd, maar hiervoor konden de resultaten gecorrigeerd worden. De groente- en fruitconsumptie van de Nederlandse jongvolwassenen was schrikbarend laag, de inneming van verzadigde vetzuren nog te hoog, maar de inneming van transvetzuren was gemiddeld bijna goed.

Conclusie: De 24-uursvoedingsnavraag lijkt geschikt binnen het nieuwe Nederlandse voedingspeilingsysteem. Het computergestuurde interview heeft als voordeel dat voedselconsumptiegegevens met een groot detailniveau kunnen worden verzameld en opgeslagen. Omdat de interviews telefonisch werden uitgevoerd was het logistiek goed haalbaar om gegevens over twee onafhankelijke dagen te verzamelen. De op deze wijze verzamelde gegevens zijn daardoor beter dan voorheen geschikt voor het beantwoorden van vragen op het gebied van voedselveiligheid en het schatten van het percentage personen dat aan de voedingsaanbevelingen voldoet. De nieuwe opzet moet nog wel verder ontwikkeld worden voor andere subgroepen in de populatie.

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