

Nordic monitoring on diet, physical activity and overweight

Part 1: Description of a common Nordic method for collecting representative data



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Preface

This report describes a project funded by the Nordic Council of Ministers (EK-FJLS) on establishing a common, Nordic monitoring system on diet, physical activity and overweight. The project comprises 3 parts and this report describes part 1. The aim of part 1 has been to describe a common Nordic method for collecting representative data on diet, physical activity and overweight, including description of sample size and characteristics, as well as practical considerations of the implementation of the monitoring in the Nordic countries.

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The project group had held three meetings: in January 2008, in June 2008 and in December 2008. In connection with the December meeting workshops on diet and physical activity were held.

All group members have contributed to the report, edited by Sisse Fagt and Ellen Trolle.

August 2009

Sisse Fagt

Ellen Trolle

Summary

In July 2006, the Nordic Council of Ministers adopted a Nordic Plan of Action on Better Health and Quality of Life through Diet and Physical Activity. As an important element in the common Nordic Plan of Action, the Nordic Council of Ministers has decided to develop a plan for a common Nordic monitoring of diet, physical activity, and overweight. In 2007, a Nordic working group was established to carry out this task.

The project consists of three parts.

Part 1: Description of a common Nordic method for collecting representative data, including description of sample size and characteristics, as well as practical considerations of the implementation of the monitoring in the Nordic countries.

Part 2: Validation of the suggested methods against an objective method (physical activity) or existing survey methods (diet).

Part 3: First collection of data in all Nordic Countries (if financing is provided).

This report describes part 1 of the Nordic Monitoring project suggesting a method for a common Nordic monitoring of diet, physical activity and overweight.

The project group consists of scientists from Nordic research institutions. The overall project group was divided into two subgroups on diet and physical activity respectively, whereas the issues on overweight was to be discussed in the joint project group. The project group has held two meetings and a combined workshop and meeting for each of the subgroups in 2008. Before, between and after the meetings the subgroups have worked together by e-mails.

This report presents the results of part 1 of the project.

The project group has discussed current surveys and research methods in the area of diet, physical activity and overweight. All the Nordic countries conduct large-scale nation-wide surveys that include data on diet, physical activity and anthropometry. Some countries have continuous surveys, others have surveys repeated every second, fifth or tenth year and others have surveys on more irregular basis. Some countries conduct surveys among all age groups, while others conduct surveys in specific age groups with years apart. It has not been considered possible to incorporate the future common Nordic monitoring in existing surveys because surveys in the Nordic countries are conducted irregularly and in different age groups. The working group has decided primarily to develop dietary indicator questions on basis of the validated indicator questions from the Norbaggreen project and the dietary questions used in Sweden. Concerning physical activity the working group will develop indicator questions on basis of experiences with the IPAQ survey and other physical activity questionnaires and the working group has decided to develop a new questionnaire that fits the purpose of the Nordic monitoring system.

Since the Nordic Plan of Action emphasizes that the monitoring should be simple and at relatively low cost, it is considered necessary to conduct the survey as a telephone interview, as a telephone interview is easier and less expensive to conduct than face-to-face interviews.

The monitoring system is suggested to start in 2010, which will serve as a baseline. If the monitoring is to be conducted every second year, the system will from 2012 and onward be able to monitor the development in dietary habits, physical activity and overweight.

The working group emphasizes that the monitoring system can be used to evaluate the goals and visions of the Nordic Plan of Action, but further suggests that the indicators may be supplemented by data from other national surveys. As an example, the working group agrees that dietary indicators cannot measure the development of the intake of salt in the Nordic population and therefore suggests that a specific monitoring project at Nordic level is initiated to discuss the reduction of salt in prepared foods and the measurements needed for following the development. In the area of social inequality the working group has proposed new goals and visions for measuring if social inequality are to be reduced both in relation to diet, physical activity and overweight. In 2009, a validation study will take place in Iceland, Denmark, Norway and Finland. Diet indicators will be validated in Iceland and Denmark and physical activity indicators will be validated in Iceland, Finland and Norway (part 2 of the project)..

The working group has contacted researchers in the area of monitoring childhood growth and in 2009, a network of monitoring childhood growth in the Nordic countries will be established. The aim of the network should be to coordinate and harmonize central monitoring using the same measures, standards and way of analyses within the Nordic Countries and thus compare the development in overweight in the Nordic countries.

The working group estimates the total costs of a future Nordic monitoring system as described in this report are around 360000 – 400000 Euros or 2.7 - 3 mill DKK every second year. If this financing is provided, the first collection of data in all Nordic countries can start in late 2010.

Questions to be included in the future monitoring system:

Diet

Which type of fat do you eat on bread (8-9 response categories),

Which type of fats do you use for frying, cooking, baking (approx. 6 response categories)

How many slices of bread do you eat during the day or week? (3 questions)

How often (monthly, weekly, daily) do you eat fruit?

How often (monthly, weekly, daily) do you eat vegetables?

How often (monthly, weekly, daily) do you eat the following?

pommes frites / fried potatoes,

fish and seafood,

sausages as a main meal,

candy and chocolate,

cakes and biscuits,

full fat cheese,

soft drinks (carbonated/not carbonated, sugar sweetened),

soft drinks(carbonated/not carbonated, light/artificial sweetened)

fruit/vegetable juice

For questions with monthly, weekly or daily answering categories, these will include several frequencies (e.g. 1, 2, 3, 4 or more times daily).

Physical activity

For adults (≥ 18 y):

Occupational activity categorized into 4 labor-intensity categories.

The following questions should include all physical activity that is not part of occupational activity.

Vigorous physical activity that last for at least 20 min each time and specifically: a) days per week; and b) total time per week. Moderate-to-vigorous intensity physical activity that last for at least 10 min each time and at least 30 min in a day including both: a) days per week; and b) total time per week.

Daily screen time (TV and computer) at leisure time on average. Also, it is suggested that at least during validation of the questionnaire, a fifth question should be included and used to classify leisure-time physical activity into 4 categories.

For adolescents (13-17 y):

Moderate-to-vigorous physical activity outside school (or working) hours :

a) days per week with at least 60 min of activity;

b) days per week with 30-59 min of activity;

c) total time of moderate-to-vigorous physical activity per week;

Daily screen time

For the parent of a child (7-12 y)

The questions would be the same as for the adolescents.

Background variables

Age, gender, education, family status, region and urbanization, self reported weight and height.

Background

Unbalanced diet, physical inactivity, and overweight are growing problems in the entire Western world, including the Nordic countries. The trend poses both a threat to the individual's quality of life and an economic threat to welfare in the Nordic societies. Current data from the Nordic countries¹ on diet, physical activity, and overweight point to a clear and alarming tendency that can be summed up in the following major areas of concern.

- A large number of citizens in the Nordic countries do not eat in accordance with the official recommendations regarding fat (especially saturated fat) and added sugar. Few meet the recommended intake levels of fruits and vegetables and many have a low intake of fish and whole-grain cereals.
- About 50% of the population does not comply with the recommendations regarding daily physical activity, and the decrease in the levels of activity among youth is especially critical.
- The number of overweight adults is increasing and now exceeds 40%. The number of overweight children is also increasing and now corresponds to between 15 and 20%.
- There is a clear social gradient in unhealthy eating, physical inactivity, and overweight. Groups with long education and higher socioeconomic status have healthier eating habits, are more active during leisure time, and have a lower frequency of overweight.
- There is a scarce amount of valid and comparable Nordic data on diet, physical activity and overweight which can be used for addressing and following time trends.

Nordic plan of action

In July 2006, the Nordic Council of Ministers - the Ministers for Fisheries and Aquaculture, Agriculture, Food and Forestry and the Ministers for Health and Social Affairs - adopted a Nordic Plan of Action on better health and quality of life through diet and physical activity.

The governments of the Nordic countries have committed themselves nationally to address the issue of an unhealthy diet, physical inactivity, and overweight and enacted policies to promote a healthier lifestyle. The Nordic Council of Ministers wants to underline these commitments by formulating common Nordic ambitions on combating an unhealthy diet, physical inactivity, and overweight. Common goals are to be created to allow for comparisons, whereby national actions taken in each of the Nordic countries can be assessed. A common ambition will be a clear benefit for the Nordic countries when coupled with a common monitoring of effects, an increased sharing of knowledge, a common effort to identify best practice, and increased scientific cooperation.

In the Plan of Action, it is concluded that the population of the Nordic countries far from follows the official recommendations on diet and physical activity, and there is a substantial prevalence of overweight and obesity among both adults and children. Therefore new common Nordic goals and visions on the development of diet, level of physical activity, and prevalence of overweight and obesity are set in the Nordic Plan of Action (table 1).

¹ Health, food and physical activity. Nordic Plan of Action on better health and quality of life through diet and physical activity
<http://www.norden.org/pub/velfaerd/livsmedel/sk/ANP2006745.pdf>

Table 1. The goals and visions for improvement of the health of the Nordic population as stated in the Nordic Plan of Action.

Diet

Goal 2011: *The consumption of fruits and vegetables and of whole-grain bread/cereals has increased, and the intake of fat, especially saturated fat and trans fatty acids, and added sugar has been reduced. The intake of salt has been maintained or reduced, depending on the specific national context.*

Vision 2021: *A major part of the population is eating according to the Nordic Nutrition Recommendations applicable. The current references for the vision are:*

At least 70% of the population above 10 years has a daily intake of fruits and vegetables of at least 500 g/day. The average intake of children, 4–10 years, is at least 400 g/day.

The average dietary intake of the population meets the NNR on fat and saturated fat plus trans fatty acids (respectively, 30 E% and about 10 E%, respectively), and at least 70% meets the NNR on fat (E% between 25 and 35).

80% or more meets the NNR recommendation on daily intake of added sugar (max. 10 E%).

70% or more consumes fish or fish products, corresponding to a main dish twice a week.

At least 70% of the adult population has a daily intake of whole-grain bread/cereals corresponding to at least half of their daily intake of bread/cereals.

The average diet of adults meets the NNR recommendation on salt.

Physical activity

Goal 2011: *The current trend, where an increasing proportion of adults and children are physically inactive, has been brought to a halt and at best reversed.*

Vision 2021: *At least 75% of the adult population is physically active (moderate intensity) for at least 30 minutes every day.*

All children aged 1–12 and at least 85% of children and youth aged 12–16 are physically active (moderate intensity) for at least 1 hour every day.

Overweight and obese

Goal 2011: *The continuing increase in the proportion of the overweight and obese has been stopped and at best reversed.*

Vision 2021: *The number of overweight and obese adults has been reduced by at least 30% from the present level.*

The number of overweight and obese children and youngsters has been reduced by at least 50% from the present level

Social inequality in health related to diet and physical activity

Goal 2011: *Existing differences between different social groups with regard to overweight, obesity, unhealthy diet, and physical inactivity have not deepened further and are at best have been reduced.*

Vision 2021: *The variation between different social groups on meeting the defined objectives with regard to diet, physical activity, and overweight/obesity is at most 20%.*

Nordic surveys on diet, physical activity, and overweight provide crucial information for the formulation of policies. As an important element in the common Nordic Plan of Action, the Nordic Council of Ministers has decided to develop a common Nordic monitoring of diet, physical activity, and overweight. It is the ambition that data will be collected every second year and in a representative way cover gender, predefined age groups (among children and adults), and social strata. The common monitoring will provide the general public and decision-makers with adequate and updated information on status and trends within the areas of diet, physical activity, and overweight and promote Nordic cooperation in achieving common ambitions.

Establishment of a Nordic working group on a common Nordic monitoring

The responsibility of coordination of the work on developing and implementing the Nordic monitoring system was delegated to The Nordic Working Group on Diet, Food, and Toxicology (NKMT) under CSO-FJLS (Food) by the Nordic Council of Ministers. In 2007, NKMT endorsed the establishment of a Nordic working group on the development of a common Nordic monitoring, and the working group was primarily formed during autumn 2007.

The participants of the working group are scientists from Nordic research institutions²:

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Sisse Fagt, National Food Institute, sisfa@food.dtu.dk (project leader)

At the first meeting two subgroups were formed on diet and physical activity:

Subgroup on physical activity

Thorarinn Sveinsson (coordinator), Sigmund Anderssen, Jeppe Matthiessen, Gunnar Johansson, Mikael Fogelholm. It was decided to contact Tuija Tammelin and Katja Borodulin for joining the subgroup.

² See appendix E for further contact information

Subgroup on diet.

Sisse Fagt (coordinator), Liisa Valsta, Wulf Becker, Lene Frost Andersen, Holmfridur Thorgeirsdottir, Margit Groth, Ellen Trolle. It was decided to contact Ingibjörg Gunnarsdottir for joining the subgroup.

The working group has held two meetings, January 24-25 2008 and June 1 2008, and a combined workshop and meeting for each of the subgroups in December 3-5 2008. Before, between and after the meetings the subgroups have worked together by emails.

In April 2008, the project leaders also had a meeting with Max Petzold and Lennart Köhler, Nordiska högskolan för folkhälsovetenskap, NHV to discuss the possibility of incorporating health indicators in the monitoring system.

Aim

The aim of this project is to suggest and validate a common, low cost, Nordic monitoring system on diet, physical activity, and overweight. Data should be collected every second year, and in a representative way cover gender, predefined age groups (among children and adults), and social strata.

The description of a common Nordic method for collecting representative data will include description of the data (the questions or measures) on diet, physical activity and weight status, description of sample size and population characteristics, as well as practical considerations of the implementation of the monitoring in the Nordic countries, based on already existing data collection systems. Specifically should it be discussed if the Swedish indicator questions for the diet can be used in the other Nordic countries (described in rapport 21-2004 from the Swedish National Food Administration) and if monitoring of physical activity should use a short version of IPAQ (International Physical Activity Questionnaire). The monitoring will be developed taking due account to the work carried out in the EU on monitoring. In addition, an estimation of the additional costs of running the monitoring system will be provided.

The project needs to consider to what extent the suggested indicators will be a sufficient measure for diet, physical activity (and overweight) in each country and to what extent the indicators provide comparable data among the Nordic countries. The project also needs to discuss to what extent the indicators will be able to measure if the goals and visions set in the Nordic Plan of Action are reached or approached.

The project consists of three parts

Part 1: A description a common Nordic method for collecting representative data, including description of sample size and characteristics, as well as practical considerations of the implementation of the monitoring in the Nordic countries. In addition, plans for the validation studies will be approved and put forward to NKMT.

Part 2: A validation of the suggested methods against an objective method (physical activity) or existing survey methods (diet). A network on child health will also be started with the objective to develop a network of monitoring child health in the Nordic countries, coordinate and harmonize central monitoring using the same measures, standards and way of analyses and third to compare the development in overweight in the Nordic countries.

Part 3: First collection of data in all Nordic countries, if financing is provided.

This present report presents the results of part 1 of the project .

Table 2. Time frame of the overall project (part 1-3)

| Part 1 | August 2007 - January 2008 | June 2008 | Summer 2008 | Autumn/winter 2008 |
|--------------|--|---|--|--|
| | Project preparation and First meeting: Discussion - Sample size, practical considerations Electronic working groups | Second meeting: Decision on which questions and measures to use Decision on validation and budget for each country | Application to Nordic Council and Nordic Innovation Centre on validation studies | Detailed planning of validation studies in selected countries NKMT meeting Aug/Sep 2008 Workshops and meetings on diet and physical activity Report to NKMT on part 1 of project |
| Part 2 and 3 | January 2009-december 2010 | | | |
| | Part 2 will be running in 2009 and 2010. The validation studies will take place in 2009. Medio 2010, a report will be published on the results of the validation including a suggestion on the coming monitoring. If financing is provided, the common monitoring (part 3) can start in 2010. | | | |

Purpose and strategy of a common monitoring program

– specific objectives

As stated in the Plan of Action³:

“The monitoring must not demand a major investment of public resources in each of the Nordic countries. The monitoring system must be as simple as possible and should if possible be integrated with current surveys. The common Nordic monitoring system will not replace existing major health or dietary surveys in the Nordic countries. On the contrary, existing health and dietary surveys are needed to validate the common monitoring, provide more detailed information, and identify factors that may explain the trend that monitoring will depict.

Each country will collect data individually within the monitoring system in keeping with the common requirements that will be formulated. Living conditions among the population with disabilities are important background factors, and issues on diet and physical activity in these groups should possibly be considered in health policies. The possibility should be considered of integrating monitoring and data collection on diet and physical activity with the existing data collection from the population of disabled people under the Nordic Council of Ministers for Health and Social Affairs.”

Further on the Action Plan states: “It is possible to monitor trends with regard to the fulfilment of the stated ambitions on dietary habits by developing and applying relatively simple questionnaires on key indicator foods.” And later: “Regarding physical activity initiatives have been taken in some of the Nordic countries to carry out comprehensive surveys, but not with regard to the establishment of a simple and continuous monitoring. The Swedish initiative concerning collection of data on physical activity in a large and representative segment of the population “Hälsa på lika villkor” is mentioned. A common Nordic monitoring system on physical activity must be able to assess the proportion of the population that meets the recommended level of physical activity.”

The primary function of a monitoring system is therefore to provide adequate and updated information to the public and to decision makers on the status and trends in the areas of diet, physical activity and overweight/obesity. The common monitoring system shall provide a continuous and comparable assessment of the status that makes it possible to assess the time trends in measures related to the goals and visions of the Plan of Action.

³ Health, food and physical activity. Nordic Plan of Action on better health and quality of life through diet and physical activity
<http://www.norden.org/pub/velfaerd/livsmedel/sk/ANP2006745.pdf>

Specific objectives of the project, part 1:

- Define what precisely the indicator questions should be able to measure, related to the goals and visions of the Nordic Plan of Action, and ensure comparability between countries.
- Suggest design and data collection method for a common Nordic monitoring system on diet, physical activity and overweight
- Develop scientific substantiated indicator questions on diet and on physical activity
- Develop plans for validating the indicator questions.
- Give an estimate of the costs of the suggested system

Current status of monitoring in the Nordic countries

National surveys on diet, physical activity, and overweight provide crucial information for the formulation of policies. The surveys do not, however, permit direct comparisons between the Nordic countries and are not conducted regularly to ensure a continuous overall assessment of the impact of policies. There is by now no up-to-date comparable data in the Nordic countries concerning diet, physical activity or overweight.

All the Nordic countries have large-scale surveys that include data on diet, physical activity, height and weight. Some countries have continuous surveys, others have surveys repeated every second, fifth or tenth year and others have surveys on more irregular basis. Some countries conduct surveys in all age groups, while others conduct surveys in specific age groups with years apart (for detailed information in the different Nordic countries, see appendix B).

Diet

Diet is monitored in all Nordic countries and the national dietary surveys have several aims and are used for both nutritional purposes and in risk assessment of additives, contaminants etc. in food. Due to different aims and resources, the surveys use different methods, thus making comparison difficult.

Sweden has developed simple **indicator questions** for diet and physical activity and has validated these questions in 2003⁴. The questionnaire includes questions on the intake of fruit, vegetables, fish, wholegrain bread, fat used on bread, French fries/fried potatoes, sausages, candy and chocolate, buns, cakes, cheese and soft drinks. In 2008 a question on type of fat was added. Also the Swedish National Institute of Public Health has worked with simple questions upon fruit and vegetables, physical activity and overweight in the project "Health on equal terms"⁵.

In the **Norbagreen** study 2002⁶, a few food frequency dietary questions (CATI – Computer Assisted Interview used in the Nordic countries) were used to monitor the intake of fruit, vegetables, potatoes, fish and bread in Finland, Sweden, Norway, Iceland, Denmark, Estonia, Latvia and Lithuania. The Food frequency questionnaire was validated in separate surveys in Finland and Estonia⁷.

Physical activity

Monitoring of physical activity at a national level is not well established in the Nordic countries and physical activity is not monitored in a similar way or in the same age groups. Several countries have conducted national or larger regional surveys on children, adolescents or adults, but monitoring should be coordinated to become comparable between the Nordic countries. Norway has started a monitoring system on physical activity and physical fitness among a representative sample of adults and of children and adolescents (9 and 15 y).

4 Sepp, Ekelund & Becker. Enkätfrågor om kost och fysisk aktivitet bland vuxna. Livsmedelsverk, Rapport 21, 2004. Becker. Indikatorer för bra matvanor. Livsmedelsverket, Rapport 3, 2007

5 Wadman, Boström & Karlsson. Hälsa på lika villkor. Resultat från den nationella folkhälsoenkäten 2006. http://www.folkhalsa.com/upload/ar2007/Rapporter%202007/A2007-01_Halsa_pa_lika_villkor_0705.pdf. See also www.folkhalsa.com/templates/Page_391.aspx. The questionnaire from 2004, 2005 and 2006 can be found on the website.

6 Similä et al. The NORBAGREEN 2002 study – Consumption of vegetables, potatoes, fruit, bread and fish in the Nordic and Baltic countries. TemaNord 2003:556. ISBN 92- 893-0952-0. Nordic Council of Ministers, Copenhagen 2003. www.norden.org/pub/velfaerd/livsmedel/sk/TN2003556.asp

7 Petkeviciene et al. Validity and reproducibility of the NORBAGREEN food frequency questionnaire. European Journal of Clinical Nutrition, 5 September 2007

Overweight and obesity

Comparable data upon prevalence of overweight and obesity are not present in the Nordic countries by now, but all Nordic countries collect self-reported or measured data on height and weight in adults in various surveys. For more than 50 years Denmark has measured children's height and weight twice or more of children during primary school. Unfortunately only data from schools in the Copenhagen area are computerized and analysed. Together with the municipalities the Danish National Board of Health is planning a monitoring system for children based on the weight and height measures collected in schools. A working group under the Danish Nutrition and Fitness Council has suggested a monitoring system for overweight and obesity in both children and adults⁸. Waist circumference is suggested to support the measures of height and weight. Since 2002, a Danish database named "Children's Health" has registered data from pediatricians and other health personnel concerning weight and length/height of Danish children. Other databases are under preparation.

Measured weight and height data for children are also collected in various age groups in FI, SE, IS and NO. In Norway only height is measured in some age groups.

In Denmark and Norway, height and weight in young males are measured, when they attend the military, but there is no central registry.

In Sweden self-reported data on weight and height of adults are collected on a regular basis (For more information see Appendix B).

Conclusion

The working group has decided primarily to develop dietary indicator questions on basis of the validated indicator questions from the Norbaggeren project and the questions used in Sweden (described in the chapter on monitoring of diet). Concerning physical activity the working group will develop these questions on basis of experience with the IPAQ survey and other physical activity questionnaires. Most of the members of the physical activity subgroup have used IPAQ or similar questionnaires on physical activity. These questionnaires are judged to be either too extensive for the purpose of the Nordic monitoring system, or their validity has been questioned. Also, they are not in accordance with the latest integrated recommendation on health-enhancing physical activity. Therefore, the group decided to develop a new questionnaire that fits the purpose of the Nordic monitoring system.

⁸ Sørensen et al Monitorering af forekomsten af fedme. Motions- og Ernæringsrådet, København 2008

Current status of monitoring in Europe

There are several initiatives in Europe concerning monitoring of diet, physical activity and overweight. The initiatives are described in details in appendix A.

WHO has suggested a surveillance system for childhood obesity in Europe, based on measured data among specific age groups. The data will be collected at schools by trained personnel (e.g. school nurses, physicians, paediatricians). More than 10 European countries, including Sweden and Norway, are now attending the initiative.

Eurostat has suggested development of indicators of food safety to assist in the monitoring and evaluation of chemical food safety and nutrition and health in the EU member states using food consumption statistics (food balance data, household budget data or data from dietary surveys). The work is still ongoing.

The European Community Health Indicators (**ECHI**) has been developing indicators on health related issues. For now the dietary questions (on the ECHI shortlist) consist only of a question on fruit consumption, excluding juice and a question on vegetable consumption, excluding potatoes and alcohol consumption.

The European Physical Activity Surveillance System (**EUPASS**)⁹ has created an inventory of national physical activity surveillance systems to contribute to the establishment of a list of core indicators and optional indicators for health-enhancing physical activity and its determinants. EUPASS also aimed at testing the validity and reliability of the IPAQ Questionnaire and its feasibility for population based monitoring. The conclusion of the EUPASS project was that IPAQ was promising but needed further development.

The European Commission, DG SANCO has funded the **ALPHA** (Instruments for Assessing Levels of Physical Activity and Fitness) project, which will end in 2009. Health related fitness (HRF) is measured across European Member countries using different tests. ALPHA aims at providing a set of instruments for assessing levels of physical activity, its underlying factors as well as fitness in a comparable way within the European Union. The project aims at establishing consensus about one instrument, procedure and approach, which can be used in European Member countries to deliver comparable results. A standard HRF test battery should then be tested for European Health Monitoring activities as well as for European Member States.

The European Commission has in the survey Health and Food (**Eurobarometer**) examined both eating habits, physical activity and obesity in Europe through a telephone interview (CATI). The latest survey was conducted in 2005¹⁰ but didn't include indicator questions on diet.

9 http://ec.europa.eu/health/ph_projects/1999/monitoring/fp_monitoring_1999_frep_08_en.pdf

10 http://ec.europa.eu/health/ph_publication/eb_food_en.pdf

Monitoring in the Nordic countries – practical considerations

The working group has discussed the possibilities to incorporate the suggested new monitoring system in already existing surveys in the Nordic countries. The general experience among the Nordic countries is that the Nordic populations are asked to participate in many surveys. The option of incorporating the monitoring in already existing surveys was discussed. In order to ensure the comparability of results between the countries, it is however crucial that data is collected at the same time of the year in each Nordic country and that data is based on the same sub-sample of the Nordic populations.

- The existing surveys are not conducted at the same time of the year in the different countries
- The cycle between surveys is very heterogeneous
- Some countries conduct surveys in specific age groups, not the whole population
- Most of the existing surveys cannot include numerous extra questions (e.g. the dietary indicator questions will comprise approx. 13 questions)
- The existing surveys cannot rephrase already existing questions, as this will impair comparison backwards and thus time trends

To illustrate the differences in when and how surveys are conducted in the Nordic countries, table 3 shows the frequency of Nordic dietary surveys among children and adolescents 4-18 y since 1990 and table 4 shows the latest dietary surveys conducted among adults.

Table 3. Nordic dietary surveys among children and adolescents 4-18 y since 1990

| Country | Age group | Year | Method |
|---------|-------------------|-------------------------------|--|
| Norway | 4, 9 & 13 y | 2000-2001 | 4 d precoded record |
| | 13 & 18 y | 1993 | FFQ |
| Sweden | 4, 8 & 11 y | 2003 | Open 4 d record |
| Denmark | 4-18 y | 1995 | 7 d precoded record |
| | 4-18 y | 2000-2006 (continuous survey) | 7 d precoded record |
| Finland | 12, 14, 16 & 18 y | Every second year since 1977 | Use of selected foods, frequency |
| | 14-18 y | Every second year since 1995 | Intake of foods in school and selected foods during the whole week |
| Iceland | 6 y | 2002 | 3 d weighed record |
| | 7-9 y | 2007-09 | 3 d food record |
| | 9 & 15 y | 2003-2004 | 2 x 24 h recall |

Table 4. Nordic dietary surveys among adults 15 – 80 y since 1990

| Country | Age group | Year | Method |
|---------|-----------|-----------|----------------------------------|
| Norway | 16-79 y | 1997 | FFQ |
| Sweden | 18-74 y | 1997/98 | 7 d precoded record |
| Denmark | 15-75 y | 2003-2006 | 7 d precoded record |
| Finland | 25-74 y | 2007 | FFQ, 2x24 h recall, 2x3 d record |
| Iceland | 15-80 y | 2002 | 24 h recall, FFQ |

Among both children, adolescents and adults dietary surveys in the Nordic countries are conducted very irregular and so are surveys concerning physical activity and overweight.

When discussing the practical consideration of incorporating the new monitoring system in already existing surveys, it is clear that this is not possible at present time. Therefore the working group recommends that the monitoring should be a separate survey.

The data collection methods to be used in a common monitoring system has been discussed. Since the Nordic Plan of Action emphasizes the need for a monitoring system to be simple and low cost, it is considered necessary to conduct the survey as a telephone interview,. Such method is easier and less expensive to conduct than face-to-face interviews. Postal enquetes have also been discussed, but most countries experience low participation rates in such surveys.

When implemented, the monitoring will indicate in which direction diet, physical activity and overweight develops in the Nordic Countries according to the goals and visions as stated in the Nordic Action Plan. However, the indicators can not describe all issues and need to be supplemented with results from the national large scale surveys.

The objective of the present project part 1 is to suggest, develop and validate the monitoring instrument, the indicator questionnaires. As the indicators included in the monitoring instrument need to work closely together with data from the national large scale surveys, the validation should aim at validating the monitoring instrument against the methods used in the large scale surveys. The validation will then provide answers to which extent the indicators of a country fit with data from the national surveys. The physical activity questionnaire in the monitoring instrument will be validated against an objective method (accelerometry). Accelerometry is a valid and reliable method for the assessment of the recommended health-enhancing physical activity.

Monitoring the diet – scientific and practical considerations

Currently used indicator questions

The starting point for discussing indicator questions on diet has been the validated Swedish indicator questions and the questions used in the Norbagreen¹¹ project.

Sweden has developed simple **indicator questions** for diet and physical activity and has validated these questions in 2003¹². In 2005, 2006 and 2008 the dietary indicator questions have been used at a national scale among a sample of 16-80 years old subjects (n=1000) using CATI (Computer Assisted Interview)¹³.

The Swedish indicator questions (a so called food frequency questionnaire, FFQ)¹⁴ - consist of 11 frequency questions (types of fat spread on bread, wholegrain bread, fruit and vegetables, pommes frites/fried potatoes, fish as a main meal, sausages as a main meal, candy and chocolate, buns, cakes and biscuits, full-fat cheese, soft drinks). The Norbagreen questionnaire has used similar questions¹⁵.

The Swedish indicator questions have been validated in 2003 among 194 adults (average age 42 years) living in the Uppsala area. The indicator questionnaire was validated against four repeated 24 h dietary recall as a reference method. Participants were interviewed face-to face at the first occasion, whereas the following recalls were conducted by telephone. The study also included questions on physical activity which was validated against accelerometry. The participants filled out the indicator questionnaire after all recalls were completed and also a second time some months later. In general there was fair to good agreement between the recalls and indicator questions, although estimated frequencies were lower for the indicator questions. Reproducibility was good.

Considerations of the foods to include in future monitoring

The indicator questions used in Sweden were based on analysis of the Swedish dietary pattern. The results from the analysis showed that certain food groups (fat on bread, types of bread, fruit and vegetables, pommes frites/fried potatoes, fish and seafood, sausages, candy and chocolate, sweet bakery products (buns, cakes and biscuits), full-fat cheese, soft drinks) was important in explaining the content of fat, saturated fat, sugar and dietary fibre in the diet. For more information, see reference 12.

Also FI, IS and DK have analysed whether the food groups selected in Sweden could explain the variation in the content of fat, saturated fat, sugar and dietary fibre in their national diet surveys. The analyses showed convincingly that questions similar to the Swedish indicator questions, with few adjustments, are relevant in the other Nordic countries (Appendix D)

The working group has discussed the issue of including artificial sweetened soft drinks (diet soft drinks) in the question on soft drinks. Consumption of diet soft drinks is increasing in all Nordic countries and it would be of interest to monitor the future development. However, the market is changing and products maybe sweetened with both added sugar and artificial sweeteners are emerging, and therefore it can be difficult to divide the consumption into products sweetened with added sugar and products sweetened with artificial sweeteners. In Sweden and Norway, there is also a trend towards less sugar-sweetened products. It was agreed in the working group to include a question on diet soft drinks and validate this question.

In 2008 Sweden has added a further question to their list of dietary indicator questions on fats used for frying, cooking etc. The purpose is to monitor the acceptance of the dietary advice to use of fluid margarine and vegetable oils for cooking purposes. In the Swedish validation study the use of such fats high in unsaturated fatty acids were related to lower E% of saturated fat.

11 A Nordic Baltic telephone survey focusing primarily on the intake of fruit and vegetables conducted in 2002, funded by the Nordic Council of Ministers

12 Sepp, Ekelund & Becker. Enkätfrågor om kost och fysisk aktivitet bland vuxna. Livsmedelsverk, Rapport 21, 2004

13 Becker. Indikatorer för bra matvanor. Livsmedelsverket, Rapport 3, 2007

14 See appendix C

15 Petkeviciene et al. Validity and reproducibility of the NORBAGREEN food frequency questionnaire. Eur J Clin Nutr, 5 September 2007

Based on the discussion in the working group suggests the following indicator questions to be included in the monitoring system:

Which type of fat do you eat on bread (8-9 response categories),

Which type of fats do you use for frying, cooking, baking (approx. 6 response categories)

How many slices of bread do you eat during the day or week? (3 questions)

How often (monthly, weekly, daily) do you eat fruit?

How often (monthly, weekly, daily) do you eat vegetables?

How often (monthly, weekly, daily) do you eat the following?

pommes frites / fried potatoes,

fish and seafood,

sausages as a main meal,

candy and chocolate,

buns, cakes and biscuits

full fat cheese

soft drinks, carbonated/not carbonated, sugar sweetened

soft drinks, carbonated/not carbonated, light/artificial sweetened

fruit/vegetable juice

In all, questions on 14 food items or food groups. For questions with monthly, weekly or daily answering categories, these will include several frequencies (e.g. 1, 2, 3, 4 or more times daily).

Will the dietary indicator questions monitor the diet sufficiently?

The monitoring system is suggested to start in 2010, which will serve as a baseline. If the monitoring will be conducted every second year, the system will in 2012 be able to monitor the development in dietary habits, physical activity and overweight over a 2 year period.

The dietary Goal 2011 of the Nordic Plan of Action states: The consumption of fruits and vegetables and of whole-grain bread/cereals has increased, and the intake of fat, especially saturated fat and trans fatty acids, and added sugar has been reduced. The intake of salt has been maintained or reduced, depending on the specific national context.

The working group has discussed, whether the suggested indicators will monitor the dietary goals and vision of the Nordic Action plan sufficiently. The working group considers that some of the dietary goals 2011 of the Nordic Action Plan will be relatively easy to monitor with simple indicator questions, as long as the goals concerns increase or reduction of certain foods. However, changes at the macronutrient level will be more difficult although the questions to some extent will be able to capture saturated fat (French fries, sausages, cheese) and added sugar (e.g. candy and soft drinks) as the suggested indicators has shown to be correlated to the intake of the macronutrients of interest.

The intake of salt is, however, difficult to measure with a few questions. In many countries, the primary contributor of salt is prepared foods, whereas the contribution of salt from household salt is minor. In DK, the median contribution of household salt is 8-10% of the total salt intake. The intake of salt, especially intake of household salt is difficult to assess with dietary methods¹⁶ and the amount of salt in processed foods have a large variability, thus making it difficult to estimate from dietary methods. Some major salt containing foods are measured in the suggested indicators (e.g. sausages, bread, cheese, French fries (pommes frites), but not all salt containing foods are measured. As the major contributor to the salt intake is processed foods, the goal of reducing the salt intake in the Nordic population should primarily be done by reducing salt in prepared foods and this industrial approach should then be measured. The working group suggest that a Nordic project is initiated to discuss reduction of salt in prepared foods and how to measure the development.

The dietary **Vision 2021** of the Nordic Plan of Action states: *At least 70% of the population above 10 years has a daily intake of fruits and vegetables of at least 500 g/day. The average intake of children, 4–10 years, is at least 400 g/day.*

¹⁶ Andersen et al. Intake of household salt in a Danish population. Eur J Clin Nutr 2008

The average dietary intake of the population meets the NNR on fat and saturated fat plus trans fatty acids (respectively, 30 E% and about 10 E%, respectively), and at least 70% meets the NNR on fat (E% between 25 and 35).

80% or more meets the NNR recommendation on daily intake of added sugar (max. 10 E%).

70% or more consumes fish or fish products, corresponding to a main dish twice a week.

At least 70% of the adult population has a daily intake of whole-grain bread/cereals corresponding to at least half of their daily intake of bread/cereals.

The average diet of adults meets the NNR recommendation on salt.

The dietary vision 2021 in the Nordic Plan of Action concerns both the intake of foods and macronutrients in the population. The vision is to increase the proportion of the population eating a certain amount of foods of interest. The indicator questions aim primarily at estimating the frequency of which foods are eaten, but do not estimate amounts eaten. Therefore the indicator questions will only indicate in which direction the dietary habits develop, but the exact estimate of how much is eaten has to be calculated on basis of national dietary surveys. Also the exact intake of fat, saturated fat and added sugars and the contribution to energy intake can not be estimated through simple indicator questions, but must be calculated on basis of dietary intake assessed from national dietary surveys. The indicators will provide an indirect measure of the macronutrients of interest.

The selected indicators measure the frequency of intake of sugar containing soft drinks. If the monitoring shows that the frequency of soft drinks decreases, this will indicate that the added sugar content in the diet has decreased as well, but from the indicators it will not be possible to indicate how large a proportion of the population that meets the NNR recommendation on maximum daily intake of added sugar contributing to the energy intake.

The vision on salt concerns the average diet and must therefore also be estimated through other sources than the indicator questions, as these do not cover the whole diet. As stated earlier, salt should be measured in others ways.

The suggested validation will validate the dietary indicator questions against current dietary habits as measured in the national dietary surveys, but as the diet develops over time it is necessary to evaluate or validate the indicators, e.g. every tenth year. The validation study will also indicate to what extent the indicators provide the same distribution of different foods in the population compared to national dietary surveys.

Conclusion

According to the Nordic Plan of Action the monitoring system shall provide adequate and updated information on status and trends within the areas of diet, physical activity, and overweight. The common Nordic monitoring system will not replace existing major health or dietary surveys in the Nordic countries. On the contrary, health and dietary surveys are needed on regular basis to validate the common monitoring, provide more detailed information, and identify factors that may explain the trend that monitoring will depict.

Regarding the connection between the indicator questions on foods and dietary goals/visions of the Nordic Plan of Action, the subgroup on diet is aware that the indicators are an indirect measure of nutrients and therefore can not be used for measuring all goals and visions in the Nordic Action Plan. This must be done through conventional dietary surveys. The subgroup on diet is also aware that foods in the current dietary habits might reflect the intake of certain macronutrients, but due to changes in dietary habits, the foods reflecting these macronutrients may change over time. It is therefore recommended that the selected dietary indicators and the macronutrients of interest need to be checked against the dietary habits regularly.

Also the variability of foods may change e.g. the content of fat could change in sausages, and if the intake of sausages does not decrease the indicators will not catch a fall in the fat intake. Therefore, the indicator foods must also from time to time be examined concerning, whether they have the same dietary content as before.

It is recommended that test and validation of the questionnaire takes place before regular monitoring starts.

Monitoring physical activity – scientific and practical considerations

Currently used indicator questions on physical activity

Recommendations for physical activity (PA) have existed for decades, but the recommendations did take large change in the mid nineties with the published recommendations from CDC and ACSM¹⁷. Although they have not taken fundamental changes, these recommendations have continued to develop and the most recent development in this area has just been published^{18,19}. New Nordic Nutrition Recommendations are planned to be released in 2012 and the included physical activity recommendations are expected to change in line with these new recommendations in the US.

Self reported questionnaire have been used to report physical activity in the Nordic countries in the past. Saltin and Grimby's two indicator questions on work and leisure-time activity^{20, 21} have been used in numerous large-scale Nordic epidemiological surveys for decades. However, modified versions of the questions have been used making comparison difficult. In addition, the questions also have some clear limitations because it is only possible to get a crude overall estimate of usual PA that may be a poor measure of daily or weekly PA and thus it is not possible to set a cut-off for meeting new PA guidelines. The IPAQ (International Physical Activity Questionnaire), which is an international recognized questionnaire, has been used in the Nordic countries in one way or another. The IPAQ questionnaire is both available in a short and long form. The IPAQ was developed for use with young and middle ages adults (15-69 years old). The test-retest reliability of the IPAQ is good but their validity, when compared to accelerometer data, is not very convincing²². Furthermore, very poor correlation was found between aerobic fitness and IPAQ activity²³. In Finland, IPAQ activity was found to correlate positively with obesity (Katja Borodulin, unpublished data). In Iceland, 25% of respondent to long form IPAQ reported moderate activity that exceeded the upper limit of normal range of physical activity according to IPAQ guidelines which indicates inherent over-reporting of the IPAQ questionnaire (Torarinn Sveinsson, unpublished data). This may suggest that the IPAQ questionnaire is too complicated and confusing for the participants.

From this it can be concluded that surveys on physical activity are not as well established in the Nordic countries as surveys on dietary habits. However, there are indications that valid estimate of physical activity may be obtained by relatively simple questions. The working group does not recommend the use of IPAQ, because IPAQ validation studies have not been very convincing and several research using IPAQ have shown very spurious results.

17 Pate et al. Physical activity and public health. A recommendation from the Centers for Disease Control and Prevention and the American College of Sports Medicine JAMA 1995, 273 (5): 402-407.

18 Haskell et al. Physical activity and public health - Updated recommendation for adults from the American college of sports medicine and the American heart association. Circulation, 2007. 116(9): p. 1081-1093

19 CDC 2008. Physical Activity Guidelines for Americans (<http://www.health.gov/paguidelines/>); EU Physical Activity Guidelines, Fourth Consolidated Draft.

20 Saltin & Grimby. Physiological analysis of middle-aged and old former athletes: comparison with still active athletes of the same age. Circulation 1968, 38: 1104-1115

21 Johansson & Westerterp. Assessment of the physical activity level with two questions: validation with double labeled water. Int J Obes 2008, 32(6):1031-3. Epub 2008 Apr 8

22 Craig et al. International physical activity questionnaire: 12-country reliability and validity. Medicine and Science in Sports and Exercise, 2003. 35(8): p. 1381-1395.

23 Fogelholm et al. International Physical Activity Questionnaire: Validity against fitness. Med Sci Sports Exerc 2006, 38 (4):753-60.

Considerations regarding physical activity issues

According to the goals and visions on physical activity in the Nordic Plan of Action both inactivity and activity should be monitored. According to the Nordic Plan of Action, physical inactivity may be defined as the proportion of people not meeting the physical activity recommendations. In the monitoring system, it will be important to differentiate insufficiently active (not meeting the recommendation) from totally inactive (no physical activity at all). The monitoring should be done from a health perspective and should take into account the current recommendations for PA; this includes the new recommendations in 2007 from the American College of Sport Science and American Heart Association where recommendations for fitness and health-enhancing PA are integrated. Also, the CDC 2008 Physical Activity Guidelines for Americans (<http://www.health.gov/paguidelines/>) and the EU Physical Activity Guidelines, Fourth Consolidated Draft should be considered.

The monitoring system should aim to capture time spent in health-enhancing PA, i.e. moderate and vigorous intensity physical activity (MVPA) but not total energy expenditure. Light intensity physical activity should not be a part of the monitoring system because its validity in self-reports has been relatively poor. However, occupational activity should be evaluated because physically heavy occupation may contribute to total energy expenditure and also have effect on leisure-time physical activity. Occupational PA may also be health-enhancing dependent on sex and age. Andersen et al.²⁴ has found that a higher level of PA at work was associated with lower mortality rates in women and Tammelin et al.²⁵ has found a positive association between heavy physical work and a high level of fitness in young workers. The PA guidelines of ACSM and AHA 2007 do not clarify if the recommendations include work.

Excessive sitting may be detrimental to health, independently of participation in some physical activities. Independent of time spent on moderate intensity physical activity, sedentary time has been associated with obesity and clustered metabolic health^{26,27}. Therefore measures of sedentary time will be included into instrument in validation study.

The working group has decided that classification of adults in five classes is needed: 1) not meeting recommendations; 2) meeting moderate-intensity recommendations; 3) meeting vigorous-intensity recommendations; 4) meeting the recommendation by a combination of moderate- and vigorous-intensity physical activity; 5) meeting both moderate- and vigorous-intensity recommendations. Classification of adolescents and children in two classes is needed: 1) not meeting the recommendations; 2) meeting the recommendations of 60 minutes of moderate intensity PA daily. Furthermore, the monitoring survey, should be able to quantify the physical activity of the respondent within each category. This would both make the monitoring surveys more sensitive to changes and trends, and make it more flexible and adaptable to further changes or modification of the physical activity guidelines and recommendations.

24 Andersen et al. Mortality associated with physical activity in leisure time, at work, in sports and cycling to work. *Ugeskr Laeger* 2002 Mar 11;164(11):1501-6. Danish.

25 Tammelin et al. Occupational physical activity is related to physical fitness in young workers. *Med Sci Sports Exerc* 2002, 34, 1, 158-166.

26 Ekelund et al. TV viewing and physical activity are independently associated with metabolic risk in children: the European Youth Heart Study. *PLoS Med* 2006; 3 (12): e488

27 Healy et al. Objectively measured sedentary time, physical activity, and metabolic risk: the Australian Diabetes, Obesity and Lifestyle Study (AusDiab). *Diabetes Care* 2008, 31(2):369-71. Epub 2007 Nov 13.

Some preliminary data analyses from Finland showed promising results about this kind of classification (Tuija Tammelin, unpublished data). Two different self-reported questionnaires were used (IPAQ short and a new developed frequency based questions) and the results were compared with 7-days accelerometer data in adult population aged 30 to 55 years. Based on new questions, the subjects were divided into 5 physical activity groups (described above) based on the current PA recommendations. Correlation between this classification and accelerometer data was higher compared to IPAQ short items and accelerometer data indicating slightly better validity for new questions. However, study population in that study was selected, population being less active than average. Therefore validation study should be conducted in population representing whole continuum of physical activity including both inactive and very active individuals of different age.

Considerations about questions to include in future monitoring

The PA subgroup suggest three age groups, adults (18-65 y), adolescents (13-17 y) and children (7-12 y), and that separate questionnaire would be required for each age group. Adults and adolescents answer for themselves and the parent of a child answers for the child. It was concluded that the youngest children (4-6 y) and the elderly (+65 y) would need special considerations and due to resources constrains they need to be considered separately. If PA indicator questions are going to be developed and/or validated among these age groups more funding is needed.

The questionnaire should be composed and conducted as a telephone questionnaire. However, that does not exclude that it can also be adapted for and conducted on the web or on paper. The questionnaire should cover physical activity during the previous 7 days rather than about physical activity in general.

Questions considered to be included in monitoring system are presented below.

For adults (≥ 18 y):
Occupational activity categorized into 4 labor-intensity categories.

The following questions should include all physical activity that is not part of occupational activity.

Vigorous activity that last for at least 20 min each time and specifically a) days per week; and b) total time per week.

Moderate-intensity activity that last for at least 10 min each time and at least 30 min in a day including both: a) days per week; and b) total time per week.

Daily screen time (TV and computer) at leisure time on average. Also, it is suggested that at least during validation of the questionnaire, a fifth question should be included and used to classify leisure-time physical activity into 4 categories.

For adolescents (13-17 y):
Moderate-vigorous activity:
a) days per week with at least 60 min of activity;
b) days per week with 30-59 min of activity;
c) total time of moderate-vigorous activity per week;
d) total time per week in vigorous activity.

Daily screen time

For the parent of a child (7-12 y), the questions would be the same as for the adolescents except that the question of total time per week in vigorous activity would be omitted.

Will the physical indicator questions monitor physical activity sufficiently?

The working group has discussed whether the suggested indicators will monitor the physical activity goals and visions of the Nordic Action plan sufficiently.

The monitoring system is suggested to start in 2010, which will serve as a baseline. If the monitoring will be conducted every second year, the system will in 2012 be able to monitor the development in dietary habits, physical activity and overweight.

The physical activity goal 2011 states: *The current trend, where an increasing proportion of adults and children are physically inactive, has been brought to a halt and at best reversed.*

The physical activity vision 2021 states: *At least 75% of the adult population is physically active (moderate intensity) for at least 30 minutes every day.*

All children aged 1–12 and at least 85% of children and youth aged 12–16 are physically active (moderate intensity) for at least 1 hour every day.

Physical inactivity is the main issue of the goal 2011 in the Nordic Plan of Action, whereas activity is the main issue of the visions of 2021. The working group considers the vision 2021 as realistic and a valid vision that is possible to meet for adults. However, it will be much more difficult to meet the vision for children and adolescents. The reason for this is that the gap between present level and target is much bigger for children/adolescents than for adults. Children – compared with adults - are obviously more active on an absolute level, but since the recommendations are more demanding (60 min daily instead of 30 min), the result is a lower proportion meeting required level.

Conclusion

Based on current knowledge, the subgroup on physical activity concludes that a questionnaire will be appropriate to monitor physical activity sufficiently to evaluate the development in physical activity. This questionnaire will be sufficient to evaluate whether the goals and vision of the Nordic Plan of Action are met. However, it is recommended that test and validation of the questionnaire takes place before regular monitoring starts.

Monitoring overweight and obesity (anthropometry) – scientific and practical considerations

The prevalence of overweight and obesity has been increasing throughout all Nordic countries since 1980's. These trends have been observed in children, adolescents and adults. Some preliminary data in Sweden and Denmark^{28,29,30} have suggested that the prevalence of overweight and obesity in children and adolescents is perhaps levelling off. Still, the goal and especially the vision in the Nordic Plan of Action for the development of overweight and obesity in the Nordic countries seem very ambitious and may be difficult to meet.

The goal 2011 in the Nordic Plan of Action concerning overweight and obesity states: *The continuing increase in the proportion of the overweight and obese has been stopped and at best reversed.*

The vision 2021 in the Nordic Plan of Action states: *The number of overweight and obese adults has been reduced by at least 30% from the present level.*

The number of overweight and obese children and youngsters has been reduced by at least 50% from the present level

Fat deposition is a result of positive energy balance and dietary energy intake and total energy expenditure are the main components of energy balance. Energy expenditure is affected by resting metabolic rate, diet-induced thermo genesis and energy expenditure caused by physical activity (work of skeletal muscles). Although there is a strong genetic component in energy balance, it is mainly connected to eating and physical activity – hence, monitoring of diet and physical activity should also be accompanied by monitoring of overweight and obesity.

Considerations about anthropometric measurements

The working group has discussed that monitoring of overweight and obesity in population-based surveys can be divided into three levels:

Simple subjective anthropometric methods (level 1)

Monitoring in studies using mailed questionnaire, telephone interview or Web. Using these designs, only self-reported data can be collected. It is however known that people tend to underreport their weight and over report their height, especially the overweight and obese³¹. The discrepancy between self-reported and true body weight increases with increasing obesity. This means that an evaluation of the real population prevalence may be underestimated by several percentage-units. Moreover, the BMI distribution will be narrower than in reality because the highest body weights are subject to the greatest underestimation.

Besides weight and height, participants could be asked to measure their own waist circumference to obtain an estimate of fat distribution. This has been done in the National Health Interview Survey 2005 (Denmark). However, self-reported waist circumference is likely to be too inaccurate to be of any use.

28 Sundblom et al. Childhood overweight and obesity prevalences levelling off in Stockholm but socio-economic differences persist. *Int J Obes* 2008; 32: 1525-30.

29 Sjöberg et al. Recent anthropometric trends among Swedish school children: evidence of decreasing prevalence of overweight in girls. *Acta Paediatr* 2008; 97: 118-23.

30 Rasmussen & Due (eds.). *Skolebørnsundersøgelsen 2006 (HBSC)*. Københavns Universitet, 2007

31 Kuskowska-Wolk, Bergström & Boström Relationship between questionnaire data and medical records of height, weight and body mass index. In *J Obes Relat Metab Disord* 1992;16:1-9.

Simple objective anthropometric methods (level 2)

Monitoring in studies in which the participants come to a monitoring facility like a laboratory or where trained personnel have taken anthropometric measurements in the field. The basic and most common used overweight and obesity-related measurements in these studies are weight, height and waist circumference (all measured). This battery could be regarded as the ideal balance between simplicity and accuracy in population-based studies as the reproducibility and validity of these measurements are high.

Advanced objective anthropometric methods (level 3)

Monitoring in studies in which the participants come to a monitoring facility like a laboratory or where trained personnel have taken anthropometric measurements in the field. In addition to weight, height and waist circumference, body composition could be measured by e.g. using skin folds or bioimpedance. The interpretation of the results is however not easy. Both systematic (the skin fold equation or bioimpedance brand chosen) and random (individual) errors exist. This leads to the fact that e.g. studies with different methods cannot be compared. Even the same skin fold equation may give different results when used by different technicians.

The Danish Fitness and Nutrition Council has recently suggested to use weight, height and waist circumference for systematic monitoring of the prevalence of obesity in Denmark³². These anthropometric measurements are the most commonly used in population-based surveys to estimate overweight, obesity and fat distribution.

Weight and height are the minimum requirement to monitor general overweight and obesity in the population as the only widely accepted criteria for overweight and obesity are based on BMI. If possible, measured weight and height should be collected in children, adolescents and adults. Measured data are best for monitoring purposes, but may be too expensive to carry out in a simple low cost system like the suggested Nordic monitoring. If this is not possible, then self-reported weight and height is sufficient. If the monitoring system is going to be based on a telephone survey this will be the only option.

Waist circumference is also important as it measures fat distribution and thereby the health risks associated with excessive abdominal fat accumulation. If waist circumference is going to be used in the suggested monitoring system, it should preferably be measured as self reported data may be too inaccurate to be of any use. If self-reported waist circumference should be part of the Nordic monitoring system, a validation study must be initiated before it is safe to use these data. Waist circumference is not necessary to give a direct answer to the goal and vision of the Nordic Plan of Action and could therefore be omitted in the monitoring system. Still, it may be wise to include waist circumference in the future monitoring system as a simple measure of assessing fat distribution.

As the monitoring shall be low cost and simple, it is suggested that the monitoring is done by telephone. Therefore the monitoring of weight and height in the population will be self-reported and thus at level 1.

³² Sørensen et al. Monitorering af forekomsten af fedme. Motions- og Ernæringsrådet, København 2008

Will the suggested anthropometric measurements monitor overweight and obesity sufficiently?

Although self-reported data is a problem from a research point of view, they may be acceptable from a political point of view, as self-reported data will most likely not bias the results with regard to trends in overweight and obesity in the population. And this is what is emphasized in the goal and vision of the Nordic Plan of Action. If the magnitude of misreporting is the same over the monitoring period, then self-reported weight and height may be used to monitor trends without validation. However, self-reported data need to be validated, if the magnitude of bias changes with time. To be aware of this problem, validation studies in different Nordic countries must be carried out every fifth to tenth year in the monitoring system. The known underreporting should be considered anyway when interpreting the anthropometric data.

Children

Most Nordic countries (DK, SE, IS, FI), but not Norway, already measure both weight and height of school children. However, data are not computerized and accessible for monitoring purposes. It is planned that part 2 (validation of indicators) of the monitoring project will include the start of a network on child health, where the issues of coordinating anthropometric measures on children in the Nordic countries can be discussed. The Nordic network on child health may speed up the process to get existing data computerized and accessible and may also encourage the political system to take action, so collection of data for school children will be carried out in all Nordic countries.

The monitoring system needs to include questions on weight and height for children, if data on diet, physical activity and overweight is going to be collected for the same individuals. But collection of anthropometric data every fourth or fifth year seem to be appropriate as changes in overweight and obesity are not so rapid.

Social inequality – scientific and practical considerations

There is no doubt that health in general in the Nordic countries is associated with social status³³. Studies show that healthy dietary habits are more common among those with higher educational level^{34,35}. Studies on dietary habits among children from Norway, Denmark, and Sweden show that children with high-educated parents eat less sugar, more fruit and vegetables, and less fat than others^{35,36,37}. Few data exist in the Nordic countries combining physical activity with socioeconomic status. The existing data, however, support a tendency towards a lower degree of compliance with the official recommendations that is comparable to the one identified for diet and health in general^{35,38}. There is a significant social gradient to the prevalence of overweight and obesity among adults in Denmark, Norway, and Iceland and the association seems to be particularly clear with regard to levels of education^{35,39}. The tendency has also been seen among children and youth pointing to a connection between levels of overweight/obesity and parents' education level and socioeconomic status³⁵.

The Nordic Plan of Action has in relation to **Social inequality in health related to diet and physical activity** stated as a goal for 2011 that: Existing differences between different social groups with regard to overweight, obesity, unhealthy diet, and physical inactivity have not deepened further and are at best have been reduced. The vision for 2021 further states that *The variation between different social groups on meeting the defined objectives with regard to diet, physical activity, and overweight/obesity is at most 20%*.

The existing formulations in the Nordic Plan of Action do not specify the term "social groups" and they are not very ambitious. The secretariat behind the Nordic Plan of Action has informed the working group to feel free to give an interpretation of how to measure if goals and visions shall be met.

The theoretical discussion within social epidemiology on how to measure social inequality have underlined the importance of not only reducing differences between social groups, but also improving health for the most vulnerable groups. This was the basis for formulation of the following proposals. Following results from many studies on social inequality in health related lifestyle, the project group suggests that education is used as primary indicator of socioeconomic position⁴⁰.

Diet

Proposal to measure if the goal on inequality has been reached:

The mean intake has increased/decreased both among groups with short and long education

The difference between the proportion of the group meeting the objective has become smaller between groups with short and long education

The proportion with the most unhealthy dietary habits has become smaller

Proposal to measure if the vision on inequality has been reached:

The difference between the mean intake of groups with short and long education has become smaller and is at most 20%

The difference between the proportion eating in accordance with recommendations/guidelines has become smaller and is at most 20 percentage point (short education compared to long education)

33 Brønnum-Hansen & Baadsgaard Increasing social inequality in life expectancy in Denmark. Eur J Publ Health, 2007

34 Health, food and physical activity. Nordic Plan of Action on better health and quality of life through diet and physical activity

<http://www.norden.org/pub/velfaerd/livsmedel/sk/ANP2006745.pdf>

35 Groth, Fagt, Brøndsted. Social determinants of dietary habits in Denmark. Eur J Clin Nutr, 2001; 55: 959-966

36 Andersen et al. Sundhedsadfærd in: Social ulighed i sundhed blandt børn og unge, Statens Institut for Folkesundhed, Syddansk Universitet, 2007

37 Rasmussen & Due (eds). Skolebørnsundersøgelsen 2006 (HBSC), Københavns Universitet, 2007

38 Ekholm O et al. Sundhed og sygelighed I Danmark 2005. Statens Institut for Folkesundhed, 2006

39 Groth et al. Dimensions of socioeconomic position related to body mass index and obesity among Danish women and men. Scan J Pub Health (in press)

40 Roos & Prättälä. Disparities in food habits. National Public Health Institute. Helsinki, Finland, 1999.

The proportion of the group with the most unhealthy dietary habits has decreased with at least 20%

Physical activity

Proposal to measure if the goal on inequality has been reached:

The increase in the proportion of physically inactive has stopped or been reversed both among groups with short and long education

The difference between the proportion of physically inactive has become smaller between groups with short and long education.

The proportion with the most unhealthy pattern/level of physical activity has become smaller

Proposal to measure if the vision on inequality has been reached:

The difference between the proportion who are physically active in accordance with guidelines has become smaller and is at most 20 percentage point (short education compared to long education)

The proportion of the group with the most unhealthy pattern/level of physical activity has decreased with at least 20%

Overweight and obesity

Proposal to measure if the goal on inequality has been reached:

The increase in the proportion of overweight and obese has stopped both among groups with short and long education

The difference between the proportion of overweight and obese has become smaller between groups with short and long education.

Proposal to measure if the vision on inequality has been reached:

The number of overweight and obese has been reduced with 30% (adults) and 50% (children and adolescents) among both groups with short and long education

The difference between the number of overweight and obese in groups with short and long education has become smaller and is at most 20 percentage point

Considering the relevant data on social background the following are suggested as a minimum: Age, gender, education, family status, region and urbanisation. For analysing education, four groups of education were suggested:

- Basic school (Short education)/ ≤ 10 years of total education)
- Vocational education (11-13 y practical)
- Short higher education (13-14 y theoretical)
- Medium higher and long higher education (> 14 y theoretical).

For analysing family/household status, three groups could be used: Single households, Household with couples (and children > 18 y), Household with children. Total household size could be considered. Region and urbanization (e.g. urban, semi-urban and rural): can be categorised from address of participant. It is considered that occupational status, employment status and household income can be omitted but of course would be valuable and can be included if the firm responsible for the survey already include these variables as a standard. It is important to use standardised ways of measuring these variables in accordance with the Nordic Statistics standard.

The possibility of including ethnic groups in the survey has been discussed. Ethnic groups are very heterogeneous and have a higher share of people with short education and a high risk of overweight and obesity in combination with other health risks. Monitoring of their dietary habits and level of physical activity is therefore highly relevant. However many experts have concluded that these groups would need their own

special surveys, focusing on their specific culture⁴¹. Their proportion of the total population is less than 10% and in a country sample of 1000 participants we will get approx 100 immigrants, but from different parts of the world, thus making conclusive results very difficult.

⁴¹ Kumar & Wandel. Symposium on "Eating behavior and physical activity in a multicultural perspective", Sixth Annual Conference of the International Society of Behavioral Nutrition and Physical Activity, Oslo, June 2007

Proposal for a common Nordic monitoring system

A valid, common Nordic monitoring system is a prerequisite for a continuous assessment of achievements in relation to the Nordic Plan of Action and to make comparisons among Nordic countries. Moreover it is essential for monitoring the progress in achieving the Nordic goals and visions when addressing the growing problems of unhealthy diet, physical inactivity and overweight.

Organisation

In order to ensure the quality of the monitoring system the following organisation is suggested:

Coordinating institute (eg. Nordiska Hälsovårdshögskolan)
Research institutes on diet and physical activity in each Nordic country (participants of the working group)
Market research companies in each Nordic country.

Responsibilities of the coordinating institute (eg. Nordiska Hälsovårdshögskolan):
Establish cooperation with research institutes and market research companies.
Ensure correct sampling procedure and contact to the participants, so response rates (calculated the way the coordinating institute has agreed to do this with the research institutes) can be calculated.
In cooperation with research institutes ensure scientific progress of the monitoring system. The research institutes will contribute to a report to NKMT and will in cooperation with the coordinating institute disseminate results of monitoring to NKMT and others. Rights and access to data shall be agreed between coordinators and research institutes.

Method

Overall design:
Simple random sample(s) from Central Population Register
Invitation letter to participants
Telephone interview, including the alternative option to complete a questionnaire on the internet
Conducted within the same two months in every Nordic country every second year

Number of participants: 2000 adults⁴² 18-65 y, 500 children (7-12 y) and 500 adolescents (13-17 y) in each country to ensure sufficient number of participants according to sex, age groups and socio-economic groups.

Questionnaires

The indicator questionnaire will include approximately 14 questions about the diet, 6 questions about physical activity and 8 questions about socio demographic data, including height and weight (table 5). In addition the questionnaire might include approximately 10 questions about health in general. This last point has been discussed with Nordiska högskolan för folkhälsovetenskap, NHV, but needs clarification.

⁴² Maybe fewer adults on Iceland

Table 5. Questions to be included in the future monitoring system:

Diet

Which type of fat do you eat on bread (8-9 response categories),

Which type of fats do you use for frying, cooking, baking (approx. 6 response categories)

How many slices of bread do you eat during the day or week? (3 questions)

How often (monthly, weekly, daily) do you eat fruit?

How often (monthly, weekly, daily) do you eat vegetables?

How often (monthly, weekly, daily) do you eat the following?

pommes frites / fried potatoes,

fish and seafood,

sausages as a main meal,

candy and chocolate,

cakes and biscuits,

full fat cheese,

soft drinks (carbonated/not carbonated, sugar sweetened),

soft drinks(carbonated/not carbonated, light/artificial sweetened)

fruit/vegetable juice

For questions with monthly, weekly or daily answering categories, these will include several frequencies (e.g. 1, 2, 3, 4 or more times daily).

Physical activity

For adults (≥ 18 y):

Occupational activity categorized into 4 labor-intensity categories.

The following questions should include all physical activity that is not part of occupational activity.

Vigorous physical activity that last for at least 20 min each time and specifically: a) days per week; and b) total time per week. Moderate-to-vigorous intensity physical activity that last for at least 10 min each time and at least 30 min in a day including both: a) days per week; and b) total time per week.

Daily screen time (TV and computer) at leisure time on average. Also, it is suggested that at least during validation of the questionnaire, a fifth question should be included and used to classify leisure-time physical activity into 4 categories.

For adolescents (13-17 y):

Moderate-to-vigorous physical activity outside school (or working) hours :

a) days per week with at least 60 min of activity;

b) days per week with 30-59 min of activity;

c) total time of moderate-to-vigorous physical activity per week;

Daily screen time

For the parent of a child (7-12 y)

The questions would be the same as for the adolescents.

Background variables

Age, gender, education, family status, region and urbanization, self reported weight and height.

Costs

The working group has asked the Market research company TOY research, who coordinated the data collection of the Norbagreen study to estimate the prices for conducting CATI omnibus, CATI Ad hoc or Internet panel surveys. The CATI surveys will be by telephone as it is considered too expensive to do face-to-face interviews. The prices are for conducting surveys in the adult population (age 18-79 y) in the Nordic countries. In FI, SE, NO and DK 2000 participants and in IS maybe only 1000 participants (if CATI) and 2000 participants (if Internet panel). Altogether n= 9000-10000 adult participants. The participants will represent the general population (or the population using the Internet). If using a CATI omnibus, it is possible to let the questions be in the start of the questionnaire. For Omnibus surveys, there is a maximum limit of questions at 30 questions, but background information (sex, age, education, region etc.) is then already collected. In an Ad hoc survey (a survey only including the indicator questions), there is no maximum limit of questions, but then background information also need to be collected and calculated into the total number of questions. TOY cooperates with Capacent in Iceland and Fieldwork in Denmark, Sweden and Norway. Planning, coordinating, analyses, reporting will cost approx. 7500 - 9500 Euros depending on the length of the FFQ. Translation of the FFQs to the languages of the participating countries will cost approx. 800 – 1700 Euros according to the length of the FFQ.

Table 6. Expenses for conducting surveys among adults in all Nordic countries

| | | (EUR) (excluded 22% VAT) | | | |
|--------------|------------------------------|--------------------------|--------------|--------------|--------------|
| | Preparative work + reporting | 5 questions | 10 questions | 20 questions | 30 questions |
| CATI Omnibus | 10.000 | 43.500 | 83.650 | 155.650 | - |
| CATI Ad Hoc | 10.000 | 75.680 | 105.280 | 160.690 | 191.450 |
| Internet | 10.000 | 48.340 | 53.140 | 64.370 | 76.410 |

In all, the preparative work and reporting will cost approx. 10.000 Euros. Data collection among adults will cost approx. 192.000 Euros, and among children approx. 96.000 Euros. The costs of the internet option in addition to the CATI survey are estimated to approx 4000 Euros.

In addition to this, the work of the coordinating institute has to be covered. The costs are estimated to 70.000-100.000 Euros, but this needs to be negotiated further with the coordinating institute.

In all, the costs of the Nordic monitoring system are estimated to 360.000 – 400.000 Euros or 2.7 - 3 mill DKK every second year. This of course depends on the choice of market research company, the coordinating institute etc.

What is measured and what is not measured?

The Nordic Plan of Action include goals and visions on both foods and nutrient. The monitoring of diet will be based on indicator food and can not in this context provide data on nutrients.

The subgroup on diet has discussed the connection between the indicator questions and dietary goals/visions of the Nordic Plan of Action. The indicators are an indirect measure of nutrients and cannot measure all goals and visions. For instance, the indicators measure the frequency of intake of sugar containing soft drinks. If the monitoring shows that the frequency of soft drinks decreases, this will indicate that the added sugar content in the diet has decreased as well, but from the indicators it will not be possible to indicate how large a proportion of the population that meets the NNR recommendation on maximum daily intake of added sugar. This must be estimated through national dietary surveys. The group also discussed that foods in current dietary habits might reflect the intake of certain nutrients, but due to changes in dietary habits, the foods reflecting the nutrient could change over time. So from time to time the indicators need to be checked against the dietary habits. Also the variability of foods may change e.g. the content of fat could change in sausages, and if the intake of sausages does not decrease the indicators will not catch a fall in the fat intake. Therefore, the indicators must also from time to time be examined concerning, whether they have the same dietary content as before.

The subgroup on physical activity has agreed that the suggested questionnaires will, based on current knowledge, be appropriate to monitor physical activity sufficiently to evaluate the development in physical activity and whether the goals and vision of the Nordic Plan of Action are met.

Plan for validation

Validity describes the degree to which a method measures what it is designed to measure. Validation can be done in different ways, but normally the method in question is validated against a reference method, e.g. relatively against another subjective method or against objective measures. When conducting a validation study information on the feasibility of the method will also be taken into consideration. If the aim of validation is to examine if indicator questions work the same way in each country, then validating must be against same reference method (e.g. validation of diet indicators against 7 day weighed record and physical activity indicators against accelerometry). If the aim of the validation is to examine how the indicators work within a country, then a validating can be with different -methods (e.g. diet indicators against food records or 24 h recall). Especially the diet indicators need to be supplemented with information from the more detailed national dietary surveys, and therefore the working group find it necessary to know how well the indicators reflect the diet as found be the national surveys.

Validation of diet

It has been decided that validation of the diet indicator questions will be done in Iceland and Denmark. The indicators on diet will be measured by a short food frequency questionnaire (FFQ), but compared to other dietary methods (food records or 24-h recall), the FFQ will provide less detailed information on foods consumed. The FFQ must be validated against a reference method, which is planned to be a food record.

Validation of physical activity

The indicator questions on physical activity will be validated in Iceland, Finland and Norway. The level of physical activity will be measured by a questionnaire indicating participation in moderate and/or vigorous intensity physical activities and exercise. The self-report questionnaires will be validated against objectively measured physical activity by using 7 to 14 days monitoring of PA by accelerometers. Accelerometers are small, invasive and provide an objective record of overall movement over a extended period of time. They have been found to be valid and reliable measure of physical activity. Daily time spent on light, moderate and vigorous intensity physical activity as well as steps can be evaluated.

Network on childhood growth

Included in the validation study is also the establishment of a network of monitoring childhood growth in the Nordic countries. The project leaders of part 1 of the Nordic monitoring project was invited to join a call of interest to Nordic Innovation Centre in the summer of 2008 concerning childhood growth. After consideration of expressions of interest the childhood growth group was asked to join the application of the Nordic monitoring group.

The aim of the network is to coordinate and harmonize central monitoring using the same measures, standards and way of analyses and to compare the development in overweight in the Nordic countries.

Timetable:

Spring 2009: completion of common questionnaires, including translation and retranslation, pilot validation study, establishment of network on child health

During 2009: validation data collection, data processing and analyses

Spring 2010: final analyses and report medio 2010

Appendix A. Status by November 2008 on monitoring in Europe

WHO has suggested a surveillance system for **childhood obesity** in Europe. By now the following countries are participating in the initiative: Belgium, Czech Republic, France, Italy, Latvia, Lithuania, Malta, Portugal, Slovenia, Spain, Sweden, the UK. The participants represent both research institutions and national authorities. The core objective will be to measure weight, height, waist and hip circumference in primary-school children aged 6.0-7.9 years. At two-year-follow-up, the objective will be to measure in a new cohort of primary-school children aged 6.0-7.9 years. Every two years another cohort will then be selected, and so on. At the same time, an optional objective will be to measure in the initial cohort of primary-school children (then 8.0-9.9 years old): weight, height, BMI, waist and hip circumference, prevalence of underweight, normal weight, overweight, obesity and mean BMI, incidence of overweight and obesity, changes in the prevalence of overweight and obesity and mean BMI relative to baseline measures. It is estimated that a sample of 3333 children is needed to get a target sample of 2400 children in each country. The data will be collected at schools by trained personnel (e.g. school nurses, physicians, pediatricians).

Eurostat has suggested development of indicators of food safety to assist in the monitoring and evaluation of chemical food safety and nutrition and health in the EU member states using food consumption statistics (food balance data, household budget data or data from national dietary surveys). In the area of **nutrition** the following indicators have been suggested: iodine, saturated fatty acids, dietary fibre, ethanol, vegetables and fruits, fish, sugar containing drinks and breastfeeding. The indicators have been discussed on a meeting in the Task Force on Food Consumption Statistics June 2007. Based on the discussions at the meeting the RIKILT Institute in the Netherlands will proceed with analysis on the feasibility of the chosen indicators and suggest how a monitoring system can be build. Representatives from the Statistical Bureaus of Sweden and Norway are member of the Task Force, as well as Pirjo-Liisa Pentilla (FI) from the Ministry of Agriculture and Forestry and Sisse Fagt (DK) from the National Food Institute. The Task Force is referring to the Working Group on Food Statistics, where the final decisions are made.

The European Community Health Indicators (**ECHI**) has been developing indicators on health related issues, but for now the dietary questions (on the ECHI shortlist) consist of a question on fruit consumption, excluding juice and a question on vegetable consumption, excluding potatoes and alcohol consumption. The ECHI website hosts the International Compendium of Health Indicators (ICHI), which is the collection of health indicators used by the international organisation WHO-Europe, OECD and the European Commission.

The European Physical Activity Surveillance System (**EUPASS**)⁴³. The project was set up to:

Create an inventory of national physical activity surveillance systems to contribute to the establishment of a list of core indicators and optional indicators for health-enhancing physical activity and its determinants.

Monitor the quality of selected indicators for the assessment of health-enhancing physical activity by testing the indicators using panel and time series data collection. Compare results of data collection by mail and telephone. This part has shown rather low correlations between different PA indicators and very different response rates in eight EU countries⁴⁴.

Analyze implementation of indicators in health monitoring and potential policy impact.

The project has prepared recommendations for a list of core indicators to be used in future surveillance and a set of additional indicators which focus on psycho-social, contextual dimensions of physical activity. The project has also supported on-going research activities to improve the validity and reliability of internationally comparable physical activity indicators (e.g. IPAQ, EUROHIS, EUPASS). EUPASS aimed at testing the validity and reliability of the IPAQ Questionnaire and its feasibility for population based monitoring. The conclusion of the EUPASS project was that IPAQ was promising but needed further development.

The European Commission has in the survey Health and Food (**Eurobarometer**) examined both **eating habits, physical activity and obesity** in Europe through a telephone interview (CATI). The latest survey was conducted in 2005⁴⁵. The questionnaire is quite comprehensive and concerns both health issues, attitudes towards and knowledge about healthy living. In the 2005 version there are no indicator questions on

43 http://ec.europa.eu/health/ph_projects/1999/monitoring/fp_monitoring_1999_frep_08_en.pdf

44 Rutten et al. Publ Health Nutr 2003 6 (4), pp 377-84

45 http://ec.europa.eu/health/ph_publication/eb_food_en.pdf

diet, but questions on perception of whether own diet is healthy. The physical activity questions concerns frequency of sitting, walking, moderate and vigorous activity (a week and per day). Weight and height data are self reported. Also changes in dietary habits were asked for in the report from 2006.

Project **ALPHA**⁴⁶. The Public Health Programme 2003-2008, carried out by the European Commission, Directorate General Public Health and Consumer Protection (DG SANCO), carries on the work of the Health Monitoring Programme in its Health Information Strand. The annually work plan for 2006 considered the need for further developing instruments for assessing levels of physical activity in different population groups. According to this request, the project "Instruments for Assessing Levels of Physical Activity and related Health Determinants" (ALPHA) has started. The main objective of ALPHA is to develop and find consensus for a comprehensive set of assessment methodology for physical activity levels in European Member States and their underlying key factors. The project comprises 4 main components: (1) The further development of the IPAQ questionnaire to fit the needs of population-based health monitoring; (2) the further development of accelerometry as an objective measurement for levels of physical activity; (3) the use of existing Geographical Information Systems (GIS) data sources to assess urban built environment features for its physical activity promoting or preventing features, and (4) the consensus on a health-related fitness test for population-based health monitoring.

The ALPHA project includes partners from Belgium, Germany, Finland, France, Slovenia, Spain, Sweden, UK as well as collaborations with networks promoting physical activity, such as the HEPA Europe network (Health Enhancing Physical Activity), WHO EURO, the IPAQ Development group and others. The project ALPHA aims in one designated work package to develop a standardised operating procedure for the use of accelerometers in population based surveys in European member states. The ALPHA project aims to develop a recommendation on how merge existing GIS data in the European member states and thus accompanying with it the assessment of urban environment characteristics (activity friendly environments). Finally, in addition to the assessment of physical activity by questionnaire, the measurement of health related fitness can more accurately identify population groups with increased health risks and thereby assist health policy planning with more reliable data in the future. Easily applicable and reliable tests are already available for population-based measurement of health-related fitness today, but European member countries are using differing tests, making the comparison of results difficult. The ALPHA project aims in one designated work package to find a consensus on one standardized health related test battery for European Health Monitoring activities as well as for health monitoring activities in EU member states. The ALPHA project intends to develop methodology for assessing levels of physical activity in the European population in a comparable way. In order to do so, consensus on a questionnaire instrument needs to be found as well as standard operating procedures for accelerometry, and GIS data analysis. The assessment of health related fitness needs to be standardized across Europe. The ALPHA project builds on extensive work that has been carried out previously by European and international networks and therefore can contribute to a better comparable data basis on levels of physical activity in the European member states.

46 Meusel et al. Selección, 2007; 16 (1):pp. 9-12

Appendix B. Existing data (by November 2008) in the Nordic Countries

Nordic Surveys

| | Diet | Physical activity | Overweight/obesity |
|--|--|---|---|
| HBSC - Health Behaviour in School-aged Children (NO, DK, SE, FI) | Self-administered questionnaire 11, 13 & 15 y. Questionnaire on how often some foods is eaten | Self-administered questionnaire 11, 13 & 15 y upon how much vigorous physical activity and sedentary activity (TV, PC etc). | Self-administered questionnaire 11, 13 & 15 y upon height and weight and perception of own weight |
| European Youth Heart study. Regional study in NO (Oslo), DK (Odense) | 9-15 y (1998), 24 h recall (baseline/follow up), diet history (follow up) | 9-15 y (1998). Measured physical activity by CSA activity monitor. | 9-15 y (1998), Measured weight and height |
| Norbagreen 2002 (NO; DK; SE; FI, IS, Baltic Countries) | Food frequency by telephone in the Nordic and by personal interview in the Baltic Countries on intake of fruit, vegetables, potatoes, fish and bread. Age range 16-60 y, but 15-74 y in SE and 16-80 y in DK | | |

National surveys

| | Diet | Physical activity | Overweight/obesity |
|----------------------------|--|---|--|
| Norway National surveys | UNGKOST 13 & 18 y (1993) FFQ | UNGKOST 13 and 18 y (1993). Questions about PA in the FFQ; Outside school hours, how often are you physical active in 20 min, or more, and that you become breathless and begin to sweat? Inactive = less than 1 time/month. Measured by questionnaire | 13 and 18 y (1993). Self reported weight and height. |
| | NORKOST 16-79 y (1993-94 & 1997). FFQ | NORKOST (1997; Adults, 67-79 years old). Questions about PA in the FFQ; How often are you physical active in at least 20 minutes? Inactive = never/less than 1 time every week | 16-79 y Self reported weight and height |
| | | MMI (1999; 15-19y, adults, elderly 60+). How often are you physical active? Inactive = never/less than 1 time every 14 days. Measured by questionnaire Norwegian Institute of public health, Adults. How will you describe your work? Sedentary, Work which demands walking e.g. teaching, Work with walking and raising, Heavy manual work. Measured by questionnaire | |
| | SPEDKOST 6 & 12 month (1998-99, 2006-07) FFQ SMÅBARNKOST 2 y (1999, 2007) FFQ UNGKOST 4, 9 & 13 y (2000-2001) 4-days precoded food diary | | 6 & 12 months (1998-99, 2006-07) 2 y (1999, 2007); 4, 9 and 13 y (2000-2001) Self reported weight and length/height |
| Regional data | | The North-Trøndelag health study (HUNT), Adults, Regional study, Questionnaire. How physical active (spare time activity) has you been in average during the last year? Working/bicycling etc counts as spare time Study: The Norwegian University of Sport and Physical Education, Norwegian Defence Research Establishment (1980-1985-2002; Military cadets) Test of maximal oxygen uptake | Self reported and objective measures regionally in different age groups (mostly adults). Objective measures from military and schools, but no central registry |

| | Diet | Physical activity | Overweight/obesity |
|--|--|---|--|
| Sweden National data | 1-74 y (1989). Precoded 7 d record | Self reported 5 levels of activity in 24 h. 4, 8 and 11 y (2003) | Self reported weight and height 4,8 and 11 y (Childrens dietary survey 2003) |
| | 18-74 y (1997-98) Precoded 7-d food record | | |
| | 4, 8 & 11 y (2003) Open 4-d food record + picture book (Matmallen) | Health on equal terms. Self reported leisure time activity (4 levels) the last 12 months. Weekly strenuous leisure time activity. 16-84 y (2004, 2005, 2006) | Health on equal terms. Self reported height and weight. 16-84 y (2004, 2005, 2006) |
| | Health on equal terms. Self reported intake of fruit and vegetables. 16-84 y (2004, 2005, 2006). Question on fat used on bread (2004) | | |
| | | | |
| Indices for better diet. 16-80 y (2005 & 2006). Short questionnaire by telephone on how often e.g. fat on bread, bread, fruit and vegetables, fries potatoes, fish, candy and chocolate, cheese, soft drinks are consumed. | | | |
| Regional data | COMPAS, Adolescents 14-16 y (Stockholm) Nine questions on foods (modified HBSC). Also questions on fast food? Question on snacking habits (yoghurt, sandwiches, fruits, milk, candy, cakes, sweet buns, vrips, soft drinks) | COMPAS, Adolescents 14-16 y (Stockholm). Questions on physical activity (sedentary activity and attending PA education in school). Accelerometer (sub groups). | COMPAS, Adolescents 14-16 y (Stockholm). Measured height, weight, hip and waist circumference. Fat mass by bioimpedance |

| | Diet | Physical activity | Overweight/obesity |
|--|--|---|--|
| Denmark National data | 15-80 y (1985) Diet history | Self-reported data on physical activity is also available from the national dietary survey 1985, 1995 and 2000 - | Self-reported data on height and weight 4-75 y (National dietary survey 1995 and 2000 -). |
| | 1-80 y (1995) Precoded 7-d food record | | |
| | 4-75 y (2000 -) Precoded 7-d food record | | |
| | ½- 3 y (2006-2007) 7 day estimated dietary record (modified) | | Measured weight |
| | The Health and Morbidity Survey 16-80y+ (1987, 1994, 2000, 2005), Frequency of potatoes, coarse bread and wholegrain, boiled vegetables, salad, fruits, fish for dinner, fat spread on bread, alcoholic beverages (surveys 2000, 2005). | The Health and Morbidity Survey .Personal interview and self-administered questionnaire – self- reported data. 4 levels of PA at work and in leisure time. How many minutes of vigorous activity a day in a week. Sedentary leisure activities . | The Health and Morbidity Survey Self reported weight and height 16-80+ y The survey in 2005 includes waist circumference |
| | National survey by the Danish Nutrition Council 15-91 y (1995, 1998, 2001 & 2004). FFQ by telephone. Do not cover total diet | | |
| | MULD (The lifestyle and everyday life of youth), 16-20 y, 2001. Questionnaire upon drinking habits on alcoholic beverages. | MULD (The lifestyle and everyday life of youth), 16-20 y, 2001.Questionnaire upon leisure time physical activity (weekly hours), active transportation (walking, biking etc). Weekly hours of PA education in school. Intensity of activity. | MULD (The lifestyle and everyday life of youth), 16-20 y, 2001. Self reported height and weight. |
| Nat. Board of Health. 11-15 y lifestyle and health 2004. Questionnaire on meal habits, frequency on consumption of fruits, vegetables, soft drinks, candy and chocolate. | Nat. Board of Health. 11-15 y lifestyle and health 2004. Questionnaire on frequency on active transportation to school (walking/biking) and how many are active more than 60 min. a day, how many watch TV/video at least three hours a day and how many use a PC at least three hours (leisure time) a day. Perception of own fitness . | Nat. Board of Health. 11-15 y lifestyle and health 2004. Self reported height and weight | |
| Regional data | Diet, cancer and health 50-64y (Århus and Copenhagen). Large FFQ | | |
| | Inter 99; Glostrup survey (1914 cohort), Østerbro survey, miscellaneous methods, often FFQ | Inter 99; Glostrup survey (1914 cohort), Østerbro survey. Questions on 4 levels of PA at work and in leisure time. How many minutes of moderate and vigorous activity in a week. Sedentary leisure activities, Seasonal variation of PA (Inter 99) | Self reported weight at the age of 25, weight fluctuation (Inter99). |
| | | | Objective measure from military and schools, but no central registry. |
| | KRAM (diet, smoking, alcohol and physical activity)-survey 2006-08. 13 municipalities in DK. Indicator questions (frequency of potatoes, bread, vegetables, fruits, fish and fat). To some participants large FFQ with estimated portions. | KRAM (diet, smoking, alcohol and physical activity)-survey 2006-08. 13 municipalities in DK. VO max test, questionnaire on physical activity in different domains (frequency and duration), reasons for being active, perception of own fitness, outdoor activities | KRAM (diet, smoking, alcohol and physical activity)-survey 2006-08. 13 municipalities in DK. Measured data on height, weight and waist and hip circumference, self reported height and weight, weight at birth, fat mass by bioimpedance |

| | Diet | Physical activity | Overweight/obesity |
|--------------------------|---|--|--|
| Finland National data | FINRISK 2007 Study. Independent cross-sectional population samples, every 5 year. age 25—74 y. Frequency of use of different food items (40-item FFQ, n=about 6500) Repeated 2x24h dietary recalls from a subsample (n= about 2000) 2x3d food records (spring+autumn), (n=about 600) | FINRISK 2007 Study. Independent cross-sectional population samples, 25-74 years of age, every 5 year. Data available 1972-2007 on about 59000 men and women aged 25-64 years Self reported physical activity: occupational PA (categorical), leisure time physical activity (categorical), exercise/leisure time physical activity (weekly frequency and duration), daily physical activity (categories on duration), and commuting physical activity (categories on daily duration). Also self-rated physical fitness (categorical). | Measured data on height, weight and waist and hip circumference 25-64 y FINRISKI 2007 Study. |
| | Health2000 Study, 2000-2001, follow-up in 2009. 30-85+ years, n= about 8000, A 130-item validated FFQ on diet | Health2000 Study, 2000-2001, follow-up in 2009, this is a follow-up for the Mini-Suomi Study. 30-85+ years,, Self-reported physical activity: Short IPAQ, occupational PA (categorical) leisure time physical activity (categorical), exercise/leisure time physical activity (weekly frequency), and commuting physical activity (categories on daily duration). Also self-rated physical fitness (categorical). Measurements of functional capacity, | Measured data on height, weight and waist and hip circumference 25-64 y Health 2000 Study. Additional bioimpedance measurements. |
| | Health Behaviour among the Finnish Adult Population (AVTK). Cross-sectional postal survey, self-administered questionnaire, n=5000, age 15—64 y. Questions on dietary habits (4 questions) and frequency of use of different food items (32). | Health Behaviour among the Finnish Adult Population (AVTK). Cross-sectional postal survey, n=5000, age 15—64 y. Implemented every year, started in 1978. Self-reported physical activity: occupational PA (categorical) leisure time physical activity (categorical), exercise/leisure time physical activity (weekly frequency), and commuting physical activity (categories on daily duration). Also self-rated physical fitness (categorical) | Self-reported length and weight are used in the calculation of BMI. |
| | The Adolescent Health and Lifestyle Survey: appr. 6000-8000 every second year since 1977; age 12, 14, 16 and 18: Nutrition: questions on nutrition have not been followed up in each survey. The items include meal patterns (breakfast, lunch, dinner), common dinner with family, snacking frequency, use of special diets, use of coffee and special coffee, use of soft drink and energy drinks, use of sweets, type of milk; in earlier surveys also use of yogurt, tea, hot chocolate, vegetables, fruits and berries, sugar with coffee/tea, type of spread on sandwich | Physical activity: frequency of participating in sports club activity, frequency of other leisure time physical activity, way of exercising (getting out of breath, sweating), type of physical activity | Experience of own weight, self-reported height and weight |
| | The School Health Promotion Study; 74 000- 88 000 respondents every second year since 1995, 8th and 9th grades in secondary school and 1st and 2nd grades in high school, appr 14-18 y. Diet: Breakfast frequency during the school week, dinner pattern with family, atmosphere and company during school lunch, common school lunch, parts of school lunch usually eaten (milk, bread, salad, warm meal), food items eaten besides school lunch during the school time, place where snacks usually are bought from, frequency of food items eaten during the whole week (13 food items). | Frequency of leisure time sports or exercise (at least half an hour), amount of leisure time exercise when getting out of breath and sweating. | Experience of own weight, self-reported height and weight |
| Regional data | Tampere City Health Profile. Two simple questions on physical activity (frequency of vigorous exercise (on a weekly basis) and daily duration of lifestyle physical activity). n=about 3500, age 15+ | Tampere City Health Profile. Self-reported weight and height. | |

| | Diet | Physical activity | Overweight/obesity |
|----------------------------------|--|--|---|
| Iceland | 15-80 y 1990. Dietary history | | 15-80 y 1990 and 2002. Self reported weight and height. |
| National data | 15-80 y 2002. 24h-recall & FFQ. | | |
| | 10, 12 & 14 y 1992-1993. 24h-recall & FFQ | | 10, 12 & 14 y 1992-1993. Measured weight and height. The school health service collect measures for weight and height, for 6, 9, 12 and 14 y old school children. Only data from the Reykjavik area are computerised and analyzed. In the future it will maybe be nation wide. |
| | | 20-80 y 1997. PA questionnaire | 20-80 y 1997. Self reported weight and height. |
| | | 20-80 y 2000. PA questionnaire | 20-80 y 2000. Self reported weight and height. |
| | | 20-80 y 2006. IPAQ, long version, self-administered | 20-80 y 2006. Self reported weight and height. |
| | Infants 1995, 5X2-d weighed food record and 24 h food record monthly from 1-12 mo Infants 2006, 2X3-d weighed food record and 24 h food record monthly from 5-12 mo | | Infants 1995 and 2006. Measured length and weight throughout infancy (birth to 12 months) |
| | 9 y & 15 y 2003-2004 2 X 24h-recall | 9 y & 15 y 2003-4 Accelerometer and questionnaire | 9 y & 15 y 2003-4. Measured height, weight and skin folds. |
| | 2-y, 2000, 3-d weighed food record 6-y 2002, 3-d weighed food record | | 2-y, 2000. Measured height and weight. 6-y 2002. Measured height and weight. |
| | 7-9 y intervention study 2007-9 3 d weighed food record | 7-9 y intervention study 2007-9 Accelerometer and questionnaire | 7-9 y intervention study 2007-9. Measured height, weight, skin fold and DXA |
| | 20-79 y 2006. The Health and Context of Living Survey [HCLS] FFQ | | 20-79 y 2006. The Health and Context of Living Survey [HCLS]. Self reported weight and height. |
| Health survey 18-79 y, 2007. FFQ | Health survey 18-79 y, 2007. Questions on physical activity | Health survey 18-79 y 2007. Self reported weight and height. | |

Appendix C. Swedish indicator questions on diet (version 2005/06)

Bilaga 2.

Så här gör du:

Nedan följer ett antal frågor om vad du brukar äta. Ha det senaste 12 månaderna i tankarna när du svarar på frågorna. Kryssa för det alternativ som för varje fråga stämmer bäst överens med hur du brukar äta.

1 Vilken typ av matfett brukar du vanligtvis använda på smörgås?

Markera ett alternativ, det vanligaste!

- 1 Smör
 2 Bregott, 80% fett
 3 Matfett 60% fett, t.ex. Bregott Mellan, Runda Bords
 4 Hushållsmargarin (margarin i folie), t.ex. Milda, HushållsEve, Ädel
 5 Bordsmargarin 80% fett (i ask), t.ex. Milda, Linnéa
 6 Lättmargarin, t.ex. Lätta, Becel, Lätt&Lagom, LättLätt, Gaio, 30-40% fett
 7 Benecol, Becel ProAktiv
 8 Använder ej matfett på smörgås
 9 Vet ej

2 Hur många skivor/bitar av följande brödsorter äter du vanligtvis under en vanlig vecka?

Markera för varje brödsort hur många skivor eller bitar du äter per dag eller per vecka om du inte äter den sorten dagligen.

- | | Skivor/bitar
per dag per vecka
<u>eller</u> | |
|---|--|--------------------------|
| 1 Hårt bröd, t.ex. rågknäcke, husman, sport | ___ | ___ |
| 2 Mjukt grovt bröd, fullkornsbröd (nyckelhålsmärkt) | ___ | ___ |
| 3 Äter inte någon av dessa brödsorter | | <input type="checkbox"/> |

3 Hur ofta äter du grönsaker och frukt? Svara per dag, vecka eller månad.

Ha det senaste 12 månaderna i tankarna. Svara på alla alternativ, men sätt endast ett kryss i den rad som passar bäst för varje matvara.

Grönsaker, baljväxter och rotfrukter. Grönsaker (färska, frysta, konserv, stuvade mm) såsom broccoli, tomat, gurka, paprika, sallat, bönor, linser, morot, rödbeta, selleri och palsternacka. Försök också att ta med rätter där grönsaker ingår som blandad sallad, grönsaksblandningar, grönsaksjuice eller grönsakssoppa och grytträtter där grönsaker ingår.

Frukt och bär. Med frukt och bär menas t.ex. ett äpple, en apelsin, en banan, en klase druvor, ett glas juice, en tallrik jordgubbar, eller frukt och bär som ingår i kräm, kompotter eller fruktsallad mm.

Änge inte de tillfällen då intaget klart understiger en portion (t ex en gurkskiva på smörgåsen, persiljekvist, bär som dekoration på tårter, mm).

*Mer sällan än 1 gång per månad eller aldrig

| | Gånger per månad | | | | Gånger per vecka | | | | | | Gånger per dag | | | |
|--|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|
| | <1* | 1 | 2 | 3 | 1 | 2 | 3 | 4 | 5 | 6 | 1 | 2 | 3 | 4 el mer |
| 1 Grönsaker och rotfrukter, alla typer (färska, frysta, konserv, stuvade mm) | <input type="checkbox"/> |
| 2 Frukt och bär, alla typer (färska, frysta, konserv, juice mm) | <input type="checkbox"/> |
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 |

**4 Nedan följer en lista med olika matvaror. Hur ofta brukar du äta dessa matvaror?
Svara per dag, vecka eller månad.**

Ha det senaste 12 månaderna i tankarna. Svara på alla alternativ, men sätt endast ett kryss i den rad som passar bäst för varje matvara.

** Mer sällan än 1 gång per månad eller aldrig*

| | Gånger per månad | | | | Gånger per vecka | | | | | | Gånger per dag | | | |
|----------------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|
| | <1* | 1 | 2 | 3 | 1 | 2 | 3 | 4 | 5 | 6 | 1 | 2 | 3 | 4 el mer |
| 1 Pommis frites, stekt potatis | <input type="checkbox"/> |
| 2 Fisk, skaldjur som huvudrätt | <input type="checkbox"/> |
| 3 Korv som huvudrätt | <input type="checkbox"/> |
| 4 Choklad och godis | <input type="checkbox"/> |
| 5 Bullar, kakor, kex, tårta m.m. | <input type="checkbox"/> |
| 6 Ost, fett 24-40% | <input type="checkbox"/> |
| 7 Läsk/saft | <input type="checkbox"/> |
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 |

Appendix D. Analyses DK, IS and FI on diet and indicator questions

Denmark (Sisse Fagt and Nina Lyng) has analysed, if the Swedish indicator questions will explain the variation in nutrients of interest in the Danish diet (based on adults from the national dietary survey 2000-2004, n= 4652, age 15-75 y). The method is a 7 day estimated record.

Analysis of correlation (Spearman and Pearson) has been performed as well as regression analysis (backwards elimination and R²). In general, the indicator questions used in Sweden are suitable for Denmark. Some questions need to be modified according to Danish dietary habits (e.g. the differentiation in the Swedish questions on hard and soft bread makes no sense in Denmark, where the question should differentiate on rye bread/coarse wheat and wheat bread). Fish does not explain variation in any of the nutrients of interest (energy, fat, saturated fat, carbohydrates, added sugar, dietary fibre), but the question should be included, since it is necessary to monitor the intake.

Table1. Which foods explain the variation of nutrients of interest in the Danish diet?

| Swedish question | | Danish | No. of variables explained* |
|-------------------------------|------|-------------------------------|-----------------------------|
| Fat on bread | | Same | XXX |
| Bread | Hard | Ryebread/coarse wheat | XXX |
| | Soft | Wheat | XXX |
| Vegetables | | Same | X |
| Fruit | | Same | XXX |
| Pommes frites, fried potatoes | | Pommes frites, crisps, snacks | XXXXXX |
| Fish | | Same | |
| Sausages as a main meal | | Sausages-main meal or snack | XXX |
| Candy/chocolate | | Same | XXXXXX |
| Buns, cakes, crisp bread | | Cakes, bisquits | XXXXXX |
| Cheese 24-40% | | Same | XX |
| Soft drinks +/- carbonated | | Same | XX |

* In total 6 possible (energy, fat, saturated fat, carbohydrates, added sugar, dietary fibre)

Table 2 .Best model for energy and selected nutrients (backward method), Denmark

| Energy total R2=0,8444 | | |
|---------------------------------------|-------------------------|------------------|
| Variable | Label | Pr > F |
| K19 | Snacks | <.0001 |
| K06_6 | Mayonaise salads | <.0001 |
| K07_4 | Sausages | <.0001 |
| K18 | Candy/chocolate | <.0001 |
| Fedtstof_ny | Fats | <.0001 |
| Fat, total R2 =0,8536 | | |
| Variable | Label | Pr > F |
| Fedtstof_ny | Fats | <.0001 |
| K06_6 | Mayonaise salads | <.0001 |
| K19 | Snacks | <.0001 |
| K07_4 | Sausages | <.0001 |
| K06_1 | Cheese | <.0001 |
| K16 | Cakes | <.0001 |
| Saturated fat R2=0,8250 | | |
| Variable | Label | Pr > F |
| Fedtstof_ny | Fats | <.0001 |
| K06_1 | Cheese | <.0001 |
| K19 | Snacks | <.0001 |
| K07_4 | Sausages | <.0001 |
| K16 | Cakes | <.0001 |
| Carbohydrate total R2 = 0,8753 | | |
| Variable | Label | Pr > F |
| K18 | Candy/chocolate | <.0001 |
| K19 | Snacks | <.0001 |
| K02_1 | Breakfast cereals | <.0001 |
| Lyst_broed | Wheat bread | <.0001 |
| Marmelade_ny | Marmelade | <.0001 |
| Added sugar R2= 0,6488 | | |
| Variable | Label | Pr > F |
| K18 | Candy/chocolate | <.0001 |
| Marmelade_ny | Marmelade | <.0001 |
| K15 | Icecream | <.0001 |
| K16 | Cakes | <.0001 |
| K19 | Snacks | 0.0012 |
| Dietary fibre R2= 0,9336 | | |
| Variable | Label | Pr > F |
| Maelkeprodukter | Milk products | 0.0018 |
| Baelgfrugt | Pulses | <.0001 |
| K02_1 | Breakfast cereals | <.0001 |
| Groft_broed | Rye and wholemeal bread | <.0001 |
| K19 | Snacks | <.0001 |

Iceland (Holmfrídur Thorgeirsdóttir) has used a similar approach as Denmark and has analysed the Icelandic diet and looked at which food groups that explain the variation of fat, saturated fat, sugar and dietary fibre in the Icelandic diet (based on adults from the national dietary survey 2002, n=2000, 15-80 y). The method is a 24 h recall along with frequency of consumption of certain foods and food groups.

Table 3. Contribution from food groups to different nutrients in the Icelandic diet (% of intake)

| | Fat (total) | Saturated fat | Added sugar | Dietary fibre |
|----------------------------------|-------------|---------------|-------------|---------------|
| Meat | 18 | 19 | | |
| Fat | 18 | 17 | | |
| Butter | 9 | 11 | | |
| Margarine | 5 | 4 | | |
| Cereal product | 18 | 15 | 24 | 55 |
| Bread | | | | 33 |
| Cookies, pastry | 12 | 12 | 19 | 7 |
| Milk and milk products | 14 | 20 | | |
| Cheese | 9 | 13 | | |
| Fruits and berries (jam/canned) | | | 4 | 10 |
| Vegetables | | | | 14 |
| Potatoes | | | | 8 |
| Sauce | 9 | 3 | | |
| Sweets, sugar | 4 | 6 | 24 | |
| Snacks | 2 | 2 | | 5 |
| Beverages | | | 38 | |
| Sodas and sugary fruit beverages | | | 36 | |

Finland (Liisa Valsta and Harri Sinkko) both analysed the contribution from food groups to fat, saturated fat, sucrose and dietary fibre intake (Table 3, % of intake) and carried out regression analyses with the same nutrients as dependent variables and food classes (foods as eaten) as independent variables. Models were adjusted by age and were done separately for men and women. Variables with p-value < 0.05 in the regression models were analysed by partial correlation controlled by age (Tables 4a-d). These analyses were carried out in the 2x3-d estimated food records data of the FINDIET 2007 sub-sample (n= 606)

In the second set of analyses with the same subjects (n=606) the FINRISK 2007 FFQ answers were used for foods/food group data and the 2x3-d estimated food records data for the intake of fat, saturated fat, sucrose and dietary fibre. First, correlation analyses in the whole population (Spearman's correlation) between the FFQ questions and nutrients were carried out to choose variables for the next analysis. FFQ questions with a p-value >0.3 were excluded. After that, regression analyses with a backward method was used to find the best model. The four nutrients were the dependent variables and the FFQ questions were the independent variables in the regressions. Furthermore, we ran regression analyses with a forward method to find out the coefficients of determination (R^2) of the independent variables (Tables 5-8).

The calculations with the Finnish National Dietary Survey FINDIET 2007 data show that the indicator questions would explain the variation of the nutrients of interest very well and that Finland can use the indicators to monitor important aspects of the diet.

Table 4. Aggregated contribution from 25 most important food groups to different nutrients in the Finnish diet (% of intake). Foods in the food groups “as eaten” (sub-group contribution in parentheses).

| | Fat (total) | | SFA | | Sucrose | | Fibre | |
|----------------------------------|-------------|-------|-------|-------|---------|--------|--------|--------|
| | Men | Women | Men | Women | Men | Women | Men | Women |
| Meat and sausage dishes | 31.8 | 25.7 | 28 | 21.8 | | | 5.4 | 3.9 |
| Fish dishes and products | 3.8 | 4.0 | 2.0 | 2.3 | 0.7 | | | |
| Fat on bread (total) | 12.7 | 10.2 | 12.0 | 9.4 | | | | |
| (Butter) | (3.8) | (3.2) | (5.2) | (4.2) | | | | |
| (Margarine) | (5.3) | (3.1) | (4.0) | (2.3) | | | | |
| (Low fat spread) | (3.6) | (3.9) | (2.8) | (2.9) | | | | |
| Cereal products (total) | 18.5 | 16.7 | 17.3 | 18.9 | 19.4 | 20.6 | 60.0 | 50.8 |
| (Bread) | (3.2) | (1.9) | | | | | | |
| (Rye bread) | | | | | (1.9) | (1.3) | (32.7) | (25.6) |
| (Mixed brown bread) | | | | | (0.7) | | (7.5) | (6.9) |
| (Savoury pasties, pizza) | (6.0) | (5.3) | (6.1) | (5.4) | | | (3.6) | (2.8) |
| (Bun) | (4.3) | (4.0) | (4.4) | (4.0) | (6.0) | (4.8) | (3.0) | 2.5 |
| Cookies, pastry | (5.0) | (5.5) | (6.8) | (9.5) | (10.3) | (13.3) | (1.4) | (2.5) |
| Milk and milk products | 2.1 | 1.8 | 7.4 | 9.7 | 10.5 | 14.6 | | 0.9 |
| Cheese (on bread) | 5.2 | 7.1 | 10.9 | 12.0 | | | | |
| Fruits and berries (jam/canned) | | | | | 24.6 | 25.4 | 12.5 | 17.1 |
| Vegetables | | | | | 2.0 | 2.7 | 7.2 | 11.8 |
| Potatoes | 2.3 | | 2.2 | | | | 4.3 | 2.3 |
| Sauce | | 1.9 | | | | | | |
| Sweets, sugar | 1.4 | 2.9 | | 4.3 | 15.0 | 16.2 | | |
| Snacks | | 2.0 | | | | | 1.2 | 2.0 |
| Beverages | | | | | 13.6 | 9.0 | | |
| Sodas and sugary fruit beverages | | | | | 4.0 | 2.6 | | |
| Alcoholic beverages | | | | | 1.5 | 1.3 | | |
| Total contribution (% of intake) | 77.8 | 72.3 | 81.9 | 78.4 | 91.3 | 92.4 | 90.6 | 88.8 |

Table 5 a-d. Partial correlations between selected nutrients and food groups (as eaten) (only $p < 0.05$ included) in the FINDIET 2007 Study

5a) Fat intake (g/day)

| Female | R | p-value | Male | R | p-value |
|-----------------------------|------|---------|-----------------------------|------|---------|
| Chocolate | 0.35 | <.0001 | Sausage | 0.38 | <.0001 |
| Butter | 0.35 | <.0001 | Butter | 0.33 | <.0001 |
| Dressing | 0.34 | <.0001 | Cheese | 0.31 | <.0001 |
| Cheese | 0.31 | <.0001 | Sausage dishes | 0.31 | <.0001 |
| Margarine | 0.27 | <.0001 | Bread, mixed flour | 0.29 | <.0001 |
| Biscuit | 0.25 | <.0001 | Biscuit | 0.28 | <.0001 |
| Eggs | 0.24 | <.0001 | Margarine | 0.27 | <.0001 |
| Meat steak | 0.23 | <.0001 | Bun | 0.24 | <.0001 |
| Sausage dishes | 0.23 | <.0001 | Snacks | 0.22 | 0.000 |
| Ice cream | 0.21 | 0.000 | Cookies, pastries | 0.21 | 0.001 |
| Sausage | 0.21 | 0.000 | Meat steak | 0.19 | 0.002 |
| Pizza | 0.20 | 0.000 | Fruit and berry pastries | 0.18 | 0.004 |
| Cookies, pastries | 0.20 | 0.000 | Savoury pasties, burgers | 0.17 | 0.005 |
| Fruit and berry pastries | 0.19 | 0.001 | Chocolate | 0.17 | 0.005 |
| Poultry dishes | 0.16 | 0.004 | Yoghurt | 0.17 | 0.007 |
| Low-fat milk | 0.15 | 0.006 | Fried potato, potato dishes | 0.16 | 0.012 |
| Fish products | 0.13 | 0.017 | Poultry dishes | 0.13 | 0.037 |
| Savoury pasties, burgers | 0.13 | 0.019 | Fish | 0.12 | 0.045 |
| Snacks | 0.12 | 0.025 | Potatoe, cooked | 0.12 | 0.050 |
| Fried potato, potato dishes | 0.11 | 0.040 | | | |

5b) Saturated fatty acid intake (g/day)

| Female | R | p-value | Male | R | p-value |
|--------------------------|------|---------|--------------------------|------|---------|
| Butter | 0.44 | <.0001 | Butter | 0.49 | <.0001 |
| Cheese, hard | 0.40 | <.0001 | Cheese, hard | 0.36 | <.0001 |
| Chocolate | 0.37 | <.0001 | Biscuit | 0.33 | <.0001 |
| Bun | 0.32 | <.0001 | Sausage | 0.32 | <.0001 |
| Pizza | 0.27 | <.0001 | Sausage dishes | 0.29 | <.0001 |
| Biscuit | 0.26 | <.0001 | Cookies, pastries | 0.25 | <.0001 |
| Cookies, pastries | 0.24 | <.0001 | Low-fat milk | 0.25 | <.0001 |
| Low-fat milk | 0.23 | <.0001 | Chocolate | 0.24 | 0.000 |
| Sausage dishes | 0.23 | <.0001 | BUN | 0.23 | 0.000 |
| Ice cream | 0.22 | <.0001 | Breakfast cereals | 0.21 | 0.001 |
| Fruit and berry pastries | 0.21 | 0.000 | Yoghurt | 0.18 | 0.004 |
| Margarine | 0.20 | 0.000 | High-fat milk | 0.17 | 0.007 |
| Sausage | 0.19 | 0.001 | Fruit and berry pastries | 0.16 | 0.008 |
| Egg | 0.19 | 0.001 | Ice cream | 0.16 | 0.010 |
| Meat steak | 0.19 | 0.001 | Meat steak | 0.16 | 0.011 |
| Bread, while | 0.15 | 0.006 | Snacks | 0.15 | 0.014 |
| Cheese, soft | 0.13 | 0.015 | Fried potato | 0.15 | 0.016 |
| Savoury pasties, burgers | 0.12 | 0.022 | | | |
| High-fat milk | 0.11 | 0.037 | | | |

5c) Sucrose intake (g/day)

| Female | R | p-value | Male | R | p-value |
|--------------------------|------|---------|--------------------------|------|---------|
| Juice drinks | 0.51 | <.0001 | Juice drinks | 0.56 | <.0001 |
| Fruit and berry soups | 0.36 | <.0001 | Sweets | 0.38 | <.0001 |
| Sugar | 0.34 | <.0001 | Biscuit | 0.36 | <.0001 |
| Sweets | 0.33 | <.0001 | Bun | 0.34 | <.0001 |
| Chocolate | 0.31 | <.0001 | Cookies, pastries | 0.33 | <.0001 |
| Bun | 0.29 | <.0001 | Fruit and berry soups | 0.31 | <.0001 |
| Fruit and berry pastries | 0.29 | <.0001 | Sugar | 0.30 | <.0001 |
| Cookies, pastries | 0.28 | <.0001 | Yoghurt | 0.29 | <.0001 |
| Biscuit | 0.25 | <.0001 | Jam | 0.28 | <.0001 |
| Yoghurt | 0.25 | <.0001 | Ice cream | 0.27 | <.0001 |
| Jam | 0.25 | <.0001 | Soft drinks | 0.25 | <.0001 |
| Breakfast cereals | 0.19 | 0.000 | Chocolate | 0.25 | <.0001 |
| Milk puddings | 0.19 | 0.001 | Fruit and berry pastries | 0.22 | 0.000 |
| Soft drinks | 0.17 | 0.002 | Fruit and berry salads | 0.20 | 0.001 |
| Fruit and berry juices | 0.14 | 0.011 | Milk puddings | 0.16 | 0.010 |
| Ice cream | 0.13 | 0.013 | Fresh fruit | 0.13 | 0.041 |
| Fresh fruit | 0.13 | 0.017 | Alcoholic beverages | 0.13 | 0.042 |

5d) Fibre intake g/day)

| Female | R | p-value | Male | R | p-value |
|--------------------------|------|---------|--------------------------|-------|---------|
| Rye bread | 0.55 | <.0001 | Rye bread | 0.78 | <.0001 |
| Fresh vegetables | 0.49 | <.0001 | Fresh fruit | 0.48 | <.0001 |
| Fresh fruit | 0.46 | <.0001 | PORR | 0.45 | <.0001 |
| Fresh berries | 0.36 | <.0001 | Porridge | 0.45 | <.0001 |
| Vegetable dishes | 0.34 | <.0001 | Fresh vegetables | 0.38 | <.0001 |
| Porridge | 0.33 | <.0001 | Fresh berries | 0.37 | <.0001 |
| Snacks | 0.32 | <.0001 | Low-fat spreads | 0.30 | <.0001 |
| Breakfast cereals | 0.27 | <.0001 | Fruit and berry soups | 0.25 | <.0001 |
| Fruit and berry soups | 0.25 | <.0001 | Margarines | 0.24 | <.0001 |
| Skimmed milk | 0.23 | <.0001 | Meat soups | 0.20 | 0.001 |
| Vegetable juice | 0.23 | <.0001 | Jam | 0.19 | 0.002 |
| Vegetable soup | 0.20 | 0.000 | Vegetable salad | 0.14 | 0.020 |
| Fruit and berry pastries | 0.18 | 0.001 | Fruit and berry pastries | 0.14 | 0.021 |
| | | | Biscuit | 0.14 | 0.022 |
| | | | Bun | 0.14 | 0.023 |
| | | | Bread, white | -0.12 | 0.048 |

Table 6 a-9b. Best model for selected nutrients and food groups in the FINDIET 2007 Study

Table 6a. Best model for fat (backward method)

| Independent variable | p-value |
|------------------------------|---------|
| Intercept | <.0001 |
| High fat cheeses | 0.0131 |
| Cookies, pastries | <.0001 |
| Cold-cut sausages | 0.01 |
| Cereals and muesli | 0.033 |
| Rye and crisp bread | 0.0048 |
| Semi-brown bread | 0.0225 |
| Sugared cola-soft drink | 0.0062 |
| Fat spread (60%) | 0.0408 |
| Fat spread (70-80%) | 0.0291 |
| Butter-vegetable oil mixture | 0.0018 |
| R ² =0.18 | |

Table 6b. Best model for fat (forward method)

| Independent variable | R ² |
|------------------------------|----------------|
| Cookies, pastries | 0.07 |
| Cold-cut sausages | 0.10 |
| High fat cheeses | 0.12 |
| Butter-vegetable oil mixture | 0.13 |
| Sugared cola-soft drink | 0.15 |
| Cooked vegetables or legumes | 0.16 |
| Rye and crisp bread | 0.16 |
| Semi-brown bread | 0.17 |
| Cereals and muesli | 0.18 |

Table 7a. Best model for saturated fat (backward method)

| Independent variable | p-value |
|-------------------------------------|---------|
| Intercept | <.0001 |
| Low fat milk | 0.003 |
| Bun, bun-dough based sweet pastries | 0.0079 |
| High fat cheeses | <.0001 |
| Fresh and frozen berries | 0.0029 |
| Cookies, pastries | <.0001 |
| Semi-brown bread | 0.0445 |
| Fat spread (<40% fat) | 0.0013 |
| Fat spread (60% fat) | 0.0005 |
| Fat spread (70 - 80% fat) | 0.0021 |
| Butter-vegetable oil mixture | <.0001 |
| Butter | <.0001 |
| Plant sterol/stanol margarine | 0.0268 |
| R ² =0.31 | |

Table 7b. Best model for saturated fat (forward method)

| Independent variable | R ² |
|--|----------------|
| Cookies, pastries | 0.08 |
| Butter | 0.14 |
| High fat cheeses | 0.19 |
| Butter-vegetable oil mixture | 0.24 |
| Low fat milk | 0.26 |
| Fresh and frozen berries | 0.27 |
| Bun, bun-dough based sweet pastries | 0.28 |
| Sausages, frankfurters, sausage dishes | 0.29 |
| Semi-brown bread | 0.29 |

Table 8a. Best model for sucrose (backward method)

| Independent variable | p-value |
|--|---------|
| Intercept | <.0001 |
| Bun, bun-dough based sweet pastries | 0.0286 |
| Ice cream, puddings, berry and fruit quark | 0.0147 |
| Baltic herring | 0.0005 |
| Other sweet baked goods | <.0001 |
| Candy (other than chocolate and liquorice) | <.0001 |
| Cereals and muesli | 0.0087 |
| Other sugared soft drink per day | <.0001 |
| Chocolate drink | 0.0007 |
| Sour milk (classes per day) | 0.017 |
| Unsweetened juice (classes per day) | 0.0245 |
| Full-fat milk | 0.0448 |
| R ² =0.31 | |

Table 8b. Best model for sucrose (forward method)

| Independent variable | R ² |
|--|----------------|
| Candy (other than chocolate and liquorice) | 0.10 |
| Sugared soft drink per day | 0.17 |
| Cookies, pastries | 0.21 |
| Chocolate drink | 0.23 |
| Baltic herring | 0.25 |
| Cereals and muesli | 0.27 |
| Unsweetened juice classes per day | 0.28 |
| Ice cream, puddings, berry and fruit quark | 0.29 |
| Sour milk (classes per day) | 0.29 |

Table 9a. Best model for fibre (backward method)

| Independent variable | p-value |
|-------------------------------------|---------|
| Intercept | 0.1929 |
| Bun, bun-dough based sweet pastries | 0.0154 |
| High fat cheeses | 0.016 |
| Fruit | <.0001 |
| Cold-cut sausages | 0.0375 |
| Porridges | <.0001 |
| Cereals and muesli | 0.0255 |
| Rye and crisp bread | <.0001 |
| Classes sour milk per day | 0.0018 |
| R ² =0.29 | |

Table 9b. Best model for fibre (forward method)

| Independent variable | R ² |
|-------------------------------------|----------------|
| Rye and crisp bread | 0.14 |
| Porridges | 0.20 |
| Fruit | 0.24 |
| Cold-cut sausages | 0.25 |
| Sour milk (classes per day) | 0.27 |
| High fat cheeses | 0.27 |
| Bun, bun-dough based sweet pastries | 0.28 |
| Cereals and muesli | 0.29 |
| Full-fat milk | 0.29 |

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