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European food availability databank based on household budget surveys

The Data Food Networking initiative

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Background: There is a need in Europe for sources of dietary data that would provide a regular flow of comparable nutrition information. In this context, the Data Food Networking (DAFNE) project has been developing a cost-effective food databank that allows monitoring of food availability within and between countries. Methods: The DAFNE project has developed a common classification system for the food and socio-demographic variables recorded in the national household budget surveys. Daily individual food availability was estimated for each participating country and basic descriptive statistics were used to depict the nutritional habits of the populations. Results: The DAFNE databank is freely accessible through DafneSoft (www.nut.uoa.gr). Three figures, based on Greek, Norwegian and UK data respectively, were selected to indicatively present the potential of the DAFNE data in order to monitor changes in the availability of 12 food groups over time; to study the effect of education in the total added lipid availability; and to follow time changes in fresh vegetable availability between manual and non-manual households. Conclusion: The HBS data allows the highlighting of issues related to nutrition surveillance. The application of the DAFNE methodology in developing a databank of standardized dietary data offers a realistic option for monitoring dietary habits in Europe. Benefiting from this potential, the European Union may additionally consider the undertaking of a pan-European individual dietary survey, in a sub-sample of the household budget population.

Keywords: DAFNE, diet, Europe, household budget surveys, nutrition

In 1997, the European Union (EU) set up a programme of action aiming at establishing a Community Health Monitoring System that would provide information for measuring and monitoring health status in the EU and further support the planning and evaluating of strategies and actions at the Community, national and local level.

Nutrition, together with physical activity, have long been recognized among the determinants of the populations' health status.[1,2] Dietary data for monitoring purposes may be derived from: i) the Food and Agriculture Organisation assembled food balance sheets, providing regular information on food supply at the population level, ii) the household budget surveys (HBS), which periodically collect data on food availability in nationally representative samples of households; and iii) specifically designed individual dietary surveys (IDS), providing information on the food intake of free-living individuals over a specified time period.[3,4]

In Europe, there is a need for sources of dietary data that would provide a regular and comparable flow of information. There is however, a limited number of IDS, which allow international comparisons, currently available and they are mainly addressing segments of the population.[5,6] Several European countries undertake national dietary surveys to assess the food intake of their population. Nevertheless, only some of them can afford regular update of the collected data.[7] Thus, the lack of periodicity in data collection, as well as the variability in the methods of data collection and analysis, limit the undertaking of national and international comparisons, a central element in a nutrition monitoring programme. Data collected through the national HBS on the other hand possess several attributes, important for nutrition monitoring at the European level. The surveys are undertaken, using harmonized methodologies, in all European countries through the National Statistical Offices. The collected data are country representative, detailed enough, linked to explanatory socio-demographic factors and updated on a regular basis.

Post-harmonization of data already collected at national level, in the context of HBS, was accomplished through the Data Food Networking (DAFNE) initiative. The DAFNE project exploits food and socio-demographic data collected in the HBS, aiming at the development of a cost-effective food databank that allows monitoring of

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food availability both within and between European populations. Since 1987, the National Nutrition Centre in Athens, Greece, has organized a series of workshops, seminars, and pilot research projects aiming at the development of the most appropriate way of using food and related data from HBS. Since 1994, the DAFNE initiative has received support by the European Commission to develop the methodology for harmonizing the HBS data of 10 European countries,[8,9] to evaluate the dietary information retrieved from the DAFNE databank through comparisons with food consumption data collected in IDS[10] and recently, to update the database in order to include 60 surveys from 18 European countries, covering the period from 1980 to 2000.

In the context of the Health Monitoring Programme, the EU supported the update of the DAFNE databank through the 'European Food Availability Databank based on Household Budget Surveys' projects. The projects aim at updating the DAFNE databank, in order to follow-up trends in nutritional practices, based on comparable and regularly updated information; to identify population subgroups whose dietary habits are not favourable according to the current scientific knowledge on the association of diet and health; and to outline preventive interventions in order to support consumer choices towards a healthy nutrition.

The present paper summarizes the DAFNE methodology for post-harmonizing the HBS data. Furthermore, it provides an essence of the DAFNE databank through graphs based on food availability data retrieved from the DAFNE databank.

METHODS

Data collection in the household budget surveys

Household budget surveys collect data on food availability at household level. The members of the participating households are asked to record mainly in open questionnaires all food purchases, contributions from the household's own production and the food items offered to members as gifts. At present, within the European Union, the recording period for food acquisitions mainly varies between seven and fourteen days and data collection is accomplished within one year, with due attention to capture seasonal variation in food intake. Trained interviewers visit the households regularly to assure complete data recording. Moreover, the concurrent recording of demographic and socio-economic characteristics of the household members may allow exploratory analyses on the evaluation of their effects on dietary choices.[11]

Incorporation of raw household budget survey data in the central database

The national datasets and their file descriptions were forwarded to the DAFNE coordinating centre in Athens, Greece. Data were read and the correct reading was evaluated through multiple cross-checks and tests of data consistency by standard procedures, including:

- the assessment of agreement between overlapping variables (e.g. age given in discrete years versus age categorized in age groups);
- the cross-tabulation of variables with related content (e.g. the age of the household head compared to his/her employment status); and
- the identification of missing data for variables considered in the analysis.

Upon completion, the raw data are stored in a central database fully operating at the Athens coordinating centre.

Post-harmonization of the food, demographic and socio-economic information

The development of a common classification system that would allow international comparisons is a central element in the development of a European food databank The process of harmonization included the establishment of operational criteria for the classification of food and socio-demographic variables, iterative cross-coding, as well as several working group meetings and bilateral visits to address specific problems. One of the results of the harmonization procedure is the development of the DAFNE food classification system, which allows the categorization of HBS-collected food data into 56 detailed sub-groups. These subgroups can be further aggregated at various levels ending up at 15 main food groups *(table 1)*.[12] Though several socio-demographic characteristics are recorded in the HBS and many of them are included in the DAFNE database in order to be considered in future analyses, focus was for the moment being put on the locality of the dwelling (classified as rural, semi-urban and urban), the educational level of the household head (classified as elementary, secondary and higher education), the occupation of the household head (categorized as manual, non-manual and retired), and on the household's composition, defined on the basis of the number and the age of the members.

Calculation of the average, daily individual food availability

Analyses were conducted separately for each of the participating European countries. Food availability per person per day was calculated by dividing the household availability by the product of the referent time period and the mean household size. Individual availability was estimated without making allowances for the proportion of food that was edible and under the assumption of equal distribution of food within the household and during the survey period. Lastly, a weighting factor was incorporated in the formula, whenever necessary, to accommodate the sampling scheme.

After completing the tasks described above, the data were stored and maintained in a Microsoft SQL Server 2000 DBMS on a Windows 2000 Server Operating System, functioning at the Athens coordinating centre. The data are stored per year and country, and can be queried by users who login through the Department of Hygiene and Epidemiology's (University of Athens Medical School) VLAN. Any user, except the Administrator, has only 'view' privileges.

Descriptive analyses were performed to describe the study populations and basic descriptive statistics (mean daily individual availability) were calculated to depict the nutritional habits of the European populations and population sub-groups, defined on the basis of their socio-economic characteristics. Selected results of the descriptive analyses are given in simple pictorial presentations in this paper and can serve as examples of the potential of the DAFNE database.

The ultimately developed DAFNE databank can be made available through the European Union Public Health Information Network of the European Commission and potentially through other information systems. Results on the mean daily food availability are currently accessible to any interested user through the DafneSoft (v 1.0).[13] The DafneSoft is a window-environment software, which allows the presentation of DAFNE data in various formats (tables, bars, pie charts, map presentations) and at various levels of detail, ranging from the analytical food codes to the common DAFNE food groups and the further export of the data for other uses. With the second version of DafneSoft (v 2.0) that will be made available by the end of May 2003, the user will also be able to follow trends in food availability over time both within and between countries, and to study the effect of occupation on the daily food availability.

RESULTS

Figure 1 presents percentage changes in the mean daily individual availability of 12 major food groups in the Greek population, from 1987 to 1999. An increase was observed in the availability of vegetables, fish and sea-

Table 1 The DAFNE food classification system

- Cereals and cereal products
  - Bread and rolls
  - Rice and cereals
  - Flour
  - Pasta
  - Cereal and bakery products (grains, flour and pasta excluded)
- Meat and meat products
  - Red meat
    - Pork meat (fresh and frozen)
    - Beef, veal and calf meat (fresh and frozen)
    - Red meat, other than pork or veal (fresh and frozen)
  - Poultry (fresh and frozen)
  - Offals (fresh and frozen)
  - Canned meat and meat products
  - Meat dishes
- Fish and seafood
  - Fish (fresh, frozen and processed)
  - Seafood
  - Fish dishes
- Milk and milk products
  - Milk
  - Cheese
  - Milk products (milk and cheese excluded)
- Eggs
- Total added lipids
  - Lipids of animal origin
    - Butter
    - Animal fat (butter excluded)
  - Lipids of vegetable origin
    - Vegetable fat
      - Margarine
      - Vegetable fat (margarine excluded)
    - Vegetable oils
      - Olive oil
      - Other seed oils
- Potatoes and other starchy roots
- Pulses
- Vegetables
  - Fresh vegetables
    - Green leafy vegetables
    - Cabbage
    - Tomatoes
    - Carrots
    - Onions and garlic
    - Other fresh vegetables
  - Processed vegetables (excluding juices)
- Nuts
- Fruits
  - Fresh fruits
    - Apples
    - Citrus
    - Bananas
    - Grapes
    - Plums
    - Berries
    - Apricots and peaches
    - Cherries and sour cherries
    - Pears
    - Other fresh fruits
  - Processed fruits (excluding juices)
- Juices (fruit and vegetable)
  - Fruit juices
  - Vegetable juices
- Sugar and sugar products
  - Sugar
  - Sugar products
- Non-alcoholic beverages
  - Stimulants
    - Coffee
    - Tea and infusions
    - Cocoa
  - Mineral water
  - Soft drinks
- Alcoholic beverages
  - Wine
  - Beer
  - Spirits

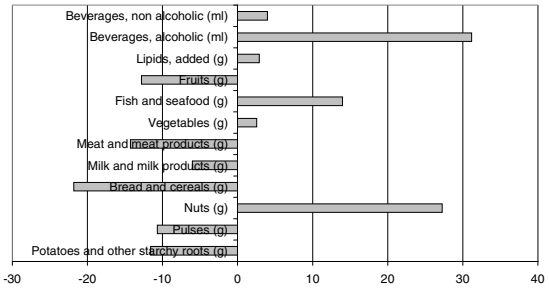

Figure 1 Percentage changes in mean food availability in Greece, from 1987 to 1999 (quantity/person/day)

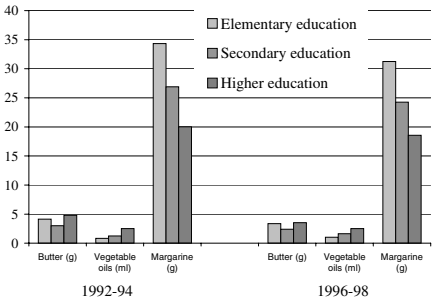

Figure 2 Mean availability of added lipids (butter, vegetable oils and margarine) in Norway, by year and educational level of the household head (quantity/person/day)

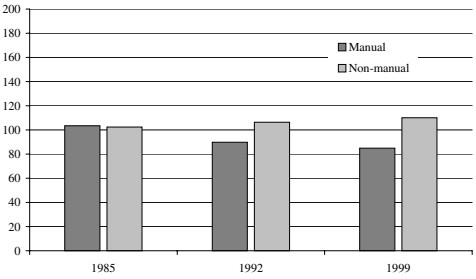

Figure 3 Mean availability of fresh vegetables in the UK, by year and occupation of the household head (g/person/day)

food, added lipids and nuts, and a decrease in the availability of meat and meat products, fruits, milk and milk products. Purchases of cereals, bread and other cereal products have decreased by approximately 22% during the 12-year period under study, while the purchase of alcoholic and non-alcoholic beverages for household consumption increased during the same period.

Figure 2 presents the daily individual availability of three types of added lipids (butter, margarine and vegetable oils) in Norway, by period of survey and educational level of the household head. The presented values refer to mean availability estimated on the basis of data collected in 1992/93/94 in comparison to data collected in 1996/97/98. Although the inter-survey period is rather short to reveal substantial changes in food choices, the lipid availability has generally decreased. A marginal increase was, however, noted in the availability of vegetable oils among households of elementary and secondary education, whereas no change was noted in the availability of vegetable oils among households of higher education. Margarine is indisputably the most popular added lipid in the country. Norwegian households whose heads are of college or university education consume smaller quantities of margarine and prefer vegetable oils and butter more than their less educated counterparts.

Finally, *figure 3* presents the mean daily individual availability of fresh vegetables in the UK, by year and occupation of the household head. Non-manual households increased the daily availability of fresh vegetables, while a decrease was noted among their manual counterparts. This change might be explained by various factors (e.g. need of manual workers for energy dense foods, financial constraints limiting the purchase of costly fresh vegetables). However, it might also reflect a better implementation of current nutritional advice among individuals occupied in non-manual professions.

DISCUSSION

It is generally acknowledged that dietary intake cannot be estimated without error and each method has its strengths and weaknesses.[14] The knowledge of the method's limitations and of the nature and the magnitude of the errors will lead to a more scientific interpretation of the results.

Dietary surveys collecting data at individual level are designed to document the current dietary patterns of population groups and possibly identifying sub-groups at nutritional risk. When international comparisons using these data are undertaken however, a number of methodological constraints emerge. For example, variable dietary assessment methods are used, making difficult to establish comparability at the international level,[7] the representativeness of the survey population and the nature of the data (e.g. reflecting or not habitual intake) may also challenge the suitability of a dietary survey for international comparisons. Lastly, the often prohibitive cost of implementing special dietary surveys may limit the European coverage of data collection. In the modern world of rapid changes however, nutrition monitoring should make use of dietary surveys that have built-in mechanisms of continuity over time, extensive coverage and allow international comparisons.

Household budget surveys provide regularly updated dietary data that can be linked to socio-demographic indicators and are undertaken in nationally representative population samples. Since, however, HBS are not primarily designed to collect nutritional information, the food data have limitations which need to be taken into consideration.[11,15] Thus in most cases, no records are collected on the type and quantity of food items and beverages consumed outside the home. With the exception of the UK where data on the out-of-home consumption have been recorded since 1992, the majority

of the European countries collect data only on expenses related to this food occasion. Furthermore, information on food losses and waste, food given to pets, meals offered to guests, use of vitamin and mineral supplements and the presence of pregnant or lactating women in the household is not consistently collected. Lastly, the HBS data are collected at household level and estimation of the individuals' intake requires the application of non-parametric modeling. The model is based on the assumption that household food availability, during the recording period, is the sum of the food quantities available to all household members, characterized on the basis of their age and gender. A discretization argument transforms the model into an ordinary regression one, for which the model coefficients represent the mean individual availability, according to age and gender.[16,17]

Bearing in mind the above conditions, the HBS-derived data stored in the DAFNE databank offer a realistic option for monitoring diet in Europe and identifying important determinants of people's dietary choices. The application of the DAFNE methodology in harmonizing and standardizing the HBS data can constitute a reasonable alternative to specially designed individual-based nutrition surveys. HBS data could help highlight issues such as differences in dietary patterns in Europe,[18] ecological associations with diet and morbidity/mortality data,[19] can contribute in following dietary trends and monitoring population groups at risk on account of their nutritional habits and in assessing intakes of additives and contaminants.

In addition, based on the potential of the DAFNE database, the EU may benefit from the nationally representative sample of the HBS, and conduct an IDS, in a sub-sample of the population already participating in the HBS. Thus HBS data will provide the first overview of the population dietary habits, which will, at a second phase, be studied in more detail using the IDS data. This survey design has already been used at national level[20,21] and proved useful in comparing two independent dietary measures, given current interests in both the HBS and IDS data.

The potential of using HBS data for nutrition monitoring purposes has long been recognized by European countries, even by those that can afford periodic undertaking of specially designed dietary surveys. The combined collection of dietary data can contribute to better interpreting the HBS food data, and use the latter for monitoring the dietary habits of European populations on a regular basis.

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